(No Model.) 4 Sheets—Sheet 1.

J. A. GRAHAM & E. J. BIRKETT.

GRAIN BINDER.

No. 503,662. Patented Aug. 22, 1893.

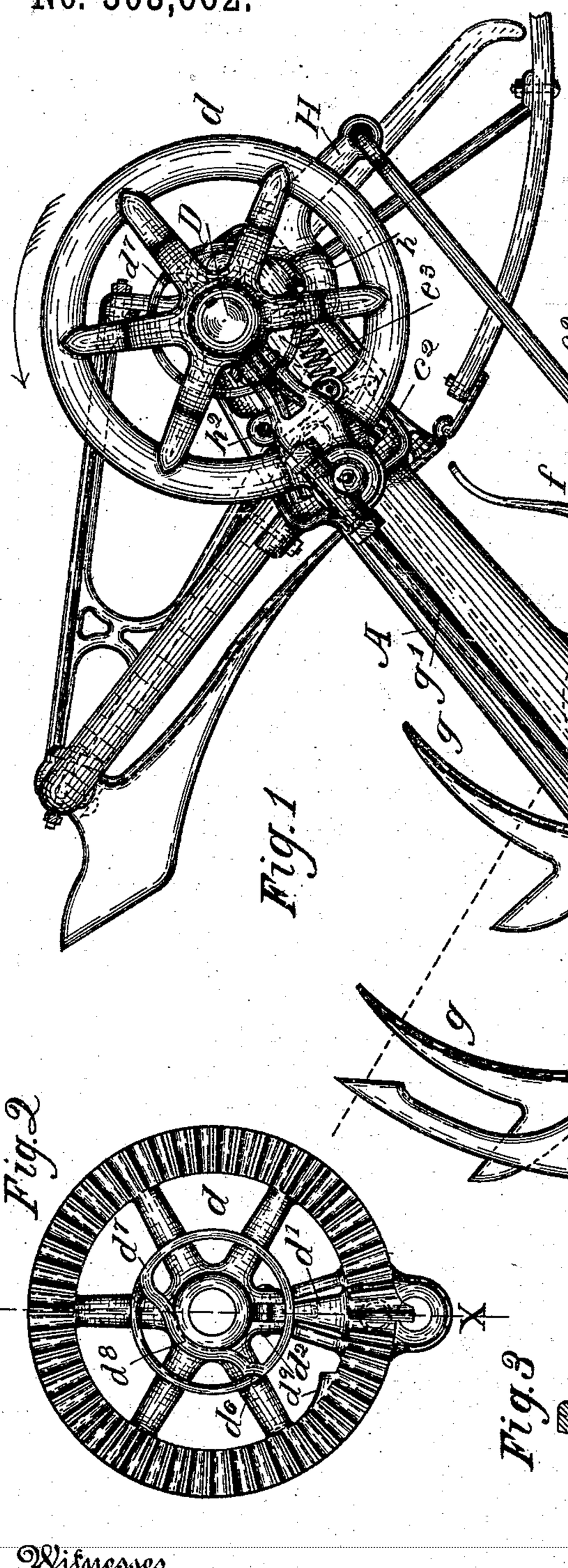


Fig. 1.

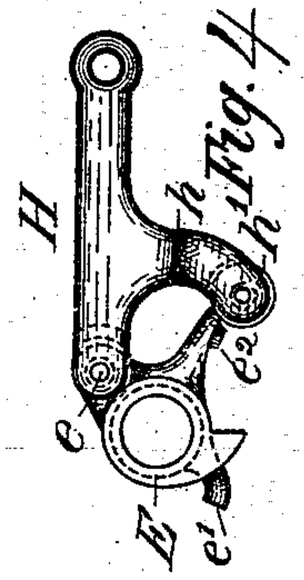


Fig. 4.

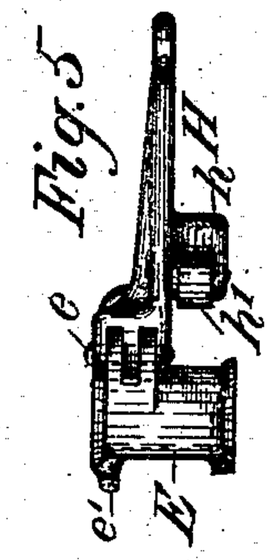


Fig. 5.

Fig. 2.

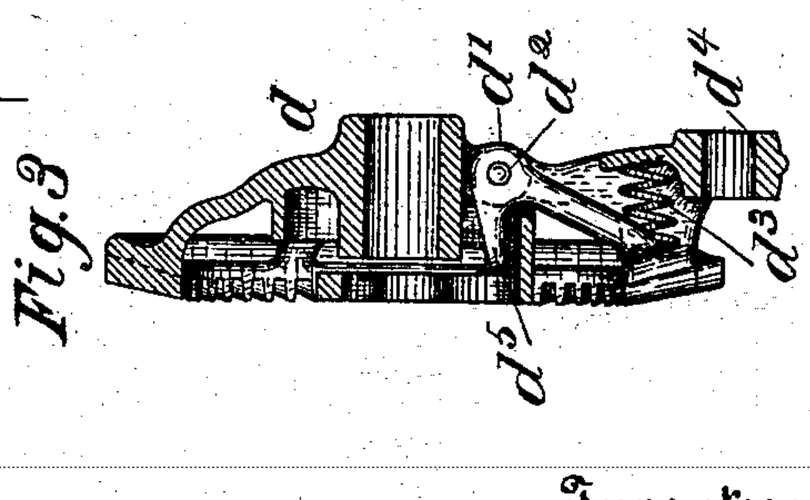


Fig. 3.

Witnesses
Benj. le Sadamo,
J. D. Walker

By their Attorney

Inventors
James A. Graham,
Edward J. Birkett,
J. H. Latimer

(No Model.) 4 Sheets—Sheet 2.

J. A. GRAHAM & E. J. BIRKETT.

GRAIN BINDER.

No. 503,662. Patented Aug. 22, 1893.

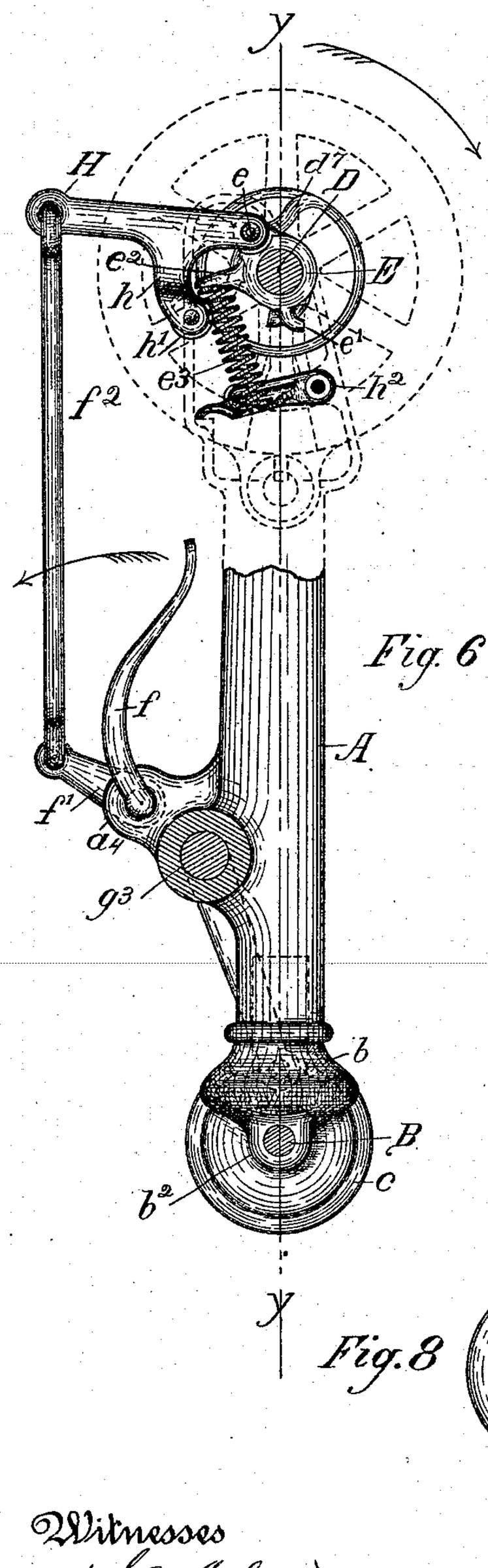


Fig. 6

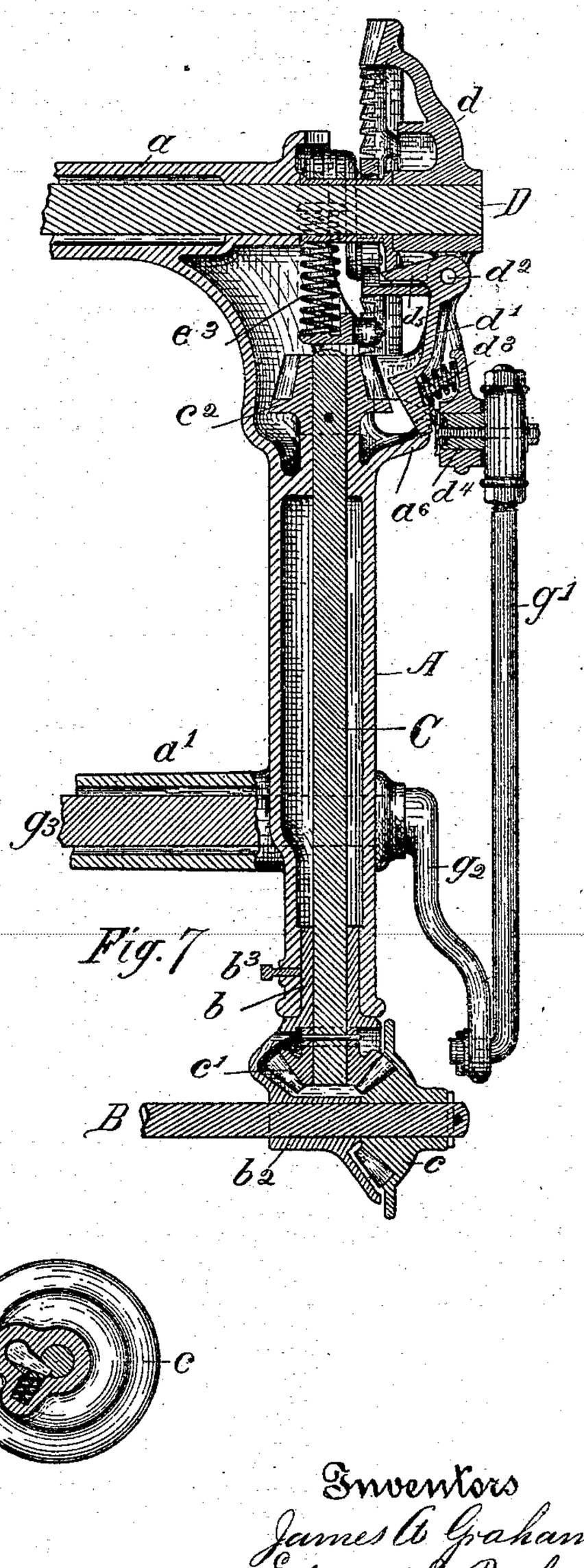


Fig. 7

Fig. 8

Witnesses
Benj. E. Adams,
J. D. Walker

Inventors
James A. Graham.
Edward J. Birkett.
By their Attorney J. H. Latimer.

(No Model.)

4 Sheets—Sheet 3.

J. A. GRAHAM & E. J. BIRKETT.

GRAIN BINDER.

No. 503,662. Patented Aug. 22, 1893.

Fig. 10

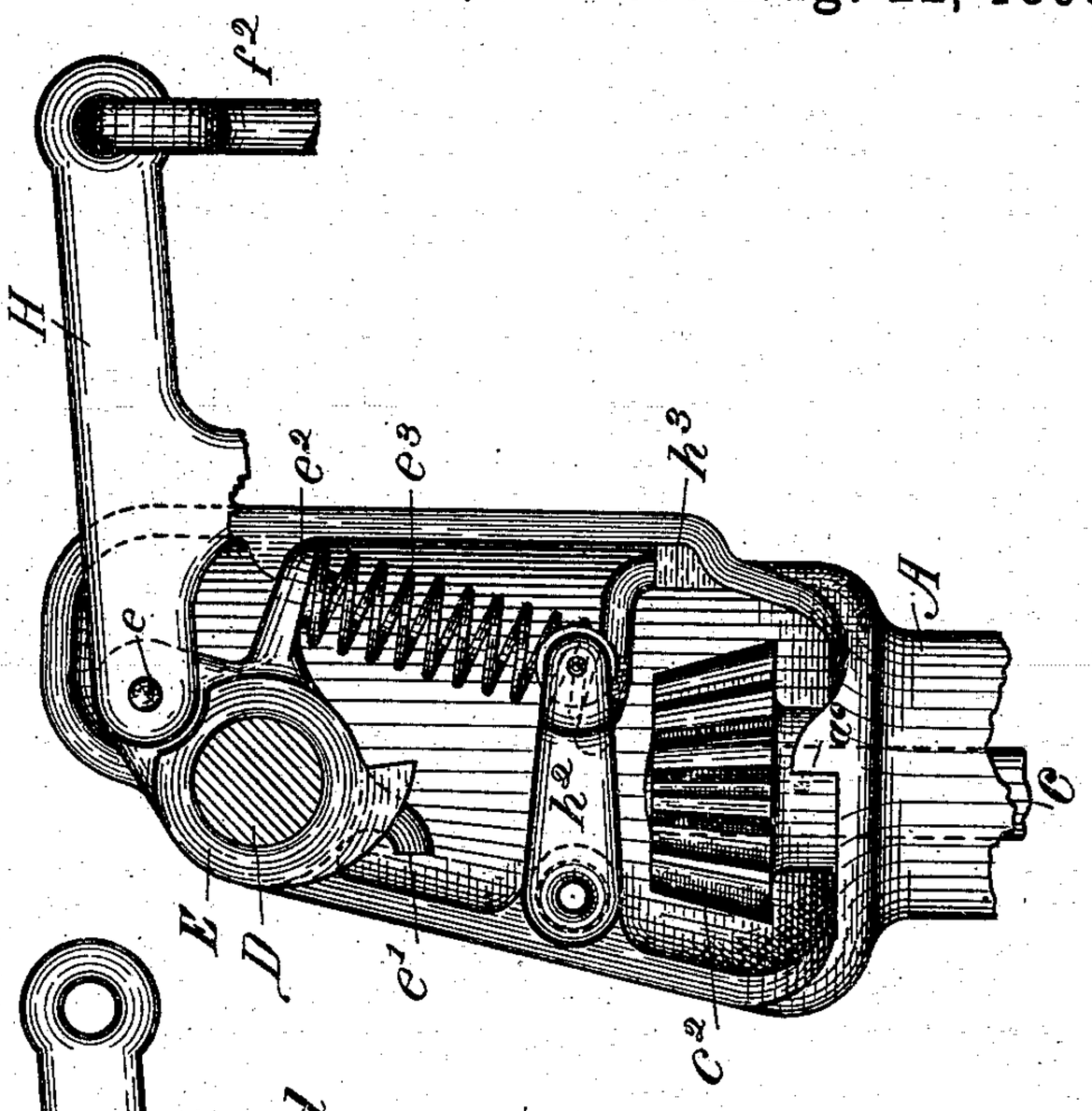
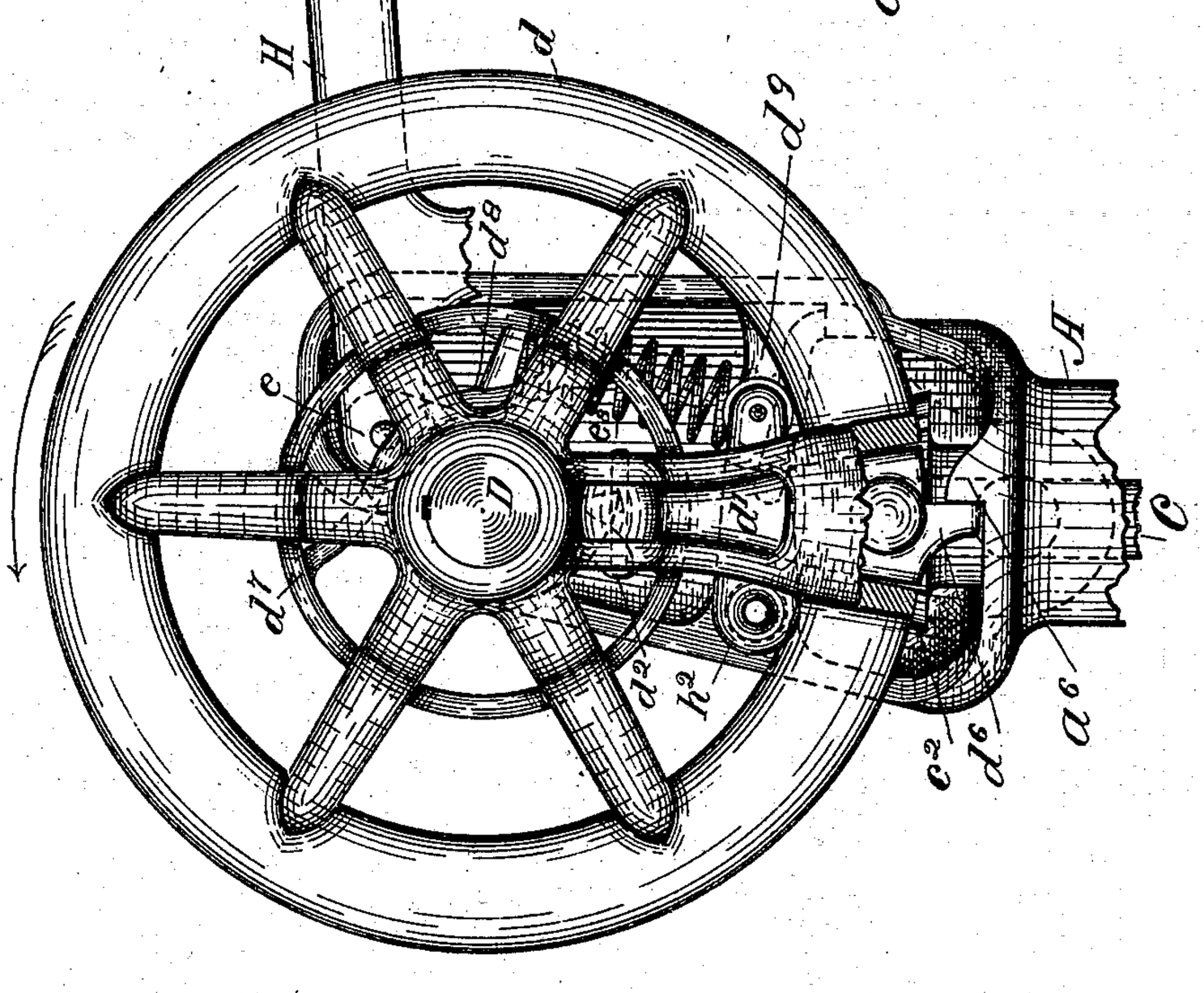


Fig. 9



Witnesses
Benj. le Breton.
J. D. Walker

Inventors
James A. Graham,
Edward J. Birkett,

By their Attorney J. H. Latimer.

(No Model.) 4 Sheets—Sheet 4.

J. A. GRAHAM & E. J. BIRKETT.

GRAIN BINDER.

No. 503,662. Patented Aug. 22, 1893.

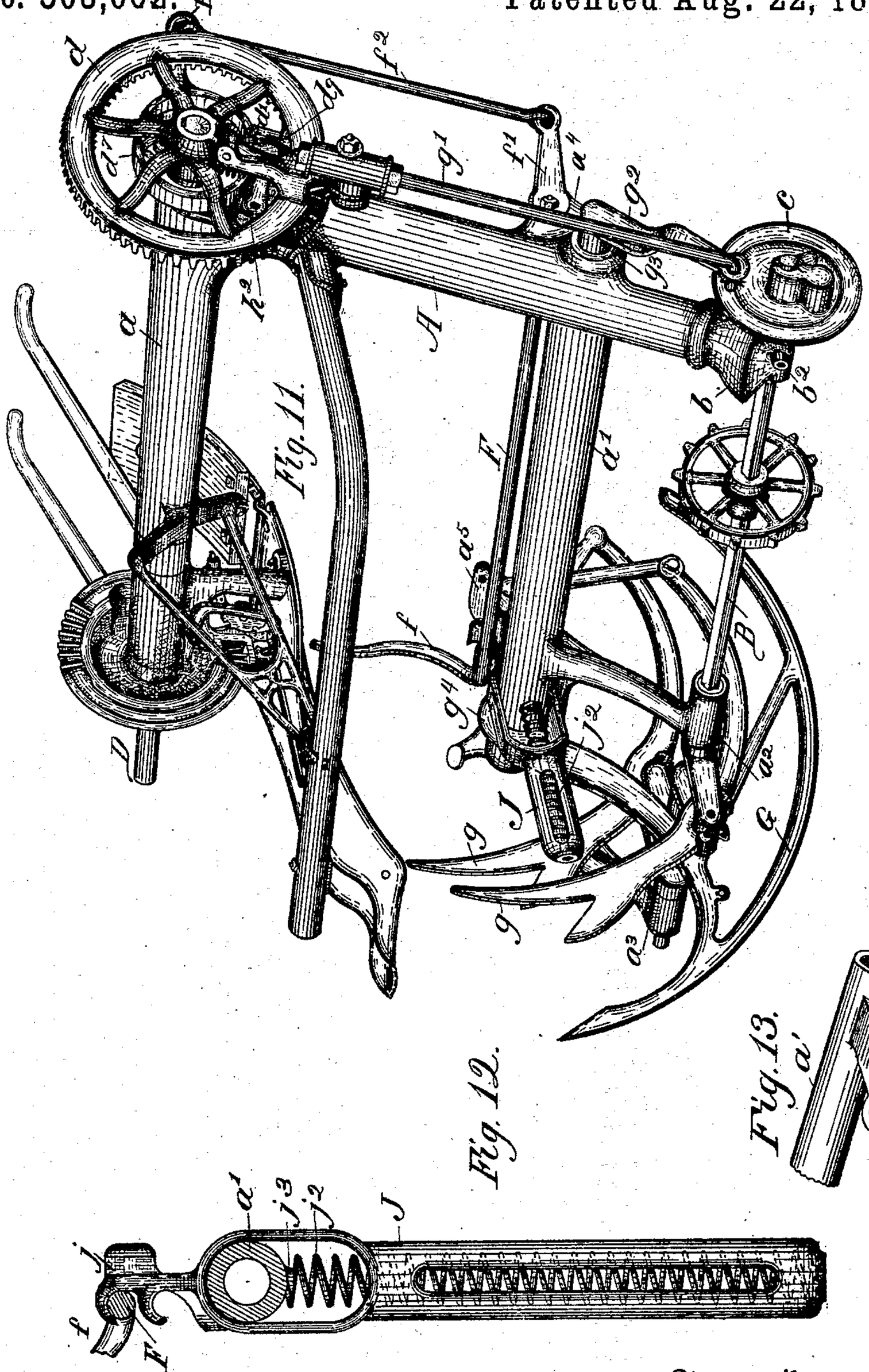


Fig. 11.

Fig. 12.

Fig. 13.

Witnesses
Benj. C. Adams.
J. D. Walker

Inventors
James A. Graham,
Edward J. Birkett.
By their Attorney J. N. Latimer.

UNITED STATES PATENT OFFICE.

JAMES A. GRAHAM AND EDWARD J. BIRKETT, OF MILWAUKEE, WISCONSIN, ASSIGNORS TO THE MILWAUKEE HARVESTER COMPANY, OF SAME PLACE.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 503,662, dated August 22, 1893.

Application filed June 20, 1892. Serial No. 437,284. (No model.)

To all whom it may concern:

Be it known that we, JAMES A. GRAHAM and EDWARD J. BIRKETT, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Grain-Binders; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

Our invention relates to that class of automatic grain binders in which the grain as it is delivered into the binder is by the action of the packers formed into a gavel against a yielding compressor arm which, when a sufficient amount of grain for a gavel has been accumulated, yields and trips the binding mechanism into gear, and thereupon the needle arm advancing compresses the grain against the compressor arm and places the twine in the knotter, which ties and discharges the bundle.

Our improvements consist essentially, first, in the construction and arrangement of the binder frame and gearing for operating the binding mechanism; and, second, in the compressing and tripping mechanism for automatically starting and stopping the binder at the proper times.

They consist also in certain other novel features of construction and arrangement hereinafter particularly described and pointed out in the claims.

In the accompanying drawings, like letters designate the same parts in the several views.

Figure 1 is a rear end elevation of a portion of a grain binder to which our improvements are applied. Fig. 2 is a face view of the bevel gear on the knotter shaft. Fig. 3 is a section of said gear on the line *x x* Fig. 2. Fig. 4 is a side view of the trip lever and cam. Fig. 5 is a plan view of the parts shown in Fig. 4. Fig. 6 is a front elevation of a portion of our improved binder, a part of the frame being broken away to expose the trip and compressing mechanism and the several parts being shown in the position they occupy when the binder is at rest. Fig. 7 is a sectional view on the line *y y* Fig. 6 of a portion of the binder. Fig. 8 is an end view of the driving pinion on the rear end of the packer shaft, a portion being cut away to expose its ratchet connection with said shaft. Fig. 9 is an enlarged rear end view of a portion of the binder, a part of the trip lever and gear on the knotter shaft being broken away to disclose parts which would otherwise be hidden thereby. Fig. 10 is a view like that shown in Fig. 9, except that the gear wheel is removed. Fig. 11 is a perspective view of our improved binder; and Fig. 12 is a side elevation of the yielding compressor yoke on the lower arm of the binder frame, which is shown in section. Fig. 13 is a perspective view of a portion of arm a' of the binder frame, showing the arm a^5 projecting therefrom, and which supports the forward end of the compressor.

A represents the upright portion of the binder frame, formed with two parallel tubular arms a and a' projecting horizontally therefrom; the former carrying the knotter shaft D and the latter the needle shaft g^3.

The upper end of part A, at or near its junction with arm a, is formed into a housing as shown in Figs. 7 and 10 for inclosing and shielding a part of the trip and compressor connections. It is also formed near its upper end with a bearing for the upper end of shaft C, and below said bearing it is made tubular or hollow for the purpose of inclosing said shaft. Fitted into its lower end and secured therein by a set screw b^3 is a box b, carrying the lower end of shaft C, and formed at right angles thereto with a box b^2 carrying the rear end of shaft B; said boxes being so formed as to constitute a housing for the inter-working pinions c and c'; the former mounted loosely upon and connected by a ratchet with shaft B, and the latter secured to the lower end of shaft C.

B is a continuously rotating driving shaft, which may be driven from any convenient part of the machine. It is provided at its front end with cranks for operating the packers g g, and is supported in the box b^2, above

mentioned, and in suitable bearings a^2 and a^3 projecting from the binder frame. The upright shaft C, continuously rotated by the shaft B through the connecting pinions c and c', is provided at its upper end with a bevel pinion c^2 for intermittingly actuating the binding mechanism, as hereinafter explained. Mounted upon the rear end of knotter shaft D is a mutilated bevel gear d arranged to work with the pinion c^2. The number of teeth left out of gear d in this instance is three, but it is evident that the number should be varied according to the size of said pinion. An outwardly or laterally yielding sector d', provided with the requisite number of teeth to fill the break in said gear, is pivoted thereto by a bolt d^2 and held in working position by a spring d^3 interposed between it and an overhanging portion of said gear. The overhanging part of said gear is formed outside of its periphery with a box d^4 for the connection of the upper end of pitman g', which is connected at its lower end with a crank arm g^2 on the rear end of needle shaft g^3, carrying at its front end the needle G in the usual manner.

F is the trip and compressor shaft, supported at the rear end by a lug or arm a^4 projecting from the binder frame and at the front end by a yielding yoke J, which is formed with two or more notches or bearings to receive said shaft, as shown in Figs. 11 and 12, for regulating the size of the gavels. Upon the front end of shaft F is mounted the trip and compressor arm f, which yields to the pressure of the grain accumulated against it by the packers and, turning said shaft in the direction indicated by the arrow in Fig. 6, trips the binding mechanism into gear when the gavel has attained the proper size, and then acts in opposition to the needle arm G to compress the gavel. Upon the rear end of shaft F is secured the crank arm f', which is connected with the trip lever H by a connecting rod f^2. Lever H is pivoted to suitable ears on the trip cam E by a pin e, and is formed with an intermediate depending arm h carrying in its end a roller h' which rests, when the binder is not in operation, in depression d^6 in the cam d^7 on the inside of gear d, and acts as a fulcrum for said lever H in turning cam E upon its bearing. Cam E mounted loosely upon the knotter shaft D, holds sector d' out of engagement with pinion c^2 when the binder is at rest, by contact with an arm d^5 projecting from said sector, as shown in Fig. 7, but when it is turned upon its bearing by the trip and compressor arm f, through the connections hereinbefore described, out of engagement with arm d^5, the sector d' is thrown by spring d^3 into engagement with the pinion c^2, and thereby sets the binding mechanism in motion. Cam E is limited in its movement in both directions by lugs e' and e^2 coming in contact with the inside of the binder frame, as shown in Fig. 10.

A spring e^3, interposed between lug e^2 upon cam E and the locking dog h^2 pivoted to the binder frame, as clearly shown in Fig. 10, resists the yielding of the compressor arm f and holds said dog in engagement with a lug d^9 on the rim of gear d. It is evident that separate springs may be used for these purposes, but we prefer in practice the single spring, which, when arranged as shown and described, insures the return of the trip lever H to its normal position after a bundle is discharged, the lug d^9, passing under the roller in the end of dog h^2 and compressing said spring just as said lever is brought home.

The yoke J is formed with an elongated transverse opening, by which it is mounted and permitted to move in the direction of its length upon the lower arm a' of the binder frame. It is guided and held in place between an outwardly projecting arm a^5 on the binder frame and a flange g^4 on the hub of the needle arm G, and is formed with a groove j, shown in Fig. 12, which engages with the front edge of said arm a^5, as shown in Fig. 11. Yoke J extends inwardly from arm a' and is formed into a receptacle for a coiled spring j^2 which is seated at its outer end upon a lug j^3 on arm a' and holds the compressor arm f with a yielding pressure against the action of the needle G in compressing the grain.

Our improved binder operates as follows: When the necessary quantity of grain to form a gavel has been accumulated by the packers, the compressor arm f forced thereby outwardly in the direction indicated by the arrow in Fig. 6, and acting through shaft F and connecting rod f^2, swings the trip lever H on its roller h' as a fulcrum, and thereby turns cam E on the knotter shaft D out of engagement with arm d^5 of sector d', which is then thrown inwardly by spring d^3 out of engagement with stop a^6 upon the binder frame into engagement with the pinion c^2 upon the continuously rotating shaft C. The binding mechanism is thus set in motion. The gear wheel d, rotated in the direction indicated by the arrow in Fig. 1, and acting through pitman g' and crank arm g^2 on needle shaft g^3, raises the needle arm G to compress the gavel in the usual manner between it and the compressor arm f, which is held during the operation in its upright position, as shown in Fig. 6, by the roller h' on arm h of the trip lever traveling upon the outer portion of the periphery of cam d^7. As the gear wheel d continues to revolve, the roller h' drops into the depression d^8 in said cam, thus permitting the compressor arm f to fall sufficiently to allow the discharge of the bundle from the binder. The roller h' passing out of the depression d^8, raises said compressor arm f to its normal upright position, and at the completion of the revolution of gear d drops into its seat d^6 in cam d^7. As the gear d completes its revolution, it carries arm d^5 of sector d' into contact with trip cam E, and thereby throws said sector out of engagement with the continuously rotating pinion c^2. The projection upon

the lower end of sector d' thereupon engages with lug a^6 on the binder frame, as shown in Fig. 9, and stops the binding mechanism; at the same time the locking dog h^2 drops back of lug d^9 on gear d, and is held in place by the spring e^3, thus preventing a backward movement of said gear. By reference to Figs. 6, 9 and 10, it will be observed that the dog h^2 is formed with a stop at its free end, which engaging with a lug h^3 on the binder frame supports the dog in the proper position for carrying spring e^3, as shown, and holds the roller in said dog out of contact with the rim of gear d, except when it engages the lug d^9, as hereinbefore mentioned. The binding mechanism now remains quiescent until it is again set in motion in the manner hereinbefore described, by the formation of another gavel.

We do not wish to be understood as limiting ourselves to the exact construction and arrangement of parts herein shown and described, as it is evident that many changes may be made without departing from the spirit of our invention.

We claim—

1. In a grain binder, the combination with the knotter shaft, a driving shaft transverse thereto and gearing for connecting said shafts, of the binder frame formed with a hollow upright inclosing said transverse driving shaft and provided at its lower end with a detachable box for said transverse shaft, substantially as and for the purposes set forth.

2. In a grain binder, the combination with the knotter shaft, a driving shaft and a connecting shaft transverse thereto, of the binder frame formed with a hollow upright inclosing said transverse shaft, and boxes for said driving and connecting shafts formed together and detachably secured to said frame, substantially as and for the purposes set forth.

3. In a grain binder, the combination with the knotter shaft, a driving shaft, a connecting shaft transverse thereto and gears connecting said driving and connecting shafts, of the binder frame formed with a hollow upright inclosing said transverse shaft, and detachable boxes for said driving and transverse shafts formed with a housing for said gears, substantially as and for the purposes set forth.

4. In a grain binder, the combination with the knotter shaft, a driving shaft and a connecting shaft transverse thereto of the binder frame formed with a hollow upright inclosing said transverse shaft, and boxes for said driving and connecting shafts formed together with a shank, which is detachably secured in the open end of said hollow upright, substantially as and for the purposes set forth.

5. In a grain binder, the combination of a bevel driving gear, a mutilated driven bevel gear provided with a laterally movable toothed section pivoted thereto and held in working position by a spring, a cam arranged to hold said toothed section out of engagement with the driving gear, and a trip lever connected with said cam, substantially as and for the purposes set forth.

6. In a grain binder, the combination with the knotter shaft, of a driving gear, a mutilated driven gear mounted on the knotter shaft and provided with a displaceable toothed section and with a cam, an oscillatory trip cam loosely mounted on the knotter shaft, and a trip lever pivoted to the trip cam and having a bearing on the periphery of the gear cam, substantially as and for the purposes set forth.

7. In a grain binder, the combination with the knotter shaft of a driving gear, a mutilated driven gear provided with a displaceable toothed section and with a cam, a spring arranged to hold said toothed section in working position, a trip cam loosely mounted on the knotter shaft and arranged by contact with a projection on said toothed section to hold it out of engagement with the driving gear, stops for limiting the movement of said trip cam, a trip lever pivoted to said trip cam and having an arm provided with a friction roller bearing against the periphery of the gear cam, and a compressor arm connected with said trip lever, substantially as and for the purposes set forth.

8. In a grain binder, the combination of a driving gear or pinion, a mutilated gear provided with a laterally movable toothed section pivoted thereto and held in working position by a spring, a trip cam arranged to move and hold said toothed section out of contact with the driving gear or pinion, and trip mechanism connected with said cam substantially as and for the purposes set forth.

9. In a grain binder, the combination of a driving and a driven gear, means for engaging and disengaging the same, an oscillatory trip cam controlling the engagement of said gears, a compressor arm, a trip lever connected therewith and pivoted to said cam, a locking dog for engaging the driven gear, and a spring interposed between said locking dog and trip cam, substantially as and for the purposes set forth.

10. In a grain binder, the combination of a driving gear, a driven gear provided with a cam and a laterally movable toothed section pivoted thereto, an oscillatory trip cam for holding said toothed section out of engagement with said driving gear, a trip lever pivoted to said trip cam and provided with an arm bearing upon the periphery of the gear cam, a compressor or trip arm connected with said trip lever, a locking dog for engaging the driven gear, and a spring interposed between said dog and trip cam, substantially as and for the purposes set forth.

11. In a grain binder, the combination of a driving gear and a driven gear provided with an inwardly projecting lug, means for engaging and disengaging said gears, an oscillatory trip cam controlling the engagement of said gears, a compressor arm, a trip lever connected therewith and pivoted to said cam, a locking

dog pivoted to a suitable support and arranged to ride over and engage with the lug on the driven gear, and a spring interposed between said dog and the trip cam, substantially as and for the purposes set forth.

12. In a grain binder, the combination of a driving gear and a driven gear, provided with a lug, means for engaging and disengaging said gears, a trip cam controlling the engagement of said gears, a compressor arm, a trip lever connected therewith and pivoted to said cam, a locking dog pivoted to a suitable support and arranged to ride over and engage with the lug on the driven gear, a spring interposed between said dog and the trip cam, and a stop arranged to hold said dog out of contact with said gear, except when it engages with said lug, substantially as and for the purposes set forth.

13. In a grain binder, the combination of a driving and a driven gear, means for engaging and disengaging the same, an oscillatory trip cam controlling the engagement of said gears, a trip lever pivoted to said cam, a locking dog working with said driven gear, a spring interposed between said locking dog and trip cam, and a frame provided with a housing inclosing said driving gear, cam, dog and spring, substantially as and for the purposes set forth.

14. In a grain binder, the combination with the binder frame and compressor shaft provided with a compressor arm, of a yoke carrying said shaft adjacent to said compressor arm and having a yielding connection with the binder frame, substantially as and for the purposes set forth.

15. In a grain binder, the combination with the binder frame and a compressor shaft provided with a compressor arm of a yoke provided with a series of bearings for said shaft, and having a yielding connection with said binder frame, substantially as and for the purposes set forth.

16. In a grain binder, the combination with the binder frame and the compressor shaft provided with a compressor arm of a slotted yoke loosely mounted on the lower arm of the binder frame and provided with a series of bearings for said shaft, and a spring interposed between said yoke and the binder frame so as to permit the compressor arm to yield outwardly, substantially as and for the purposes set forth.

JAMES A. GRAHAM.
EDWARD J. BIRKETT.

Witnesses:
HUBERT SCHLOEMER,
GODFRED SCHLOEMER.