(No Model.)

6 Sheets—Sheet 1.

# B. F. STEWART.

## GRAIN BINDER.

No. 428,645. Patented May 27, 1890.

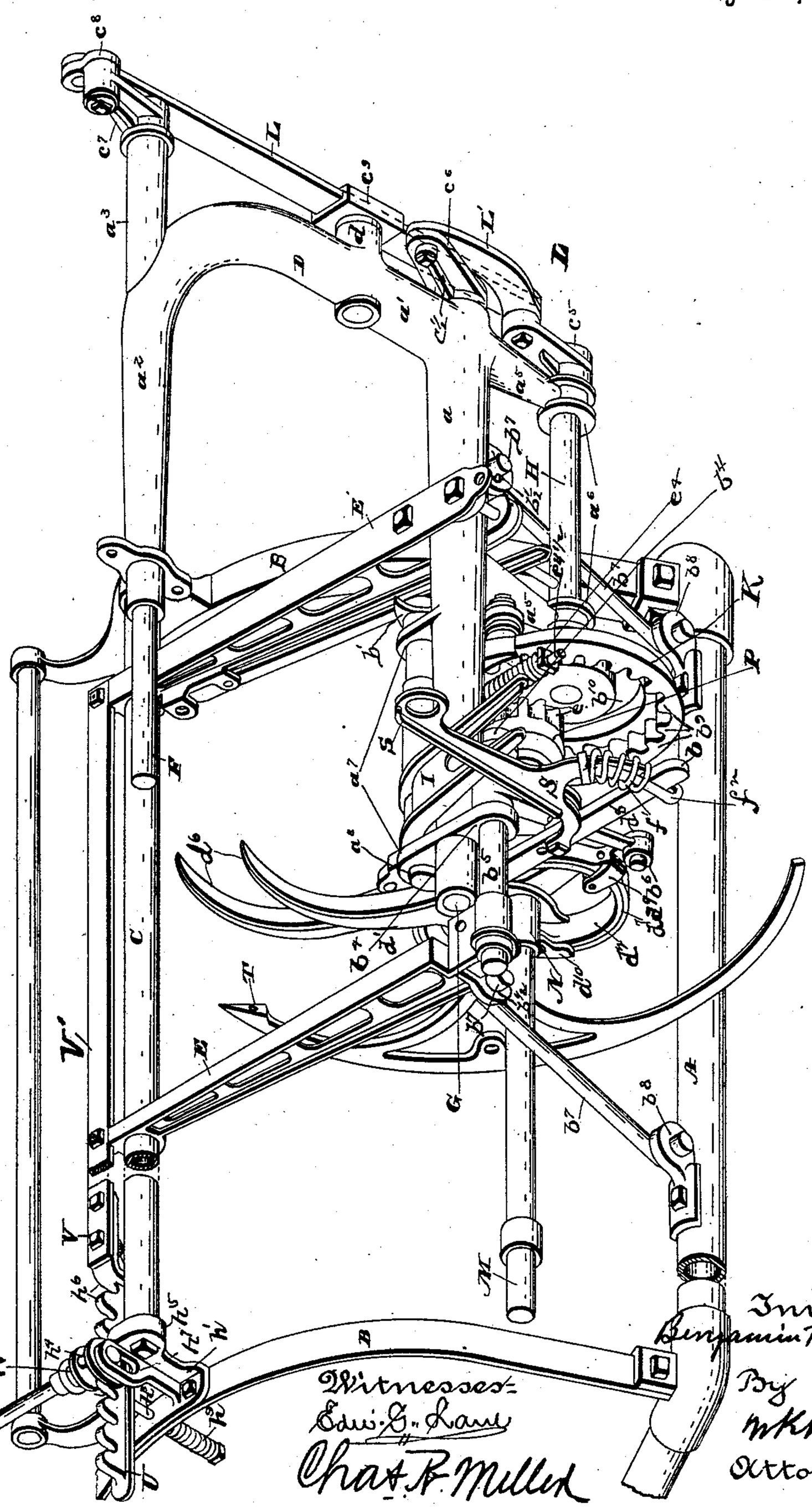

Fig. 1.

Witnesses:
Edw. G. Lane
Chas. F. Miller

Inventor
Benjamin F. Stewart
By
M. K. Miller
Attorney.

(No Model.) 6 Sheets—Sheet 2.

# B. F. STEWART.

## GRAIN BINDER.

No. 428,645. Patented May 27, 1890.

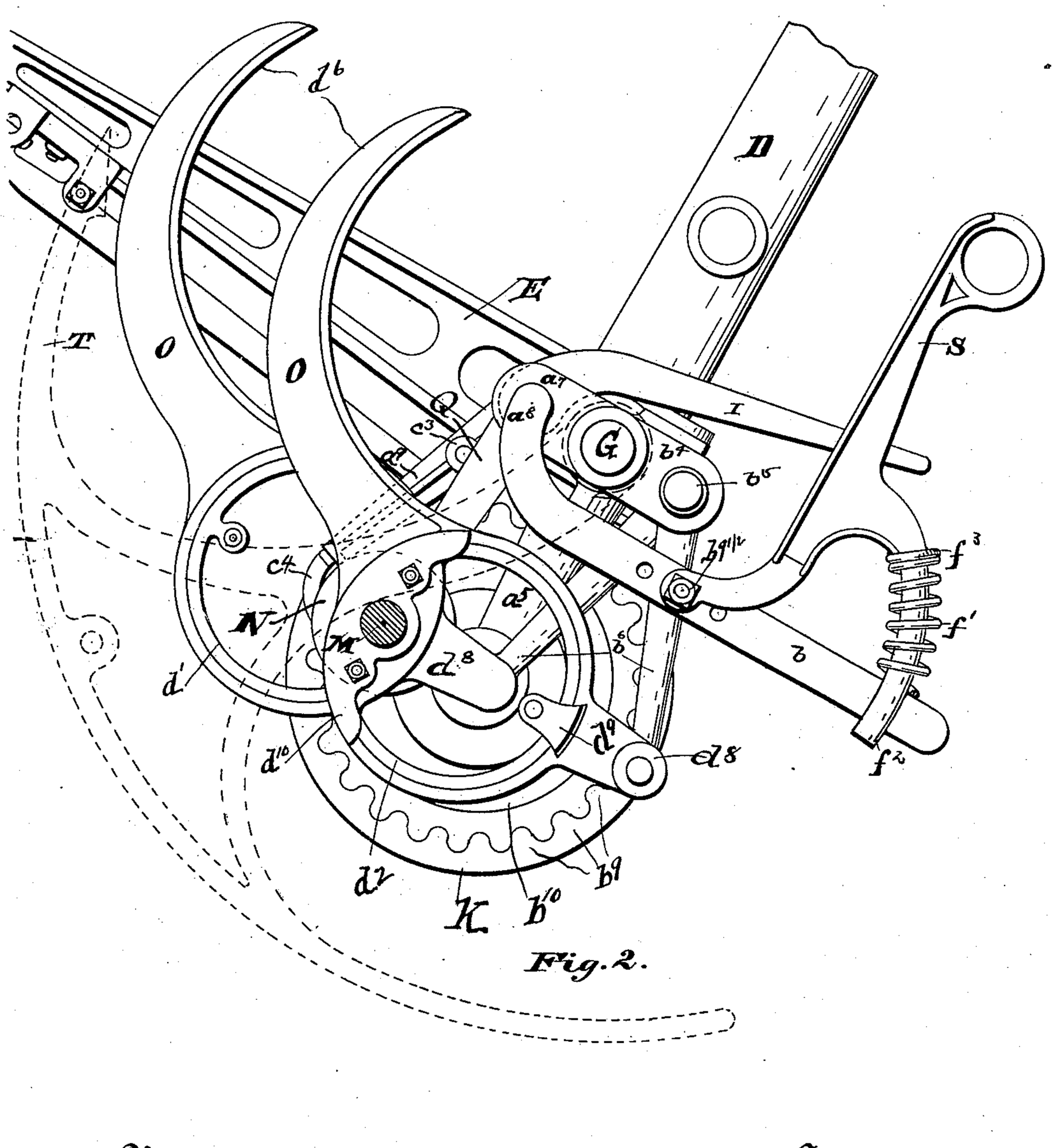


Fig. 2.

Witnesses:
Edw. H. Sawyer
Chas. R. Miller

Inventor.
Benjamin F. Stewart
By. W. H. Nichols
Attorney.

(No Model.)

6 Sheets—Sheet 3.

# B. F. STEWART

## GRAIN BINDER.

No. 428,645. Patented May 27, 1890.

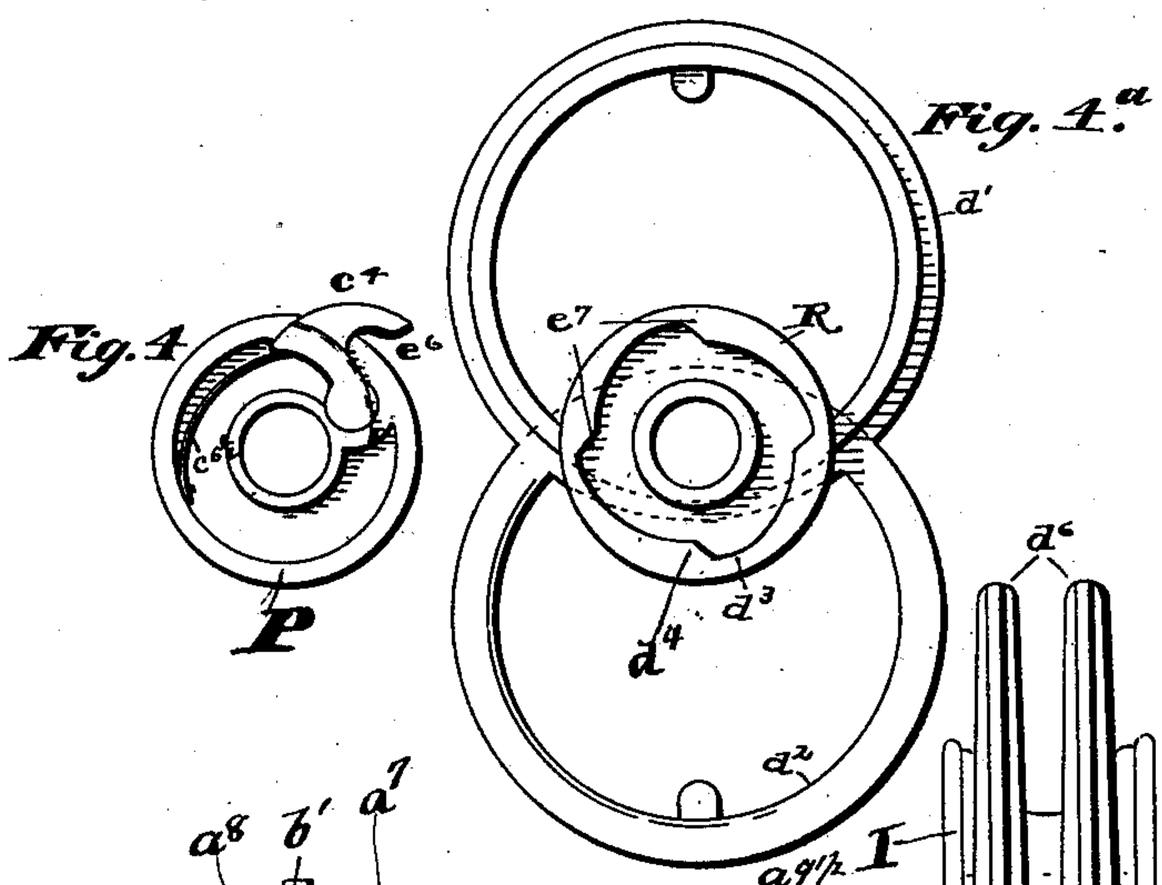





Fig. 3

Witnesses:
Edw. S. Lane
Chas. R. Miller

Inventor
Benjamin F. Stewart
By. W. K. Miller
Attorney.

(No Model.) 6 Sheets—Sheet 4.

# B. F. STEWART.

## GRAIN BINDER.

No. 428,645. Patented May 27, 1890.

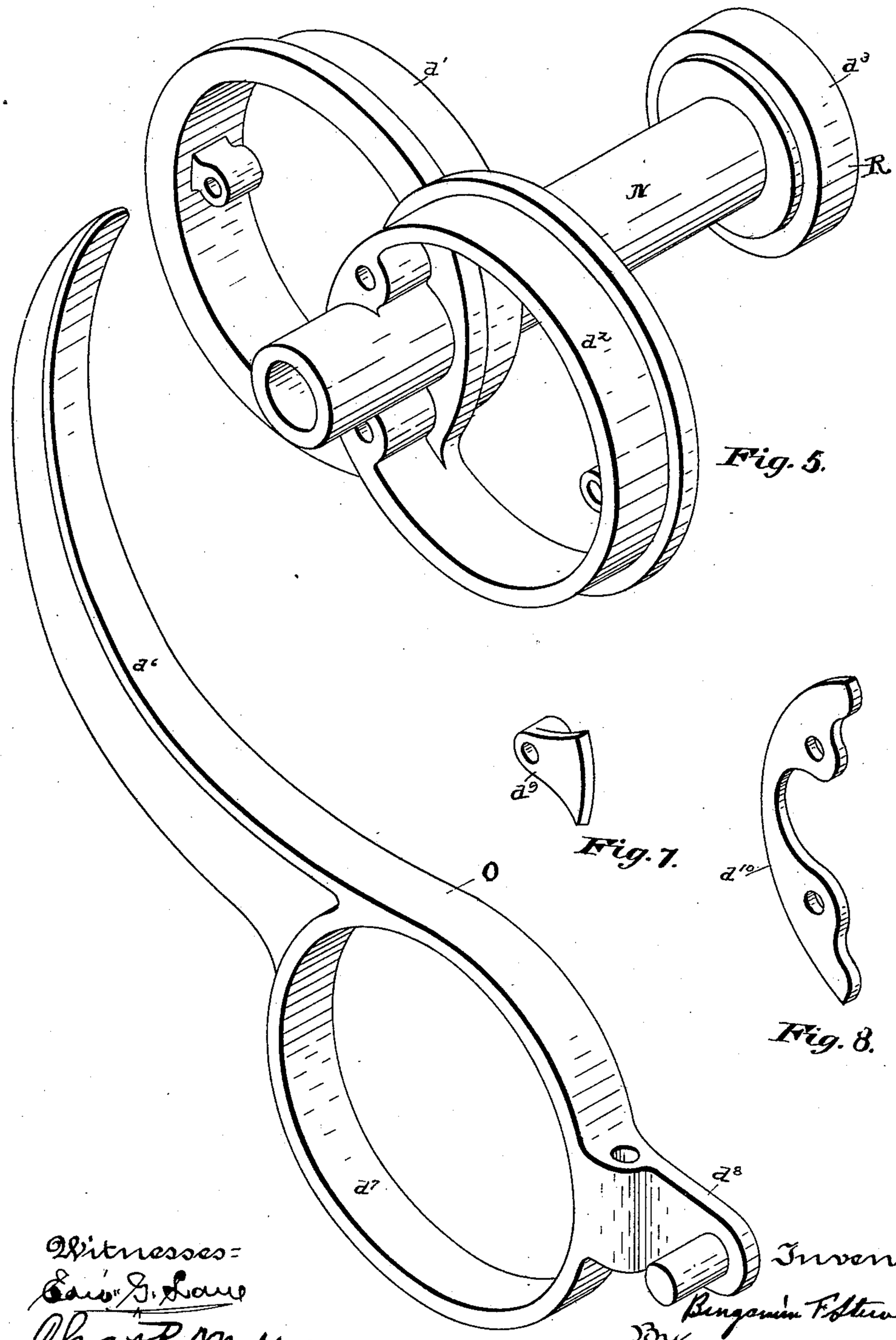


Fig. 5.




Fig. 7.




Fig. 8.

Fig. 6.

Witnesses=
Chas. G. Lane
Chas R. Mills

Inventor
Benjamin F. Stewart
By
W. K. Miller
Attorney

(No Model.) 6 Sheets—Sheet 5.

# B. F. STEWART.

## GRAIN BINDER.

No. 428,645. Patented May 27, 1890.

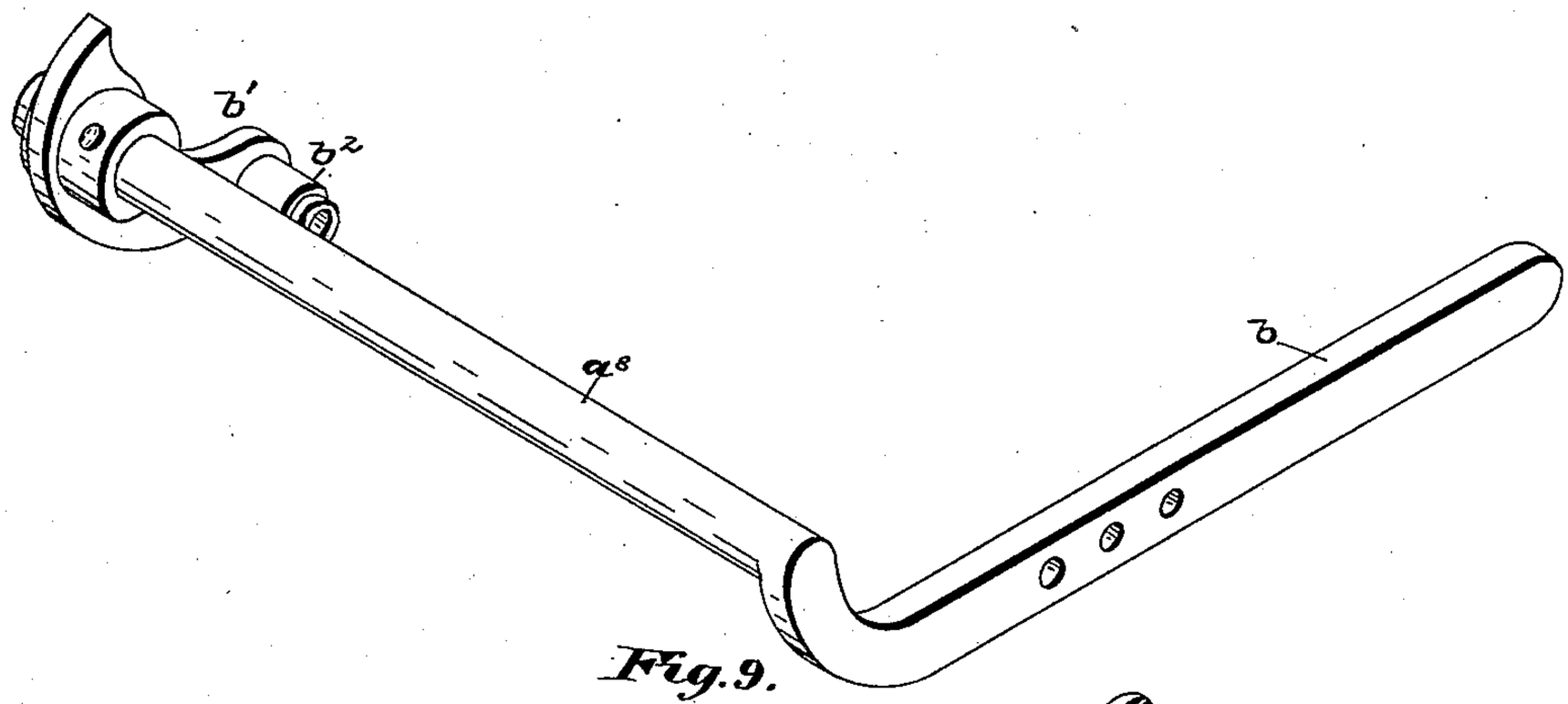


*Fig. 9.*

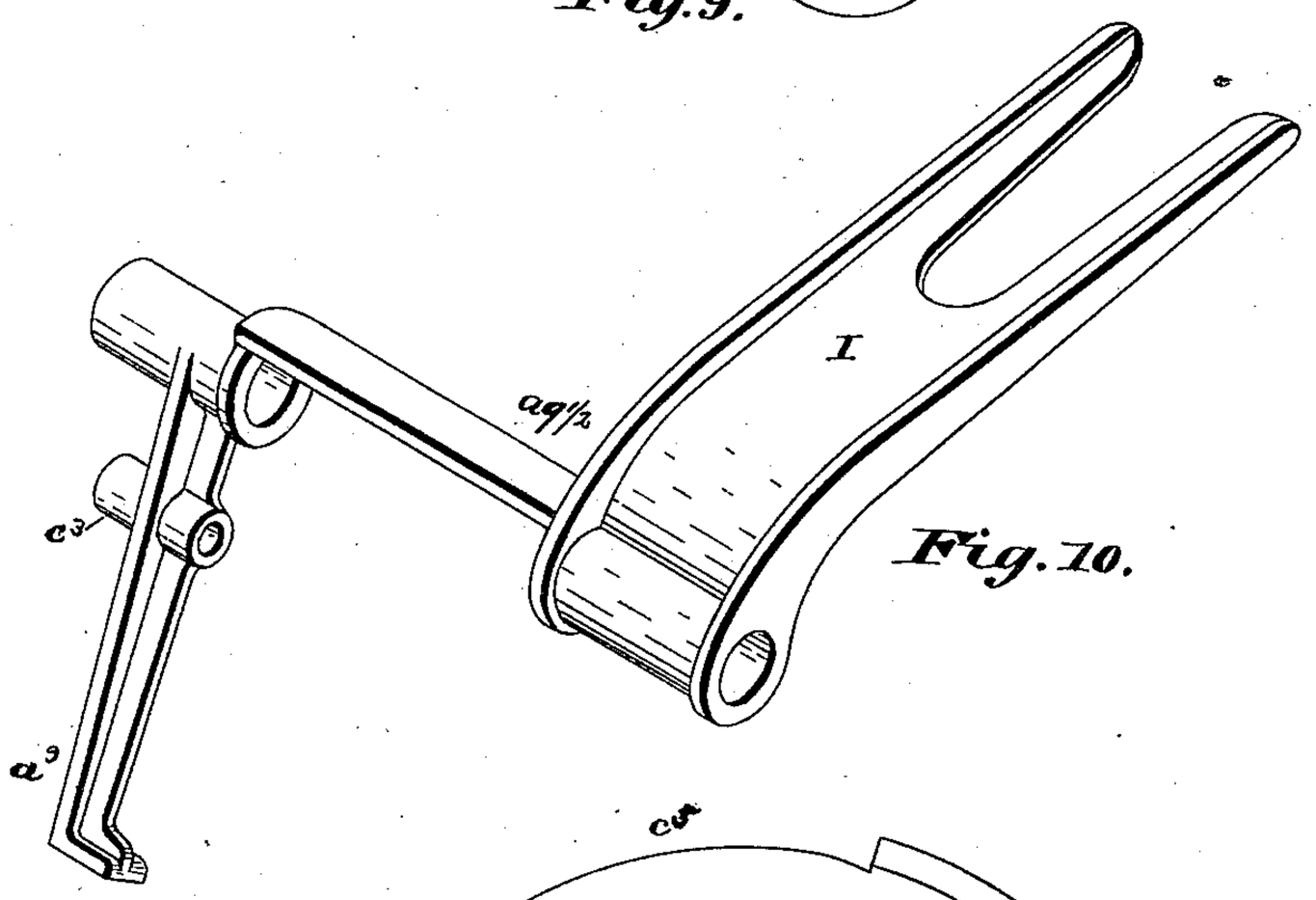


*Fig. 10.*

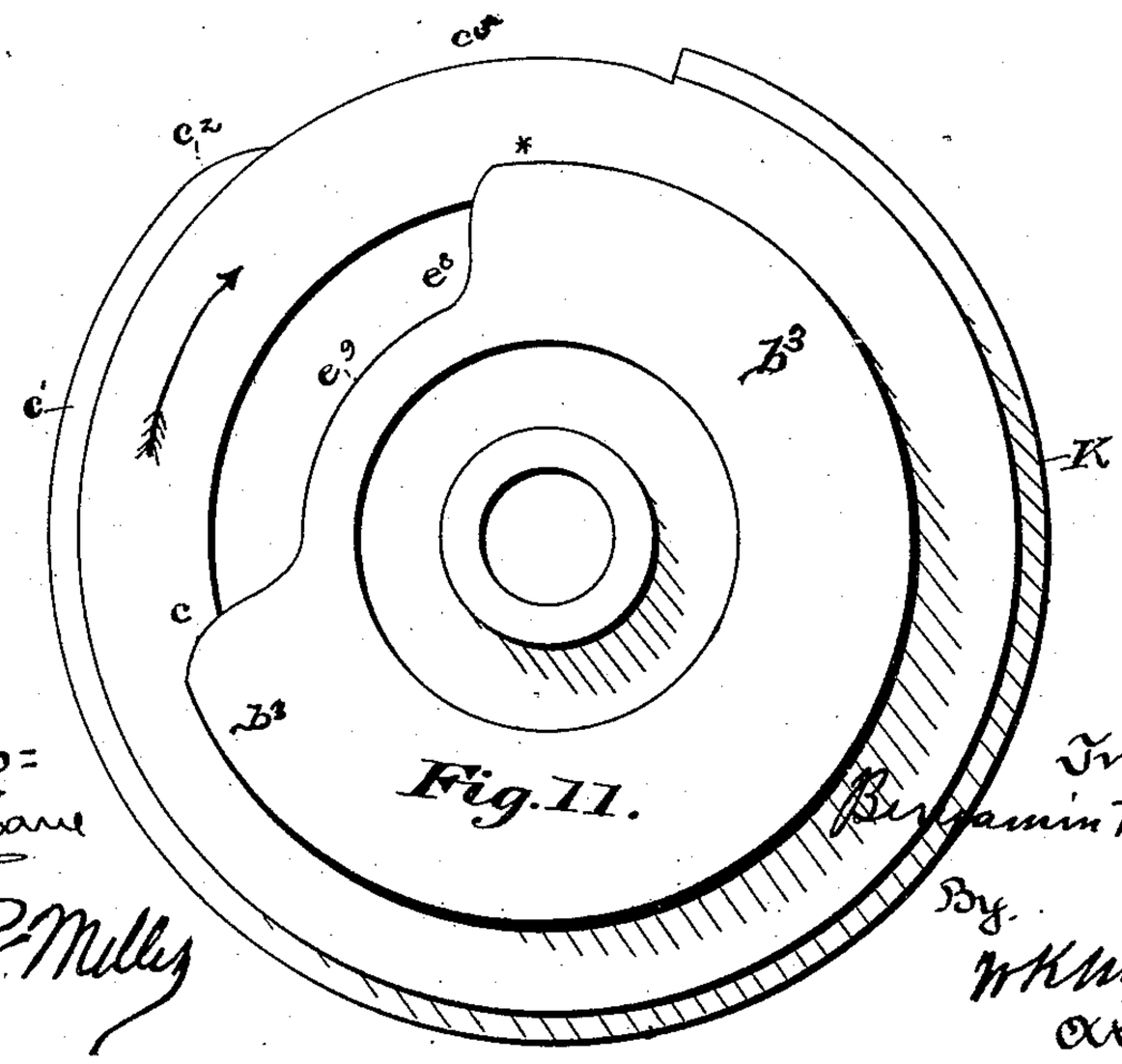


*Fig. 11.*

Witnesses=
Edw. G. Lane
Chas. F. Mills

Inventor
Benjamin F. Stewart
By
W. K. Miller
Attorney.

(No Model.) 6 Sheets—Sheet 6.

# B. F. STEWART.

## GRAIN BINDER.

No. 428,645. Patented May 27, 1890.

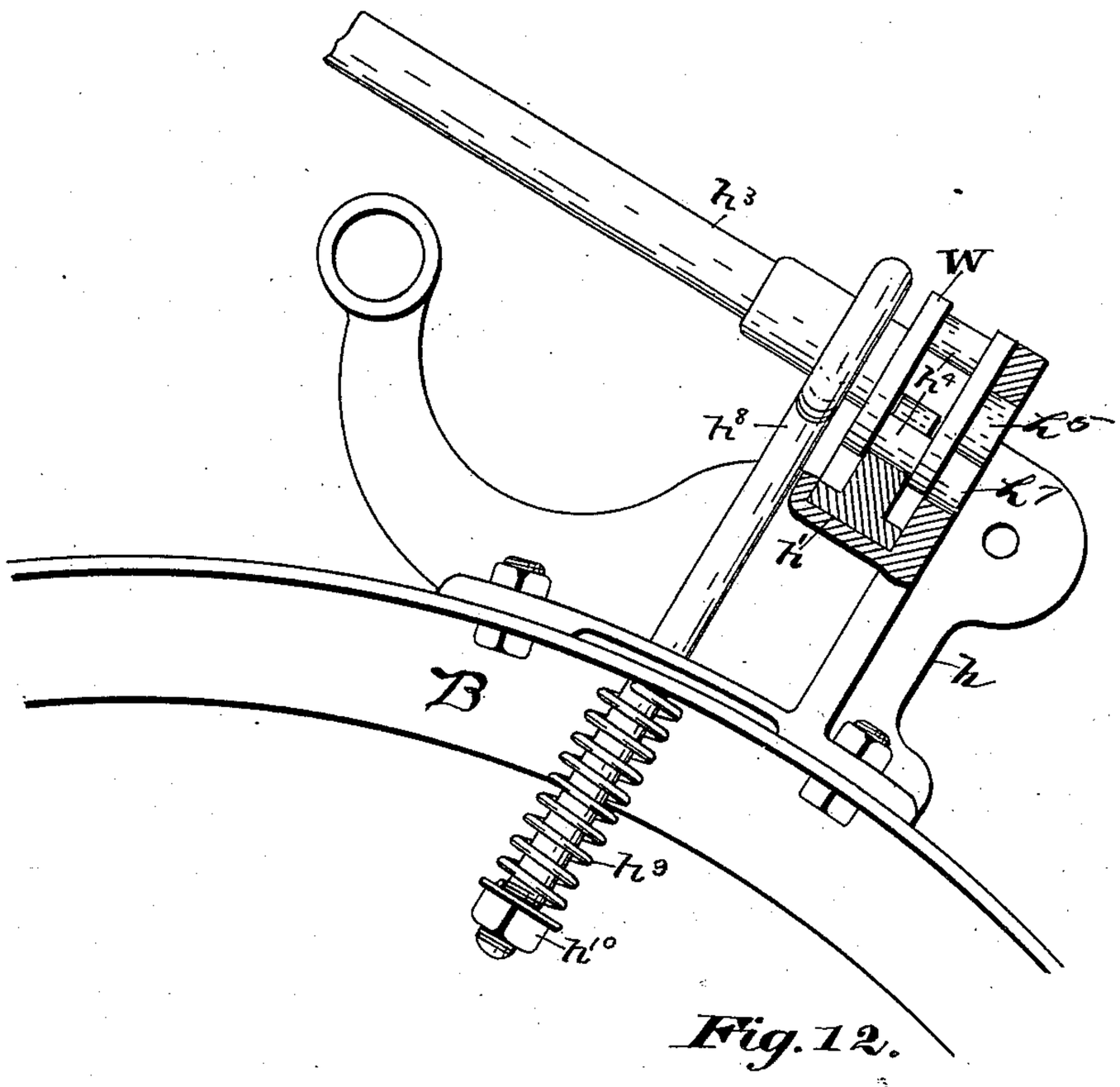


Fig. 12.

Witnesses:
Edwin L. Sawyer
Chas. R. Miller

Inventor
Benjamin F. Stewart
By. W. K. Miller
Attorney

# UNITED STATES PATENT OFFICE.

BENJAMIN F. STEWART, OF CANTON, OHIO.

## GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 428,645, dated May 27, 1890.

Application filed November 7, 1888. Serial No. 290,236. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN F. STEWART, a citizen of the United States, and a resident of Canton, county of Stark, State of Ohio, have invented a new and useful Improvement in Grain-Binders, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification.

My invention relates to improvements in grain-binders.

The object is to simplify and reduce in bulk and cost the machinery employed to operate the binder mechanism without impairing its efficiency.

A further object is to simplify and improve the grain-packers and the machinery employed to operate them; to provide new and improved machinery for compressing and releasing the bundles; to provide improved means for intermittently operating the binder machinery, and to provide means for adjusting the binder-frame forward and backward on the harvester-frame and for securing the same in the desired adjustment.

With these ends in view my invention consists in certain features of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in perspectivive of a grain-binder, illustrating my invention. Fig. 2 is an end view or elevation from the rear to show the packers. Fig. 3 is a view from the inside between the harvester and the binder. Figs. 4 and 4ª are views of the gear-clutch for the packers, showing the rack and pawl. Fig. 5 is a view in perspective of the packer-actuating eccentric and gear-clutch case. Fig. 6 is a similar view of the packer. Figs. 7 and 8 are clips by which the packers are secured to the eccentrics. Figs. 9 and 10 are views in detail of the compressor support and trip. Fig. 11 is a plan view of the back of the binder-actuating gear-wheel, showing face for actuating the gear-clutch dog and compressor. Fig. 12 is an end view of binder-shifter.

As my invention is applicable to many of the well-known harvesters I will proceed with the description, referring only to harvester parts in conjunction thereto.

The parts A, C, and B are respectively the lower, upper, and cross pieces of the binder-supporting frame. The lower tubular arm $a$ of the binder-frame D is secured in the trusses E E′, the upper ends of which are loosely secured on the frame-piece C, the lower ends being pivotally supported on the upper ends of links, having a pivotal connection with the sill A, as hereinafter explained.

The binder-frame D is composed of a lower horizontal pipe portion, as $a$, a vertical portion, as $a'$, and an upper horizontal portion, as $a^2$, the upper portion $a^2$ having an outwardly-projected portion, as $a^3$, forming a journal-box for the support of the binder-shaft F.

The lower horizontal portion $a$ is of pipe form, and in it is provided journal-bearings for the needle-shaft G. It is also provided with hangers $a^5$, having journal-boxes $a^6$, in which is supported the binder-actuating shaft H. There is also provided integral with the lower horizontal portion $a$ laterally and inwardly-projected lugs $a^7$, in which is secured a shaft $a^8$, upon which the trip I and dog $a^9$ are supported. On the said shaft $a^8$ is secured the compressor-supporting arm $b$ and actuating-arm $b'$, upon which there is provided a roller $b^2$, that engages a cam $b^3$ on the wheel K, and about diametrically opposite the lugs $a^7$ the lugs $b^4$ are provided, in which a pin, as $b^5$, is secured, about which the packer-links $b^6$ have a pivoted connection. The outer end of the pin $b^5$ is secured to the truss E, by which the rear portion of the binder-frame is supported. The front end of the binder-frame is supported by the truss E′, secured to the lower horizontal portion $a$ and to the harvester-frame piece C. As a further support for the binder-frame and the parts connected thereto and hereinafter explained, links, as $b^7$, are provided, having a pivotal connection $b^8$ with the frame-sill A and $b^{1\text{-}2}$ with the trusses E and E′, or, if preferable, to some part of the binder-frame, the object being to provide a yielding support upon which the binder parts may swing backward and forward across the harvester-frame, as hereinafter explained.

On the rear or inner end of the binder-actuating shaft H is mounted a wheel, as K, said wheel having on its face a series of inwardly-projected teeth $b^9$ and an annular groove $b^{10}$,

and on its back a cam, as $b^3$, having a cut-away portion, as $c$, by which the compressor-arm is vibrated, and about the periphery of said wheel there is an outwardly-projected flange $c'$, cut away at $c^2$, forming a cam.

On the front end of the shaft II there is mounted a crank $c^5$, and on the end of the needle-shaft G is mounted a similar crank $c^6$. These cranks are connected by a link L', substantially as shown. The length of the crank $c^6$ determines the amount of rotation of the shaft G and the throw of the arm or needle T, usually about one-third of a revolution.

On the front end of the knotter-shaft F there is mounted a crank $c^7$, to the outer end of which there is pivotally secured a differential link or crank $c^8$, by which the difference between the circle described by the end of the driving-link L and the cranks $c^5$ and $c^7$ may be compensated, the said link passing through a pivoted loop or fulcrum $c^9$, connecting the cranks $c^5$ $c^8$. Said loop has a supporting-spindle that is passed through and rotated in a journal-box $d$, supported by the frame D.

The parts just above described have been fully set forth in my application for Letters Patent filed on the 6th day of August, 1887, Serial No. 246,336, and will, for the purposes of this application, need no further description.

M represents the packer-shaft. It is located below and inside of the shaft G. Its rear end may be supported in a journal-box secured to the harvester-frame in any of the well-known and approved ways, and near its front end it is supported in a journal-box $d^5$ in a hanger Q, suspended from the compressor-shaft $a^8$.

In the accompanying drawings a sleeve N is shown secured on the shaft M and extending through the journal-box $d^5$, forming a bushing about the shaft within said journal-box. One end of said sleeve is provided with a pair of eccentrics $d'$ $d^2$, cast integral therewith and about diametrically opposite each other, and on the opposite end of the sleeve a clutch-bearing hub R is secured having interiorly-projected teeth, as $d^4$. It is evident, however, that the eccentrics and the hub might be separately secured to the shaft M and the shaft allowed to bear directly within the journal-box $d^5$, if so preferred.

The packers O have a finger portion $d^6$, a ring portion $d^7$, and a tail portion $d^8$. The ring portions $d^7$ are placed upon the eccentrics $d'$ $d^2$, the tail-pieces are pivotally secured to depending links $b^6$, and the ring portions are held in position on the eccentrics by clips $d^9$ and $d^{10}$, fastened to the eccentrics and projecting outwardly over the edges of the ring portions $d^7$, as shown. The clips $d^9$ and $d^{10}$ may be of any suitable shape adapted to the purpose.

On the front end of the shaft M is loosely mounted a pinion P, having teeth $e$, adapted to engage similar teeth $b^9$ on the wheel K. The back portion of said pinion is provided with a pivoted pawl $c^4$, having the outwardly-curved end $c^6$. This pawl is forced outwardly by a spring $c^{6\,1\text{-}2}$, attached to the said pinion and in engagement with said pawl. This pawl, when released, will engage the clutch-teeth $d^4$ of the clutch R, as shown in Fig. 4ª, for the purpose to be hereinafter explained.

The front end of the shaft M is projected beyond the pinion P into the groove $b^{10}$ in the face of the wheel K, by which the teeth $b^9$ on the wheel and $e$ on the pinion are held in engagement. This provision is not a material matter and may be omitted; but for the purpose of this case I have suspended the hanger Q on the compressor-shaft $a^8$. It will be noticed that the shaft M, because of its journal-connection at its rear end with the harvester-frame at its seat in the groove $b^{10}$ of the wheel K at its forward end, does not yield transversely to its axis, as is the case with the packer-shaft described in my application filed August 6, 1887, Serial No. 246,336. The gearing, however, so far as relates to the internal teeth of the wheel and the external teeth of the pinion, are similar. In both cases the number of teeth in the wheel is three times the number of teeth on the pinion, this number and division having been found necessary to allow the packers to act with desired speed, and that three revolutions of the packer-shaft and pinion will give the binder-actuating shaft one full revolution, and by the use of the link L, having one of its ends pivotally secured to the crank $c^5$ on the binder-actuating shaft II and the other end pivotally secured to the crank $c^7$ on the end of the knotter-shaft F, and the provision of a fulcrum placed between a shaft II and the shaft F, over which the link L may be vibrated, to apply the driving-power laterally to the driven crank to help it over the dead-points and to rotate the knotter-shaft in a direction opposite to the movement of the packer-shaft, giving to the packer-shaft and packers the proper movement to compact the cut grain into the grain-receptacle, and to the knotter-shaft the proper movement to discharge the bound bundle, and by the use of the link L', having one of its ends pivotally secured to the crank $c^5$ on the binder-actuating shaft II and the other end pivotally secured to the crank $c^6$ on the end of the needle-shaft G, the latter will, by the rotation of the former, be rocked on its bearings to raise and lower the needle to place the cord about the bundle.

I do not limit myself to the form or construction of the fulcrum shown and herein described, as there are other forms that are well known by which the same result may be reached; but I call particular attention to the fact that the shafts F and A are wholly dependent upon their link-connection with the shaft II for their rotary and rotary-reciprocating movement, respectively, thus dispensing with the usual train of gear and cam wheels formerly used, and thus simplifies the construction, reducing the weight and initial

cost of the machine. Neither do I limit myself to the precise manner, as shown, of linking the shafts F, G, and H together, as a slight change of the pivotal connection of the shaft G to the other parts might be resorted to without in the least changing the spirit and scope of the invention.

From the hereinbefore-described arrangement of parts it will be understood that the gist of this feature of my invention consists in connecting the binder-actuating shaft, the knotter-shaft, and the needle-shaft of the binder with driving-links, so that one revolution of the driving-shaft H will, by the linked connection, revolve the knotter-shaft and the linked connection of the needle-shaft to either of the hereinbefore-mentioned points, whereby the needle-shaft may be rocked on its bearing the desired distance to give the needle the proper forward movement to place the cord into the holder and back to a position of rest below the grain-table.

The cord-holder and grain-table are not shown in the drawings, as this invention is applicable to any of the well-known and improved forms of cord-holders and grain-tables.

The mechanism by which the binder is brought into action consists of the trip I, sleeved to turn freely upon the compressor-shaft $a^8$ and having its free end extending outwardly and the inner end connected to the dog $a^9$ by a bar $a^{9\,1\text{-}2}$. The dog is provided with a roller or pin $c^3$, adapted to travel on the rim $c'$ of the wheel K, which rim is cut away, as shown at $c^2$, forming a cam or depressed rest-surface $c^5$, which allows the roller to drop a distance sufficient to bring the outer end of the dog $a^9$ into a locking engagement with the pawl $c^4$, in which position it is held by a coil-spring $e^4$, engaged upon an extension $e^{4\,1\text{-}2}$ of the dog and exerting an outward pressure upon the said dog.

S denotes the compressor-finger pivoted to the compressor-supporting arm $b$ at $b^{9\,1\text{-}2}$. To prevent violence to the compressor and the needle, a coil-spring $f'$ is provided about an arm $f^2$ of the compressor S, one end of the spring resting on the arm $b$ and the other against the shoulder $f^3$ of the arm $f^2$.

The operation of the parts so far as described is as follows: The cut grain is compacted into the receptacle against the compressor-finger S to the desired density. The pressure of the grain upon the trip will move it downwardly and by its connection with the dog $a^9$ and rocking movement will raise the dog out of engagement with the pawl $c^4$, at which instant the spring $c^{6\,1\text{-}2}$ will throw the end $e^6$ of the said pawl into engagement with the rack-teeth $d^4$ of the clutch R, thereby coupling the pinion P with the driving-clutch R. The pinion engaging the wheel K will impart motion to the same. The roller $b^2$, hereinbefore described, which rests at a point on the cam $b^3$, designated by a star, will travel up and over said cam, thereby rotating the shaft $a^8$ and rocking the arm $b$ and driving the finger S inward against the grain and the forward movement of the needle T, thus compressing the sheaf or bundle to a desired density. At the instant the knot has been tied the roller $b^2$ will pass over the end $c$ of the cam $b^3$ on a depressed rest-surface $e^9$ sufficiently near the center of the wheel K to allow the arm $b$ to swing down to drop the finger S out of the way of the bundle as it leaves the binder, after which the roller $b^2$ will raise over the cam $e^8$, at which instant the roller $c^3$ on the dog $a^9$ will drop onto the depressed rest-surface $c^5$, allowing the dog to come into a locking engagement with the pawl, throwing it out of engagement with the clutch R, and restoring the parts to position, as shown in Fig. 1. To prevent a reverse movement of the parts, any ordinary device may be employed to lock the wheel K against a reverse rotation.

To move the binder-frame across the end of the harvester for the purpose of adjusting the band to the length of the cut grain, a tooth-rack, as U, is secured to the binder-frame, as shown at V, by means of a bar V', connecting the upper ends of the trusses E E', the back of said rack resting in a groove $h'$ in a bracket $h$, secured to the harvester-frame.

A disk-wheel W is pivotally secured to the end of an operating-shaft $h^3$, said disk-wheel having two studs $h^4$ diametrically opposite each other, by which the disks forming the wheel W are secured together, and which engage the teeth $h^6$ of the rack U. An outwardly-projected hub $h^5$ is provided and is supported in the oblong perforation $h^7$ in the bracket $h$, in which it may rise and fall as the studs $h^4$ step over and engage the teeth of the rack-bar as the pinion is rotated for the purpose of moving the binder across the frame and to hold it in desired adjustment.

To secure a continuous engagement of the studs with the teeth, a rod, as $h^8$, is provided, having an eye on its upper end, which embraces a hub on the inner side of the disk-wheel, as shown in Fig. 12. The free end of the rod is passed through a perforation in the frame-piece B, and about it is placed a coil-spring $h^9$, the energy of which is exerted downwardly against the hub $h^{10}$, the result of which is to hold the studs of the disk-wheel in close engagement with the rack. When the binder has been adjusted, the two studs should rest on the rack between the teeth, in which position they will be held by the spring, thus locking the binder-frame in desired adjustment.

To regulate the tension of the binding-cord, any well-known or improved device may be employed.

Having thus fully described my invention, what I claim is—

1. The combination of the packer-shaft M, packers secured thereto, a compressor-shaft, a compressor secured thereto, the binder-actuating shaft H, the pinion on the packer-shaft,

the internal gear-wheel mounted on the shaft H in engagement with said pinion and provided with a peripheral cam, a clutch between the pinion and the shaft M, a dog $a^9$, secured to the compressor-shaft and actuated by the cam of said wheel to operate the clutch, and a compressor-actuating cam $b^3$, substantially as set forth.

2. The combination, with the binder-actuating wheel K, the trip I, a dog $a^9$, carrying the roller $c^3$ to engage the cam $c'$ on the wheel K, compressor-shaft $a^8$, having its laterally-projected compressor-supporting arm $b$, the compressor-finger S, carried thereby, arm $b'$ on the shaft $a^8$, roller $b^2$ on arm $b'$, and the cam $b^3$ on the wheel K, substantially as set forth.

3. The combination of the packer-shaft M, packers secured thereto, pinion on said shaft, a clutch R for engaging said pinion and provided with a pawl $c^4$, the binder-actuating shaft H, an internal gear-wheel mounted on one end of said shaft, a crank $c^5$, secured to the opposite end, the knotter-shaft F, a crank $c^7$, mounted thereon, a link connecting said cranks, a fulcrum intermediate said cranks for said link, a needle-shaft G, having a link-connection with said shafts, and the dog $a^9$, engaging the pawl $c^4$, and the trip I, connected with the dog, whereby the binding machinery may be intermittently operated, substantially as set forth.

4. The combination, with the harvester, of a binder-frame adapted to move transversely upon the harvester, having the rack U, the shaft $h^3$, the disk-wheel W, having studs $h^4$ diametrically opposite each other, a supporting-bracket $h'$ on the harvester having an oblong perforation $h^7$, a restraining-rod $h^8$, encircling the shaft $h^3$, and the spring $h^9$, substantially as set forth.

In testimony whereof I have hereunto set my hand this 3d day of November, A. D. 1888.

BENJAMIN F. STEWART.

Witnesses:

CHAS. R. MILLER,

W. K. MILLER.