(No Model.)

2 Sheets—Sheet 1.

J. F. STEWARD.

AUTOMATIC GRAIN BINDER.

No. 504,372.

Patented Sept. 5, 1893.

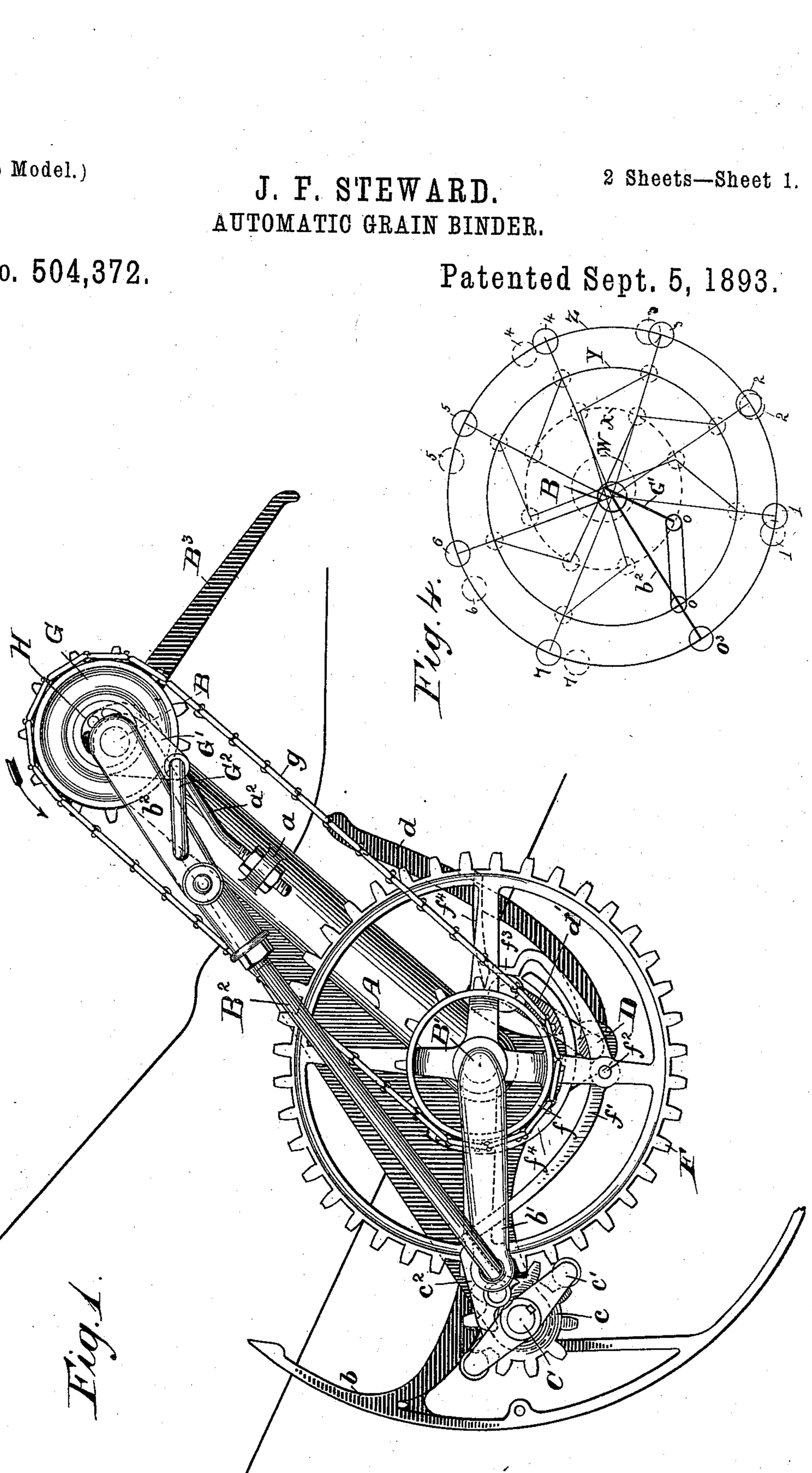

Fig. 1.

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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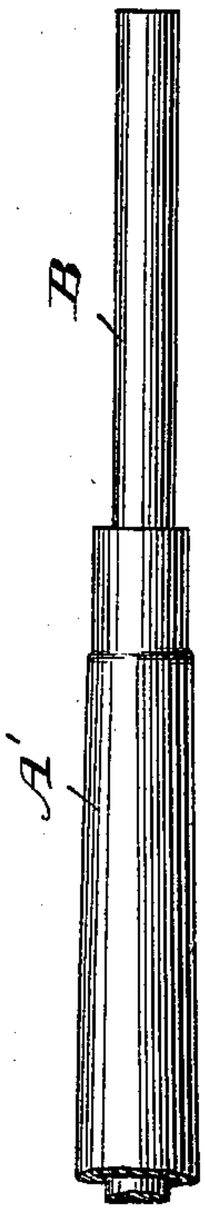
Fig. 2



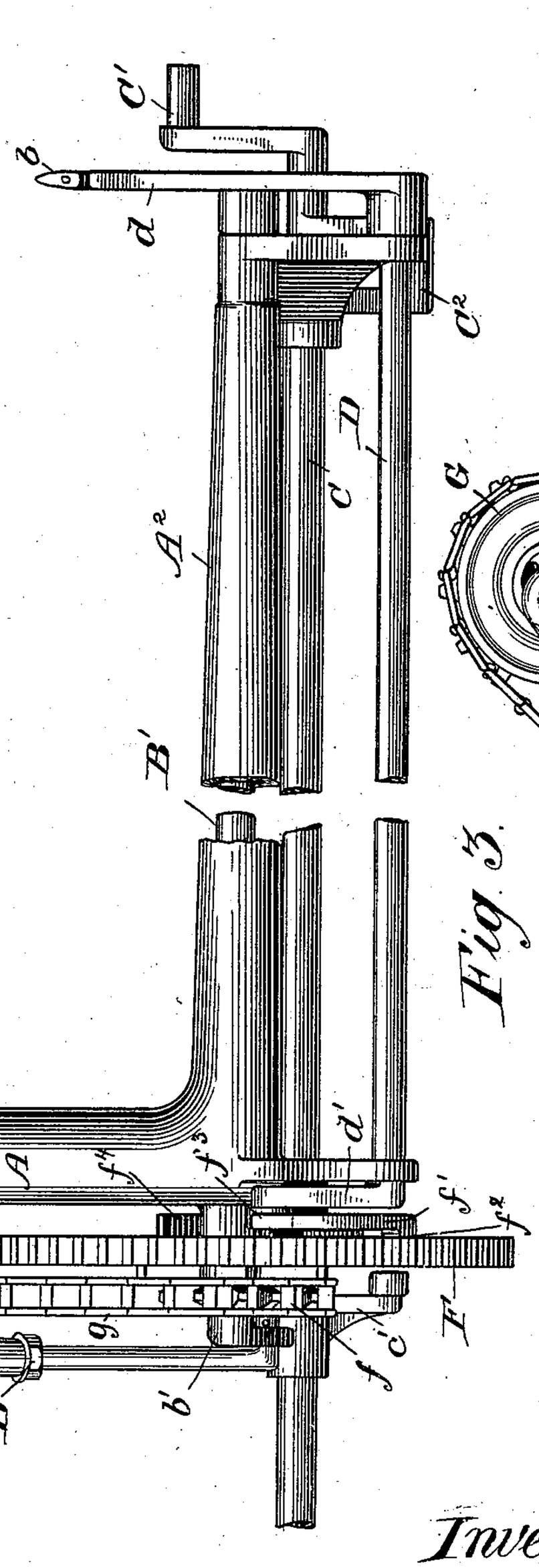
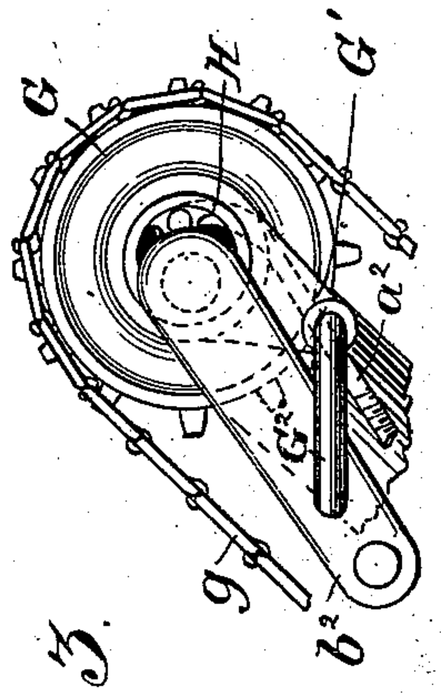


Fig. 3.



Witnesses.
arthur Johnson.
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UNITED STATES PATENT OFFICE.

JOHN F. STEWARD, OF CHICAGO, ILLINOIS.

AUTOMATIC GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 504,372, dated September 5, 1893.

Application filed April 15, 1893. Serial No. 470,401. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. STEWARD, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Grain-Binders, of which the following is a specification, reference being had to the accompanying drawings.

The object of my invention is to provide means whereby the binding devices may be moved at different rates of speed during different intervals of the time of operation in binding a bundle, and also to provide means for slackening the driving chain for removing it and incidentally to tighten the chain should it become elongated by the accumulation of lost motion in the joints. These two features need not necessarily be embodied in the same binder, but I have applied a device for producing the variable motion that also serves as a chain tightener without materially affecting the former.

In the drawings, Figure 1 is a rear elevation of a rear-geared binder as applied to a left hand cut harvesting machine, showing, however, but the parts necessary to make my invention clear. The parts are shown in position only for producing the variable speed of the binding devices. Fig. 2 is a stubble-side elevation of the same. No knotting devices, bundle discharging devices, nor packing mechanism are shown. Fig. 3 represents the parts forming the subject matter of my invention as in the positions for performing the added function of tightening the chain. Fig. 4 is a diagram designed to show the variation in speed accomplished in my machine.

In machines made and operated by me, embodying this invention, I have made the tripping arm serve also as a compressor, but believe it not necessary to further encumber the drawings. The needle is shown, and that may be considered as one element of the compresser, the other element being the tripping-arm *d*.

In the drawings, A is the vertical end-portion of the binder frame, A′ the sleeve as one piece with the part A, that supports and forms journal-bearings for the knotter-driving shaft B. A^2 is a like sleeve, parallel with the former, and forming a support and journal-bearings for the needle shaft B′.

C, is the packer-shaft suitably supported in the binder frame and having the cranks C′ and C^2.

D, is the tripping shaft that may also be considered the compressor shaft, having upon its forward end the arm *d*. This shaft is supported and journaled in lugs on the main frame.

b, is the needle secured to the shaft B′, and upon the rear end of the latter is the needle crank *b*′. Upon the needle shaft, between the needle crank and the binder frame, I place the gear wheel F, and as one piece with it make the sprocket-wheel *f*. Upon the packer-shaft I loosely place the pinion *c*, and to the said shaft key the driver *c*′. Upon the pinion *c* is the driving dog c^2. The driving dog and the driver serve as a clutching device of well known form and need not be described. I make the diameter of the wheel F, and that of the pinion *c*, such that the sum of the radii of their pitch circles shall equal the distance between the centers of the needle shaft and packer shaft, and preferably give the wheel four times the diameter of the pinion.

G, is a sprocket wheel upon the needle shaft, of diameter like that of the sprocket wheel *f*, around which and the latter is thrown the chain *g*. Upon the shaft B is formed the crank b^2, and upon the sprocket wheel G, the crank G′. The crank upon the latter is connected to that upon the shaft B by the link G^2, said link having its hooked ends passing through eyes in both. It is plain that as the wheel G rotates in the direction indicated by the arrow, the crank upon the needle shaft is drawn by that G′, and the shaft B thus rotated. Connecting the crank b^2 with the crank *b*′ is the pitman B^2. As the shaft B is rotated the needle crank is drawn by the pitman, and the needle *b* carried to its position for placing the band around the bundle and while so moving serves as a compressor.

Upon the wheel F, is the trip *f*′, pivoted at f^2. A suitable spring and stops control its movement. It is provided with a pad f^3.

Upon the shaft D is the crank *d*′ provided with an anti-friction roller to rest upon the pad f^3.

The operation of the tripping device is as follows: The grain brought against the arm *d* rocks its shaft and forces the anti-friction

roller against the pad f^3, rocking the trip lever f' upon its axis and throwing its end from contact with the driving dog c^2. The clutching devices are then permitted to engage and the rotation of the packer-shaft is imparted to the wheel F, and through the chain, motion given to the knotter driving shaft and through the pitman to the needle. The tripping compressor arm is controlled by the cam track f^4, being permitted to fall in order that the ejecting arm B^3 may carry the bundle thereover. Loosely mounted upon the shaft B is the eccentric H. Upon the part A of the main frame is the lug a. Connecting the eccentric to this lug is the link a^2 secured, by means of nuts, to the said lug. If these nuts be loosened the eccentric may be turned to slacken the chain. It is best to have the length of the chain such that the eccentric will be in the position shown in Fig. 3 in which case, after wear has loosened the chain it may be tightened, the nuts upon the link a^2 serving as means for moving the eccentric, which movement will cause the wheel to be carried slightly farther away from its driving mate f. This movement of the driven wheel serves a better purpose, as a chain tightener, than the usual method wherein an anti-friction roller is applied to one side of the chain, because in the latter case the slack being all taken up at one side, the position of rest of the driven wheel is changed and in fact its "timing" is affected. The more important purpose, however, is the arrangement of the eccentric, the sprocket wheel G mounted thereon and provided with the arm G', and the crank b' connected to the said arm G' whereby I am enabled to effect the variation in speeds referred to. The eccentricity of H is such, in the drawings, as to shorten the distance from the center of the eye in the arm G' to the center of the shaft upon which the crank B is formed, about one fourth when in a position of rest, the result of which is as follows: The arm G' moving, when started from the initial position shown in Fig. 1 at a given rate, draws the crank G' after it, but as it is moved farther in the direction indicated by the arrow, the crank G' changes. Its relative position has the same effect upon the arm b^2 as if it were shortened and results in a slower drawing thereafter of the crank B' and thus a slower movement of the needle during that portion of the time when it is compressing the gavel. The effective length of the arm G' decreases quite rapidly, thus, although starting the needle quickly, passing through its early movement at a decreasing rate of speed until at its greatest height, which it reaches at a time when the compression is fully accomplished. The driving crank then begins to change its relative position, and the needle is moved backward with an increasing speed.

The importance of taking advantage of every opportunity to move the parts of the binding attachment rapidly when not laboring hard will be understood when it is taken into account that an ordinary self-binder in heavy grain must complete a bundle in a distance of about six feet of advance. By my arrangement I can shorten the period of rotation and thus adapt my machine to handle a greater amount of grain in a given time than has been heretofore done.

In Fig. 4 is a full line circle that represents the shaft B'. Surrounding this is a dotted line W, that represents the eccentric, and having greater diameter still is the dotted circle x, coincident with the path of movement of the eye in the end of the arm G'. Without this is the full line circle Y, that coincides with the path of movement of the eye in the arm b^2, into which the link G^2 passes, and without all is the full line circle Z that represents the path of movement of the wrist of the crank b^2. The straight full line b^2 represents the arm b^2, and the full line G' represents the arm of like letter. The outer circle is divided into eight equal spaces by dotted circles 1 to 7 inclusive, ending at the full circle O^3. These circles would represent the position of the wrist of the crank b^2 if the latter were driven at a uniform rate, but because of the effect of the eccentric H, the arms G', b^2, and the link G^2, the wrist, at one eighth of a revolution of the sprocket wheel G, is hastened and brought to the full circle 1 of the figure. From this point the movement of the wrist and hence, through the instrumentality of the pitman B^2, the needle begins to decrease, and when the sprocket wheel G has made a fourth of a revolution the wrist is at the full circle 2 of the figure—but little in advance of the position that it would be if moved at a uniform rate. When the said wrist is brought to the full circle 3 of the figure it has not then reached the position it would have attained if driven at a uniform rate, and when at 4 of the figure it is still slower. At 5 it is some distance short of the position it would have attained had the rate been uniform. From this point the rate of movement increases slightly and near the close of the revolution it is hastened and reaches the point of starting, O^3. At the times when the wrist is passing from O^3 to 2, little power is required, but compression at this time begins and more power, from this time until the time of ejection of the bundle begins, is required than at others. The time that calls for greater power occupies about five eighths of the time of revolution of the binding devices. After that the increase of movement from 5 home to O^3 is then permissible. If desirable the eccentricity of H may be made greater and the variation in the rate of speed thus made more effectual.

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

1. In a grain binder, the shaft B which moves

all parts directly concerned in the operation of binding, in combination with the eccentric H, the arm b^2, the arm G′ and the link G^2, substantially as described.

2. Combined with the shaft B, the adjustable eccentric H loosely mounted thereon, the driving wheel G having the arm G′, free to rotate upon the said eccentric, the arm b^2 and the link G^2, all combined substantially as described.

JOHN F. STEWARD.

Witnesses:
GEO. H. ELLIS,
ARTHUR JOHNSON.