(Model.) 5 Sheets—Sheet 1.

J. D. NIX.

GRAIN BINDER.

No. 260,115. Patented June 27, 1882.

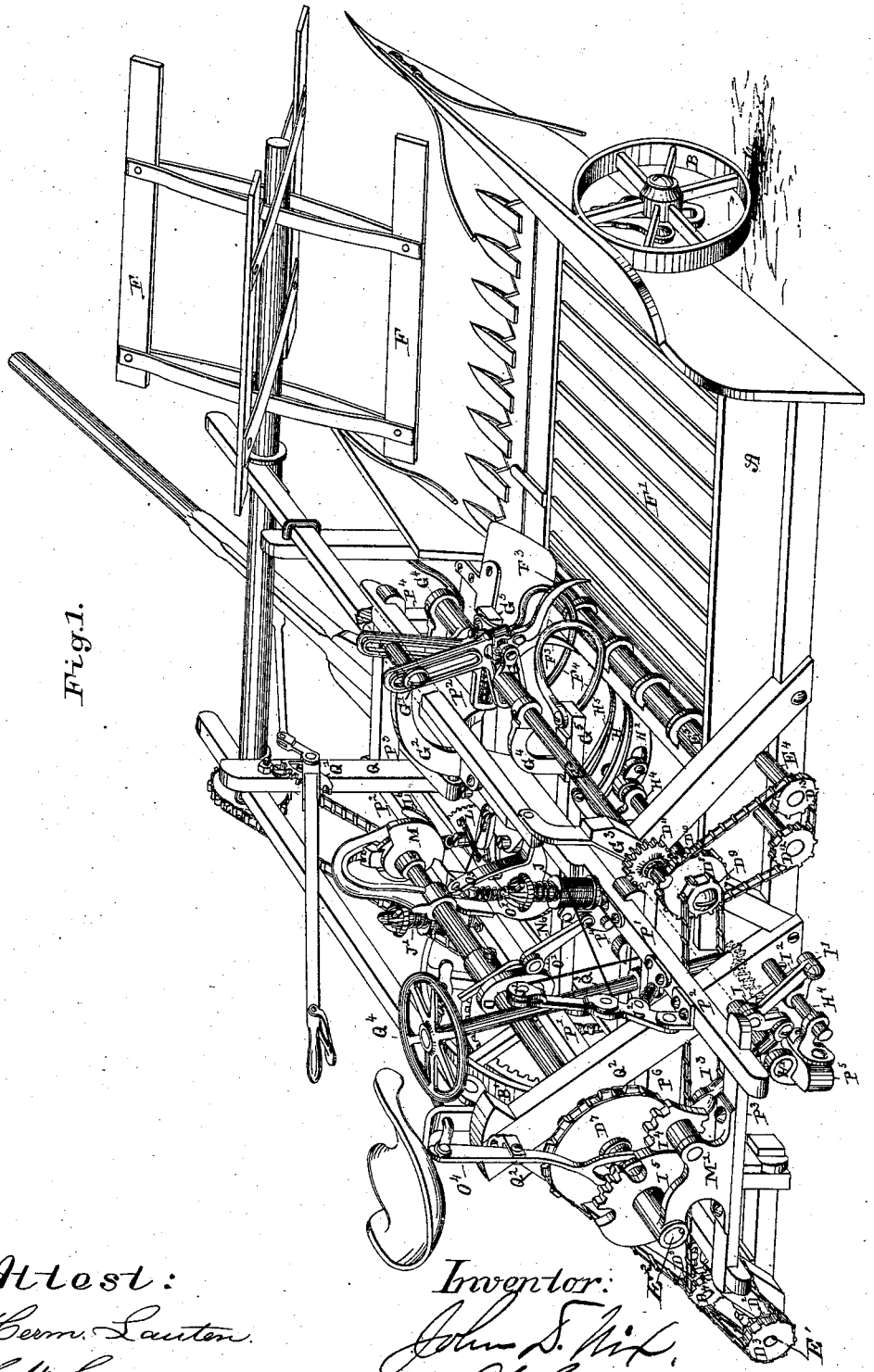

Fig. 1.

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(Model.)

5 Sheets—Sheet 2.

J. D. NIX.

GRAIN BINDER.

No. 260,115. Patented June 27, 1882.

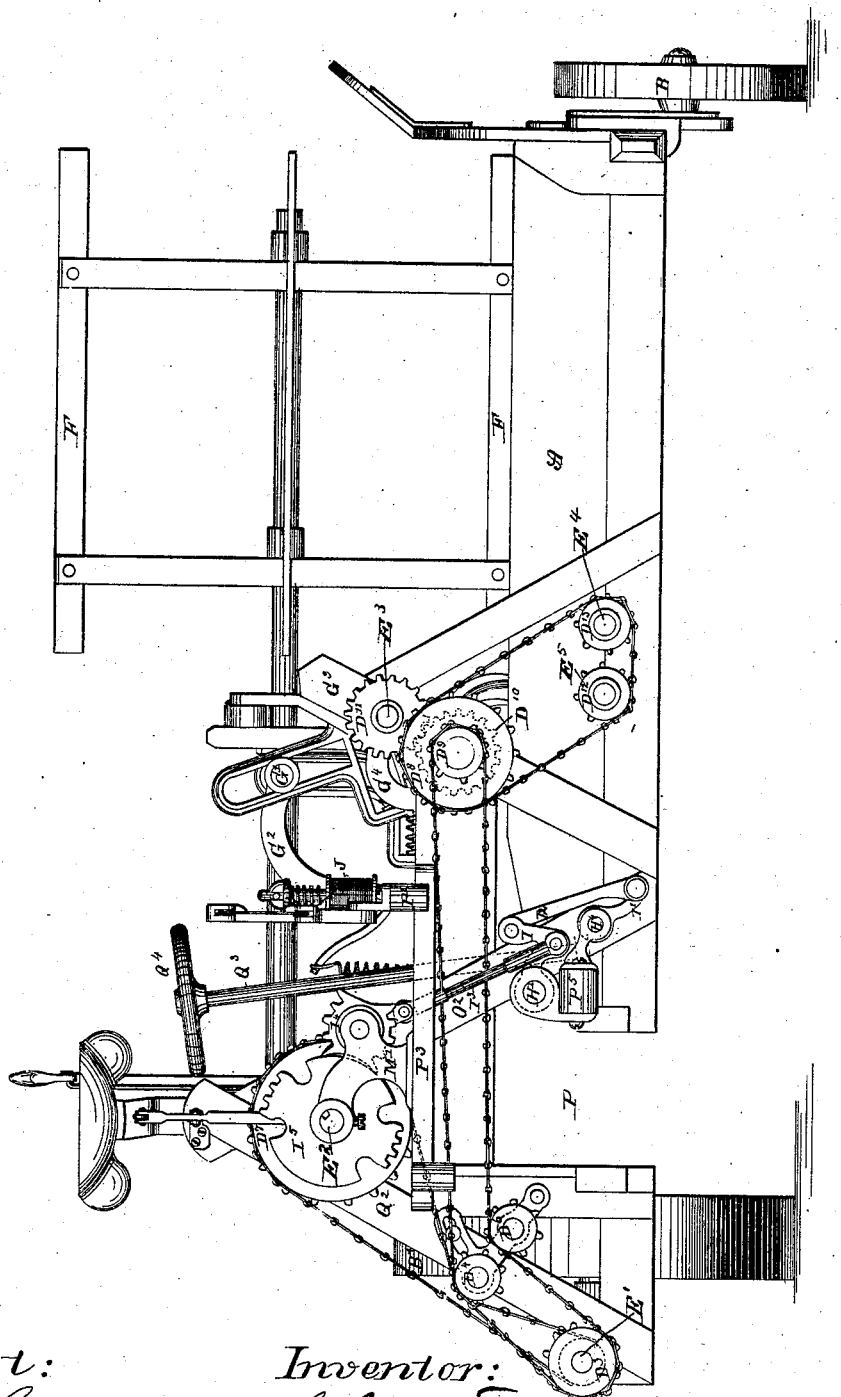

Fig. 2.

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(Model.)

5 Sheets—Sheet 3.

J. D. NIX.

GRAIN BINDER.

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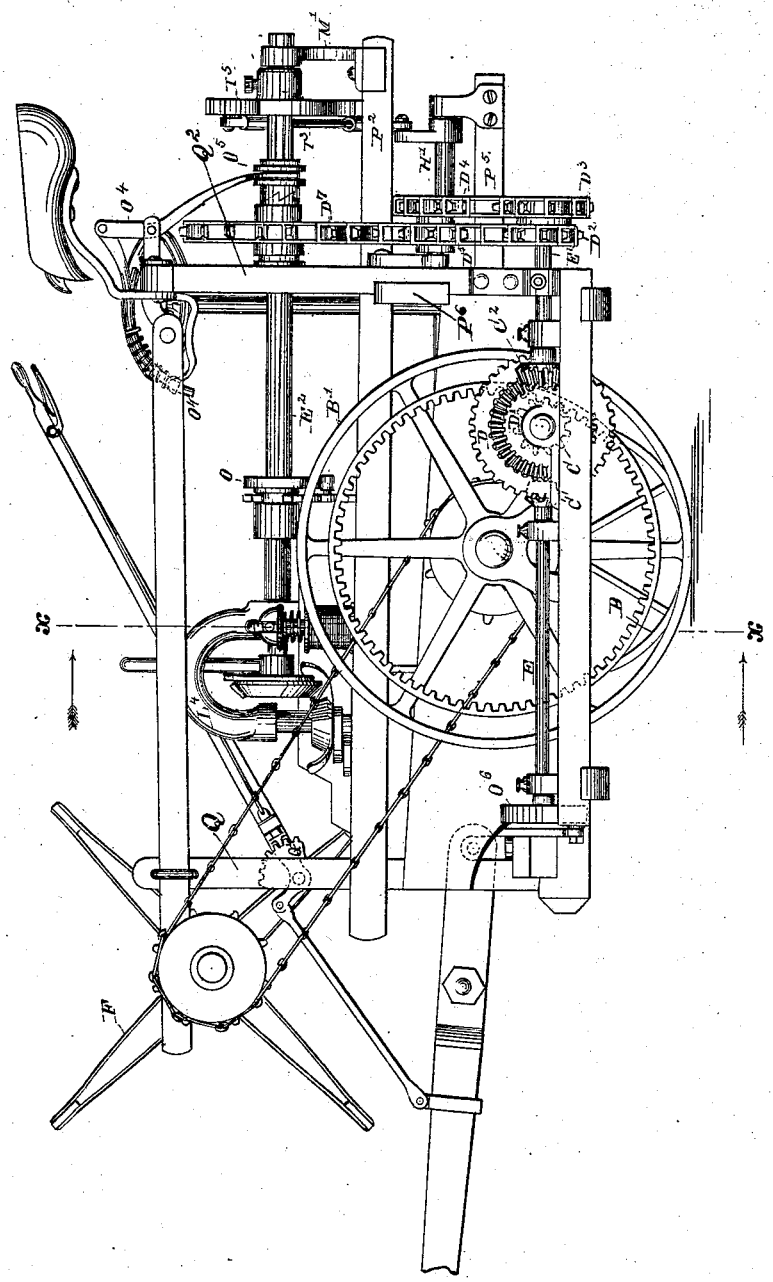

Fig. 3.

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(Model.) 5 Sheets—Sheet 4.

J. D. NIX.

GRAIN BINDER.

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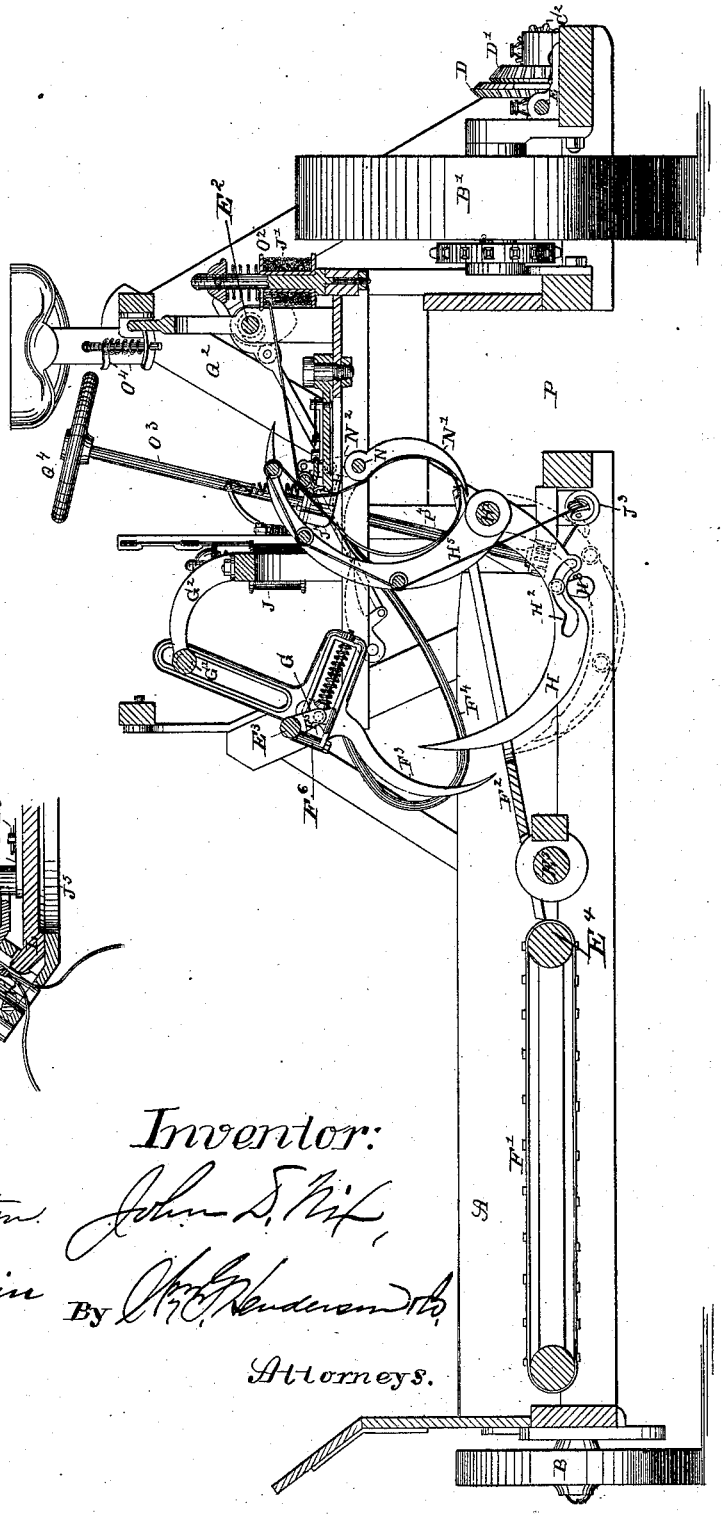

Fig. 4.

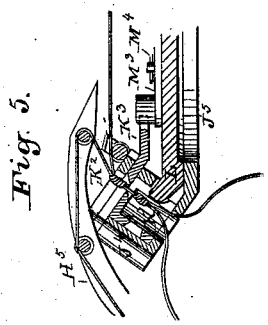

Fig. 5.

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(Model.)

5 Sheets—Sheet 5.

J. D. NIX.

GRAIN BINDER.

No. 260,115. Patented June 27, 1882.

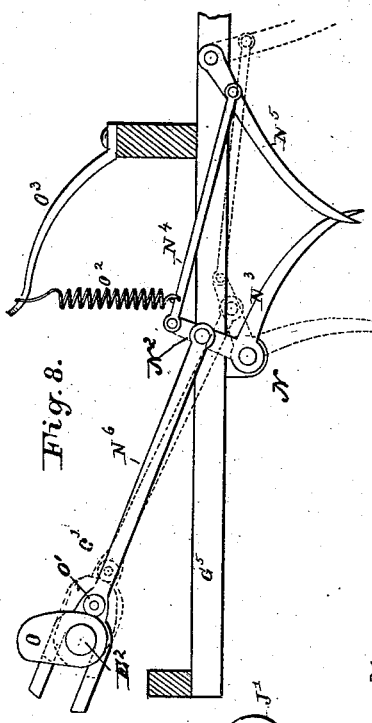

Fig. 8.

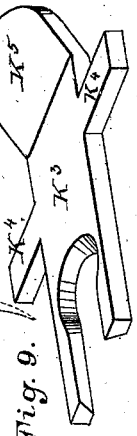

Fig. 9.

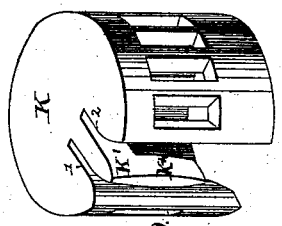

Fig. 10.

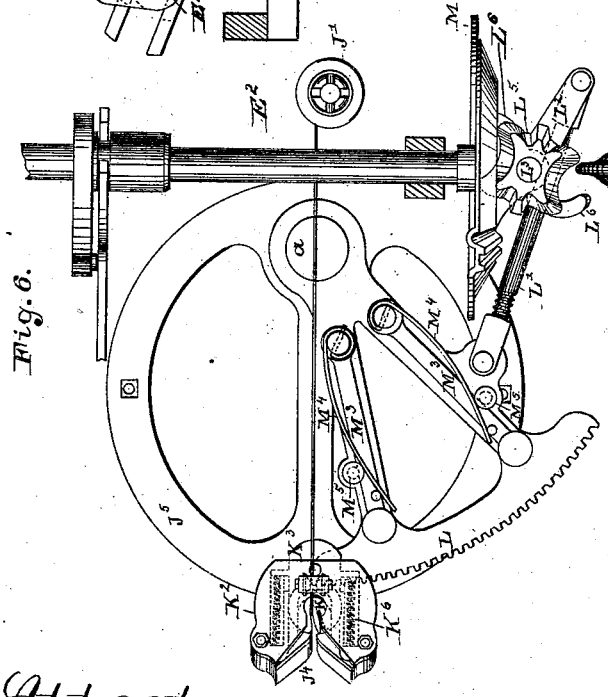

Fig. 6.

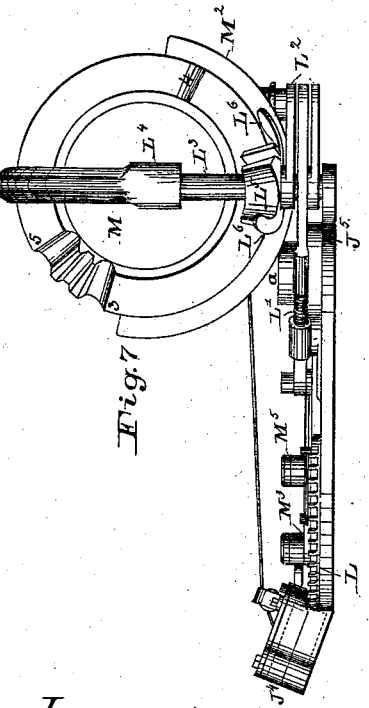

Fig. 7.

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UNITED STATES PATENT OFFICE.

JOHN D. NIX, OF MOUNT VERNON, ILLINOIS.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 260,115, dated June 27, 1882.

Application filed June 28, 1881. (Model.)

To all whom it may concern:

Be it known that I, JOHN D. NIX, a citizen of the United States, residing at Mount Vernon, in the county of Jefferson and State of Illinois, have invented certain new and useful Improvements in Grain-Binders; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters or figures of reference marked thereon, which form a part of this specification, and in which—

Figure 1 is a perspective of the harvester and self-binder. Fig. 2 is a rear elevation thereof; Fig. 3, an end elevation thereof, looking from the end next to the grain-binding attachments. Fig. 4 is a vertical longitudinal section on the line *x x* of Fig. 3, looking in the direction of the arrows. Fig. 5 is a detached sectional view of the wire twister and cutter. Fig. 6 is a detached plan view of the wire twister and cutter and portions of the mechanism for operating the same. Fig. 7 is an end view of the same parts. Fig. 8 is a detached view of one set of dividers, showing the same in two positions. Fig. 9 is a detached perspective view of the wire-cutter; Fig. 10, a perspective of the twister.

My invention relates generally to harvesters and grain-binders, and particularly to the construction of the machine over which the grain passes to the binding mechanism; secondly, to means for effecting a division in the grain before it is bound; thirdly, to means for collecting or gathering the grain before it is moved forward to be bound; fourthly, to the means for binding the grain into sheaves; fifthly, to means for effecting a division between the sheaf and gavel; and, finally, to the construction and combination of other parts, all of which will be hereinafter particularly described, and then sought to be clearly defined by the claims.

In the accompanying drawings, the letter A indicates the body or frame of the machine, which is supported at one end by the wheel B and at the other end by the driving-wheel B′. This last wheel is internally cogged, and through pinions C C′ C^2 and gears D, D′, D^2, D^3, D^7, D^8, D^9, D^{10}, D^{11}, D^{12}, and D^{13} imparts motion to shafts E E′ E^2 E^3 and rollers E^4 and E^5, and they in turn impart motion to the several parts connected to them. The gears D^4, D^5, and D^6 are idlers, and are connected to the side of the frame by means of an adjustable plate, as shown, so as to take up slack in the gear-chains.

The grain as it is cut by the sickle is thrown by the reel F upon the traveling apron F′, by which it is carried forward to the ribbed roller E^5, the ribs of which project up through the end of the table F^2, which is slightly inclined from that end rearwardly and cut away over the binder-arm and divider, so as to permit them to be raised from beneath to above the table. The ribs on the roller E^5 are intended to prevent the loose cut grain from falling between the apron and table and to direct the grain onto the table. As the grain passes from the apron to the table it is taken first by one and then the other of the two packing-fingers F^3, and by them carried under the guides F^4, the fingers alternately holding and drawing forward the cut grain and packing or pressing it against the divider, while the guides hold it down upon the table. These fingers are formed or made with a slotted upper end, a curved lower end, and an intermediate slotted portion open at one end, this slotted portion being at right angles to the length of the finger.

In the intermediate slotted portion there is placed a box, F^5, from one end of which a rod extends through the finger, and around the rod there is coiled a spring, with one end bearing against the finger and the other against the box, so that the finger may be distended or extended outwardly, and when the outward pressure against the same is released the said spring will draw it back to its normal position. The box has flanges on its sides, which bear against the finger and prevent the box from being pulled sidewise out of the slots, and a threaded bolt or screw, F^6, passed through projecting parts of the finger, closes the otherwise open end of the finger and prevents the box from being pulled out at that end. These boxes (each finger being provided with one) form bearings for the double cranks G, which are on the shaft E^3, the cranks extending in

opposite directions to each other, so that when the shaft of which they form a part is turned one finger will be thrown out, while the other will be drawn in. These fingers are guided in their respective movements by two flanged rollers, fitted so as to turn in the upper slotted portions of the fingers, and held in place by a bolt or rod, G′, which passes through the rollers and the end of an overhanging arm, G^2, which is between the fingers, and bolted or otherwise secured to one of the cross-beams of the machine.

The shaft E^3 is journaled so as to be moved endwise in a standard, G^3, which is on one side of the frame A, and in two overhanging arms, G^4, suitably secured to the two bars G^5, which are joined to the frame or carriage that carries the twisting mechanism, and extend in the direction of the width of the machine, and to which are also secured the guides F^4, one end of each being secured to the end of the bar G^5 and the other end to the same bar back from its end. The gear D^{11} on the end of shaft E^3 is feathered or splined to the shaft, so as to turn therewith and yet be free to slide thereon. As the grain is carried by the fingers F^3 over the table F^2, under the guides F^4, (the binder-arm H^5 and the divider H, in which it is partially inclosed, being entirely below the surface of the table F^2,) the grain is packed by the fingers against the strand of wire held by the binder-arm and the compressor arm or finger N′ until sufficient grain has accumulated to make a sheaf, when the divider and binder-arm rise together through and above the table and the grain thereon until the point of the divider is between the guides, where the divider remains at rest, while the binder-arm continues to rise, carrying the gavel forward against the wire and compressor-finger more firmly. When the divider is at rest above the table, and while the binder-arm is advancing, the grain is being packed by the fingers against the divider, and this continues until the binder-arm returns and folds itself within the divider again, when both fall together beneath the table, and when the divider and binder-arm have fallen below the table, and the resistance which the divider had offered to the action of the fingers is thus removed, the grain which had been packed against the back of the divider is carried by the fingers forward against the wire and compressor-arm, as before.

The divider H, for illustration, is represented as having two arms of concave form on top, united at their forward ends and diverging toward their rear ends, at which point they are fitted about a shaft, H′, in a manner that will permit the shaft to turn therein.

One arm of the divider is provided with a cam-shaped slot, H^2, into which fits the wrist of a crank, H^3, connected to the end of the shaft H^4. The slot H^2 is of such shape that when the wrist of the crank turns therein the divider will be raised by the wrist until the wrist passes a given point, after which the divider will remain stationary until the movement of the wrist is reversed and the wrist reaches the same given point, when the divider will fall, the object being to have the divider raised high enough to effect a good division in the grain and remain in that position until the binding-arm has been lifted up from it and carried to the twister, and after the completion of the twist returned to the divider, when both divider and binder-arm shall fall together.

Both shafts H′ and H^4 are journaled in suitable bearings on the machine in a manner that will permit them to be moved endwise. To the shaft H′ is keyed the binding-arm H^5, which is illustrated as fitting within the divider. The shafts H′ H^4 are provided respectively with cranks I I′, which are connected together by the rod I^2, while another rod, I^3, connects crank I with a projection on the side of the gear-wheel I^4, which gear is rotated by the gear I^5, keyed to the shaft E^2. When motion is imparted through said gears and cranks to the shafts H′ H^4 the divider H and binding-arm H^5 are thereby raised together until both are above the table, the divider separating the grain which has been advanced as far as its point from that which has passed beyond it, and when both divider and binding-arm have risen thus far together the divider remains stationary, while the binding-arm continues to move onward and upward, carrying with it the grain which is to form the sheaf, the point where the binding-arm is to leave the divider being determined by the cam-shaped slot H^2 in the divider, as already described; and after the sheaf has been bound and dropped and the binding-arm brought back to within the divider both divider and binding-arm are drawn back under the table, so as to permit the grain which has in the meantime been packed against the divider to be moved forward by the spring-actuated fingers into position to be taken by the divider and binding-arm and carried onward, as has been already described.

The wire for binding the grain is run off from two spools or reels, J J′, the wire from reel J passing over the tension device J^2, then over a sheave located beneath the tension device, thence across to a universal sheave, J^3, thence up over the three sheaves, shown as formed on the binding-arm, to the point of the arm. The other strand passes from the spool J′ to the binder-head, where it passes down through a slot in the twister, and is at first twisted by hand to the strand brought from the reel J, and the two strands, when thus joined, form practically one strand, continuing from the point of the binder-arm up to the twister, so as to encircle the gavel and bind it into a sheaf when the two sections of the wire are twisted together about the gavel.

The twisting mechanism comprises a binder-head, J^4, bolted or otherwise secured to the plate J^5, which is secured to the beams G^5, and a twister, K, fitted within the binder-head, so as to revolve therein. The binder-head has a

slot in its front with flaring sides, and is made to incline upwardly in the direction of its front, so as the better to receive the wire as it is brought forward by the binder-arm. The twister is hollow and of cylindrical form, and is provided with sockets in its sides to receive the teeth of the operating-gear, and has one end open, while the other is closed, with the exception of two slots, 1 and 2, on opposite sides of the tooth K′. These slots are intended to receive the binding-wire, one strand passing from the reel J′ into one slot and the other strand being carried by the binder-arm into the other slot, so that when the twister is revolved the wires will be twisted together above and below the tooth, the pendent portion K* of the latter holding the wires fairly within the slots, and when the sheaf is severed from the strands by cutting the wire between the twists the strands from the two reels will remain connected together and be drawn down by the binder-arm as it falls back, so as to be in position to encompass the next gavel.

The twister is set within the binder-head upon an inwardly-projecting flange at the bottom thereof, and is held therein by a plate, K^2, bolted to the binder-head, and between that plate and the binder-head is a knife, K^3, the same being provided with side arms, K^4, the end K^5 of the knife extending back of the side arms. This knife has an end-play over the twister, and when not pressed inwardly its end K^5 projects back of the binder-head, where it is held by the two spiral springs K^6, set into recesses formed in the top of the binding-head, one end of the spring bearing against the head at the end of the recess and the other end against the arm of the knife, so that when the pressure which forces the knife inwardly to cut the wire is released the spring will expand and force the knife back to its first position.

The twister is turned by the bevel sector-rack L, which is fulcrumed at *a* to the plate J^5, and is reciprocated by the rod L′, which connects it to the crank L^2 of the shaft L^3, which is vertical, and has its bearings in the plate J^5 and the end of an overhanging arm, L^4, supported in a standard which rises from the plate J^5.

The shaft L^3 carries a gear-wheel, L^5, which has teeth on two sides and none on the other two, and from the gear-wheel project two fingers, L^6, both of which are represented as curved in the same direction and located at the end of each toothed section, so as to leave the same space between them on either side of the gear. This gear is rotated by a gear-wheel, M, on the revolving shaft E^2, which is journaled in the standard which supports the overhanging arm L^4, and at the other end in the arm M′, bolted to the end beam of the carriage which carries the whole twisting mechanism. The face of gear-wheel M from 3 to 4 is lower than from 4 to 5, the fall in a working gear being about one-half an inch, and between the points 5 and 3 the space is occupied by teeth which are on about the same plane as the higher portion of the face, the plain portions of the face being about equal in space, and each occupying about one-half of the face of the gear.

Along the lower face from 3 to 4, and a little way beyond 4, there is a flange, M^2, upon which first one and then the other of the fingers L^6 slides, so as to prevent the gear L^5 from being turned until the finger has passed from off the flange. Normally one of the slots in the twister is open to the slot in the binder-head, (for illustration we will say slot No. 1,) and the wire from reel J′ passes down through the same. Now, when in the course of the revolution of gear-wheel M the finger of gear L^5 passes from off the flange M^2, and the shoulder or lug at 4, formed by the fall of the face at that point, strikes the corner of gear L^5 just beyond, the gear L^5 is turned sufficiently to move, through the connecting crank-rod, the twister far enough to bring the other slot, No. 2, opposite to the slot in the binder-head, so that it may receive the wire brought up at this time by the binder-arm. The wire is brought up by the binder-arm during the revolution of the wheel M in the interval between the striking of the shoulder of the high portion of the face against the corner of gear L^5 (which moves the slot so as to receive the wire) and the meeting of the teeth of the two gears L^5 and M. While the teeth of the two gears are in mesh the sector-rack turns the twister in a direction the reverse of that in which it moved to bring around the slot to receive the second wire, and revolves it until it makes four revolutions, more or less, thereby twisting the two wires together and binding the gavel into a sheaf. At or about the time that the sector-rack completes its stroke, and while the slots in the twister are away from the slot in the binder-head—usually when they are half-way around the circle described by the twister—the knife K^3 is pushed forward so as to cut the wire and sever the sheaf from the wire of the reels. The knife is pushed forward by a pivoted arm, M^3, of which there are two, each being pivoted to the plate J^5, so as to strike against the projecting end K^5 of the knife and push it inwardly until the arm has passed by it, when the springs K^2 will push it back. These arms are acted upon by springs M^4, which hold them against studs M^5 on the plate J^5, and they are arranged so that when the sector-rack is turned in either direction the bar which first strikes the end of the knife will yield to the obstruction and pass by without moving the knife forward; but the bar which is last to strike the end of the knife will be held rigid by the stud against which it bears, so that the knife will have to yield to its pressure and be forced forward so as to cut the wire.

A shaft, N, is journaled in boxes secured to the under side of the beams G^5, so as to be a

little way back of the twister, and to this shaft is keyed a compressor-finger, N′, against which the gavel is compressed while being bound. To the end of the same shaft is keyed a crank, N^2, from which there projects toward the moving grain a finger, N^3. A rod, N^4, connects the crank with another finger, N^5, which is pivoted to one of the beams G^5, so as to project in the opposite direction to finger N^3. A pitman, N^6, connects the crank N^2 with the collar of a cam, O, which is held by a set-screw to the shaft E^2, and which bears against an anti-friction roll, O′, secured to the side of pitman N^6.

By the construction described, as soon as the knife severs the sheaf from the strand of binding-wire, the compressor-finger is drawn back, so as to let the sheaf fall down through the binder onto the ground. At the time that the compressor-finger is drawn back the finger N^3 is moved in the same direction, and separates or divides the sheaf from the straw of the gavel which follows, and at the same time pushes the sheaf outward, so that it may fall below. Simultaneously with the outward movement of finger N^3 the finger N^5 is moved in the opposite direction, so as to pull the straw of the gavel from that of the sheaf, thereby assisting in dividing or separating the gavel and sheaf. As soon as the sheaf has been discharged from the binder the compressor-finger is moved back to its first position, so as to receive the gavel which is now brought forward, and at the same time the fingers N^3 and N^5 are carried back to their first positions by means of a spring, O^2, which connects rod N^4 with an arm, O^3, projecting from the top of the machine. These thrust-dividers may be duplicated, if desired, and they may be on both sides of the twister, instead of on one side only.

The gear I^4, which is journaled in one part of the arm M^5, has two sections of its face made smooth and preferably concaved, while the intermediate sections are toothed, so as to engage respectively with the smooth and the toothed sections of the face of gear I^5, which is keyed to the shaft E^2.

The smooth and toothed sections of gears I^4 and I^5 are spaced so that when the smooth portions of the two are together the divider H and the binder-arm will remain stationary, first in an elevated position and then in a depressed position, both of them being alternately raised or lowered together when the toothed sections of the gears are in mesh. When the smooth sections are together, which is while the divider and binder-arm are beneath the table, the only movement made by the sector-rack is one that turns the twister, so as to bring around the slot which is to receive the wire from the point of the binder-arm. Next the toothed sections of the two gears come into mesh, whereby the divider is elevated and the binder-arm raised, so as to carry forward the gavel and take the wire into the twister. By this time the other two smooth sections of the gears have come together, and while they continue so the divider and the binder-arm remain elevated, and the only movements made are that which is made by the sector-rack so as to effect the twisting and cutting of the wire, that made by the thrust-dividers so as to separate the gavel and the sheaf from each other, and that made by the compressor-finger so as to let the bound sheaf fall beneath the binder. By the time that the sheaf has been severed from the reel-wire the other toothed sections of the gears have come together, when the binder-arm is returned to the divider and both the divider and binder lowered beneath the table; and thus the same operation is continuously repeated, the grain being cut and thrown upon the flat traveling apron, then taken by the packing-fingers and packed against the divider, then at the proper time, after the divider has fallen, pushed forward by the fingers upon and against the binding-wire and compressor-finger, then compressed by the binder-arm between it and the compressor-finger, and after being tied and severed from the reel of wire and separated by the thrust-dividers is permitted by the retraction of the compressor-finger to fall beneath the binder. The action of the binder-arm and dividers and tying mechanism is intermittent; but the action of the sickle and packing-fingers is continuous.

Whenever it is desired to check the action of that part of the binding mechanism which operates after the packing-fingers, a foot-lever, O^4, is depressed, whereby the clutch-collar O^5 is disconnected from the clutch-hub of the wheel D^7, so that that wheel which at other times rotates the shaft E^2 is free to turn loosely upon that shaft, and the only part of the machinery that then operates is the sickle and packing-fingers and parts between the two.

The sickle is connected to an eccentric, O^6, on the end of shaft E, and is reciprocated as that shaft is rotated by its pinion C′ meshing with the teeth of gear D.

The frame A of the binder, independent of the carriage which carries the binding mechanism, may be said to be made in two parts, transversely, the space P between the two being under the tying mechanism and forming a hatchway for dropping the sheaf through onto the ground. The plan of the binder, stripped of the binding mechanism, would be a horizontal apron, a slightly-inclined table, and a hatchway.

The carriage P′, which carries the binding mechanism, is composed of the longitudinal bars P^2, end bars, P^3, uprights P^4, and lower longitudinal bar, P^5, which connects the uprights, and a portion of which is provided with teeth, which make of it a rack-bar. This carriage is set across the main frame A, the rack-bar resting upon the front and rear beams of the frame, and the bars P^2 at one end upon the beam P^6, which connects the two sections of the main frame at that end. The standard Q, to which

is bolted the segment Q′, which receives the catch that holds the tongue-adjusting lever, limits the movement of the frame P′ in one direction, and the standards Q^2 limit its movement in the other direction.

The binding-mechanism carriage is moved endwise by means of a rod, O^3, having a pinion at one end, which meshes with a rack-bar on the beam P^5, and a wheel, O^4, at the top, by which it may be turned. The object in adapting it to be moved to and fro is to permit the gavel to be bound at any point between its ends within the play of the carriage.

By adopting the form and proportions of the frame-work and gearing shown and illustrated, and by the employment of the divider and packers, I am enabled to dispense with elevating machinery and to gather the grain upon the table, compress it into a compact gavel, divide the gavel completely from the loose grain behind it, bind the gavel, and drop the sheaf through the hatchway entirely separated from the sheaf to follow, and to perform all these operations near the sickle and practically upon the same level as the grain falls from the sickle. When the grain is carried up to the binder between endless-apron elevators the kernel is apt to be knocked out of the heads and the heads are apt to get entangled with each other, thus rendering the separation of the sheaf from the gavel somewhat difficult and unsatisfactory, and leaving the sheaves as they fall from the machine hanging together by the straw of one being entangled or interlaced with that of another, and rendering some means other than the ordinary binder-arm necessary to a proper division of the grain.

The means which I have devised and herein described make a very effectual division of the grain, completely detach each sheaf from the gavel to follow before the sheaf falls below, and overcome the disadvantages which attend the means ordinarily employed.

Having described my invention, what I claim is—

1. In a grain-binder, the combination of a reciprocating divider and a reciprocating binder-arm moving together and located under the machine, a horizontally-traveling apron, a slightly upwardly inclined table having an opening for the passage of both the divider and the binder-arm, and a hatchway at the upper end of the table for the depositing of the sheaf under the machine, substantially as and for the purpose specified.

2. In a grain-binder, the combination of a horizontal traveling apron, a slightly-inclined table at the end of the apron, provided with an opening for the passage of a reciprocating divider and binder-arm, a ribbed roller between the apron and table, and fingers for carrying cut grain from the apron over the roller onto the table, substantially as set forth.

3. In a grain-binder, an elastic laterally-expansible finger for feeding the grain to the binder-arm, substantially as set forth.

4. In a grain-binder, the combination of a grain-feeding finger having a slot between its ends at an angle to its length, a boxing fitting within said slot and having connected thereto the shaft which operates the finger, and a spring acting on the finger to retract the same after it has been laterally expanded, substantially as set forth.

5. In a grain-binder, the combination of a series of grain-feeding fingers, each having a longitudinal slot near its upper end and a transverse slot, a boxing fitting within the transverse slot of the finger, and having connected thereto a shaft for operating the fingers so that they alternately will feed forward the grain, a spring acting on the finger to retract the same after it has been laterally expanded, and a rod passing through the upper ends of the fingers to serve as guides for the same, substantially as set forth.

6. In a grain-binder, a reciprocating divider for separating a gavel from the loose grain, located under the binding-table and operated by means which project it up above the face of the table to hold the loose grain back from the gavel and retract it beneath the table when another gavel has been formed, in combination with fingers for packing the grain against the divider, and when a gavel has been formed and the divider retracted moving the gavel forward, substantially as set forth.

7. The crank-shaft H^4 and slotted divider H, in combination with binder-arm H^5 and shaft H′, the divider H having a loose connection with shaft H′, whereby the divider and binder-arm are adapted to operate as set forth.

8. The shafts H′ H^4, binder-arm H^5, and divider H, in combination with gears I^4 I^5 and connecting-rods, whereby the binder-arm and divider are intermittently held stationary and reciprocated, substantially as set forth.

9. In a grain-binder, the combination of a table for receiving the grain, a guard for holding the grain down upon the table, a divider adapted at one time to check the progress of the grain and at another time to permit its progress, and fingers for packing the grain against the divider and afterward, when the divider is retracted, moving the grain forward, substantially as set forth.

10. In a grain-binder, the combination of a table for receiving the grain, a guard for holding the grain down upon the table, a divider adapted at one time to check the progress of the grain and at another time to permit its progress, fingers for packing the grain against the divider and afterward, when the divider is retracted, moving the grain forward, and a binder-arm for lifting and carrying the grain onward under the guards to the binder-head, substantially as set forth.

11. In a grain-binder, a series of fingers or dividers adapted to be projected between the gavel and sheaf and moved in opposite directions, so as to draw the gavel and sheaf apart from each other, substantially as set forth.

12. The shaft E^2, provided with a cam, O, and shaft N, carrying the compressor-finger N′, in combination with dividers N^3 N^5 and pitman N^6, whereby as the compressor-finger is retracted the dividers will move away from each other, substantially as and for the purposes set forth.

13. The dividers N^3 N^5 and compressor-finger N′, operated as described, in combination with the sector-rack, twister, and cutter, binder-arm, and gears L^5, M, I^4, and I^5, whereby as the binding-strand is twisted and cut the compressor-finger is retracted to let the sheaf pass from the machine and the dividers effect a division in the grain, and as the binder-arm recedes the compressor-finger and dividers return as they were, substantially as set forth.

14. In a grain-binder, the combination of a reciprocating divider adapted to alternately hold back the grain and permit it to be moved forward, a binder-arm to carry the gavel from the divider to the binder-head while the divider remains at rest, a device to bind the strand about the gavel, a knife to sever the sheaf from the reel of binding-strand, and a divider for drawing the gavel and sheaf apart from each other, substantially as set forth.

15. In a grain-binder, the combination of an apron for receiving the cut grain, a table onto which the grain is passed from the apron, reciprocating fingers for feeding the grain over the table, a divider for holding back the grain packed against it by the fingers, and at times permitting the grain to move past it, a binder-arm for carrying the grain to the binder-head, a device for securing the binding-strand about the gavel, a knife for cutting the binding-strand, and a divider for drawing the gavel and sheaf apart from each other, substantially as set forth.

16. The hollow cylindrical twister K, provided with the tooth K′, formed, as shown, with the pendent portion K*, on the opposite sides of which, in the top face of the twister, are the slots 1 and 2, substantially as and for the purposes set forth.

17. In a grain-binder, the combination of a slotted binder-head, a slotted twister housed therein, a knife adapted to slide across the twister and cut the strand, a rack for moving the twister and provided with an arm for moving the knife, and means for actuating the rack L, so that it will move one of the slots in the twister away from the slot in the binder-head and bring the other slot opposite thereto, and then revolve the twister so as to twist the strand and slide the knife so as to cut it, substantially as set forth.

18. In a grain-binder, the combination, with a slotted binder-head, of a slotted twister and means for turning the twister so as to move one of its slots away from the slot in the binder-head and bring the other slot opposite thereto, and then reverse the movement of the twister and revolve it so as to twist the binding-strand, substantially as set forth.

19. The combination of slotted twister K and knife K^3, housed in the binder-head J^4, sector-rack L, provided with pivoted and spring-actuated arms M^3 and studs M^5, gear M, and gear L^5 and crank connecting it with the sector-rack, whereby the twister is operated and the wire cut, substantially as set forth.

20. The combination of gears L^5, M, I^4, and I^5, sector-rack L, twister K and knife K^3, binder-arm H^5, divider H, and their shafts, and the lever-rods which connect the sector-rack, divider, and binder-arm with the gears, whereby the respective parts will divide, carry forward, and bind the grain and sever the sheaf from the reel of binding-strand, substantially as set forth.

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

JOHN D. NIX.

Witnesses:
W. H. SIMMONS,
ALBERT WATSON.