4 Sheets—Sheet 1.

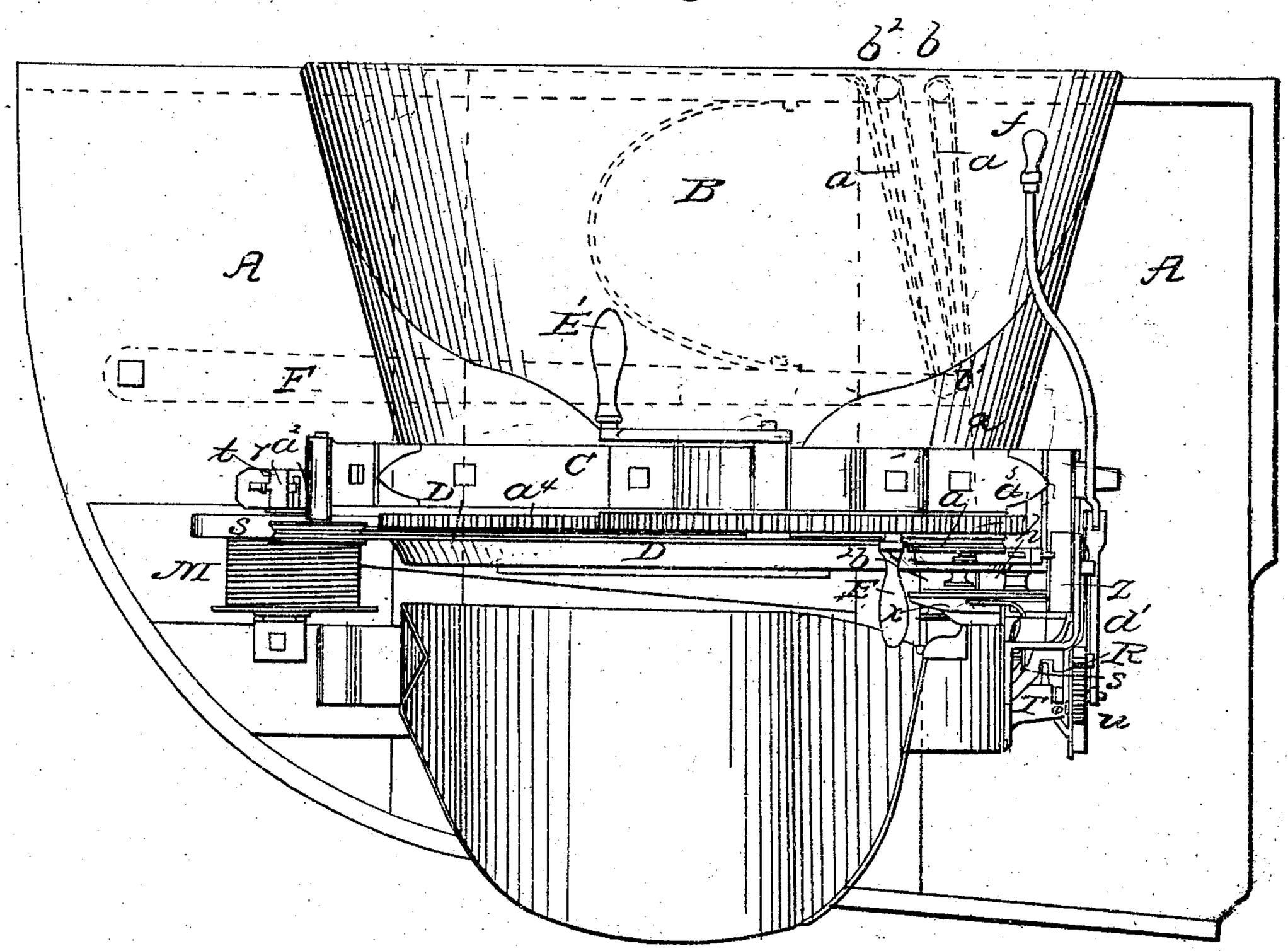
J. BEHEL.

Grain Binder.

No. 49,970.

Patented Sept. 19, 1865.

Fig. 1.



Witnesses:

Jas S. Ferguson

W. L. Benson

Inventor

J. Behel

4 Sheets—Sheet 2.

J. BEHEL.

Grain Binder.

No. 49,970. Patented Sept. 19, 1865.

Fig. 2,

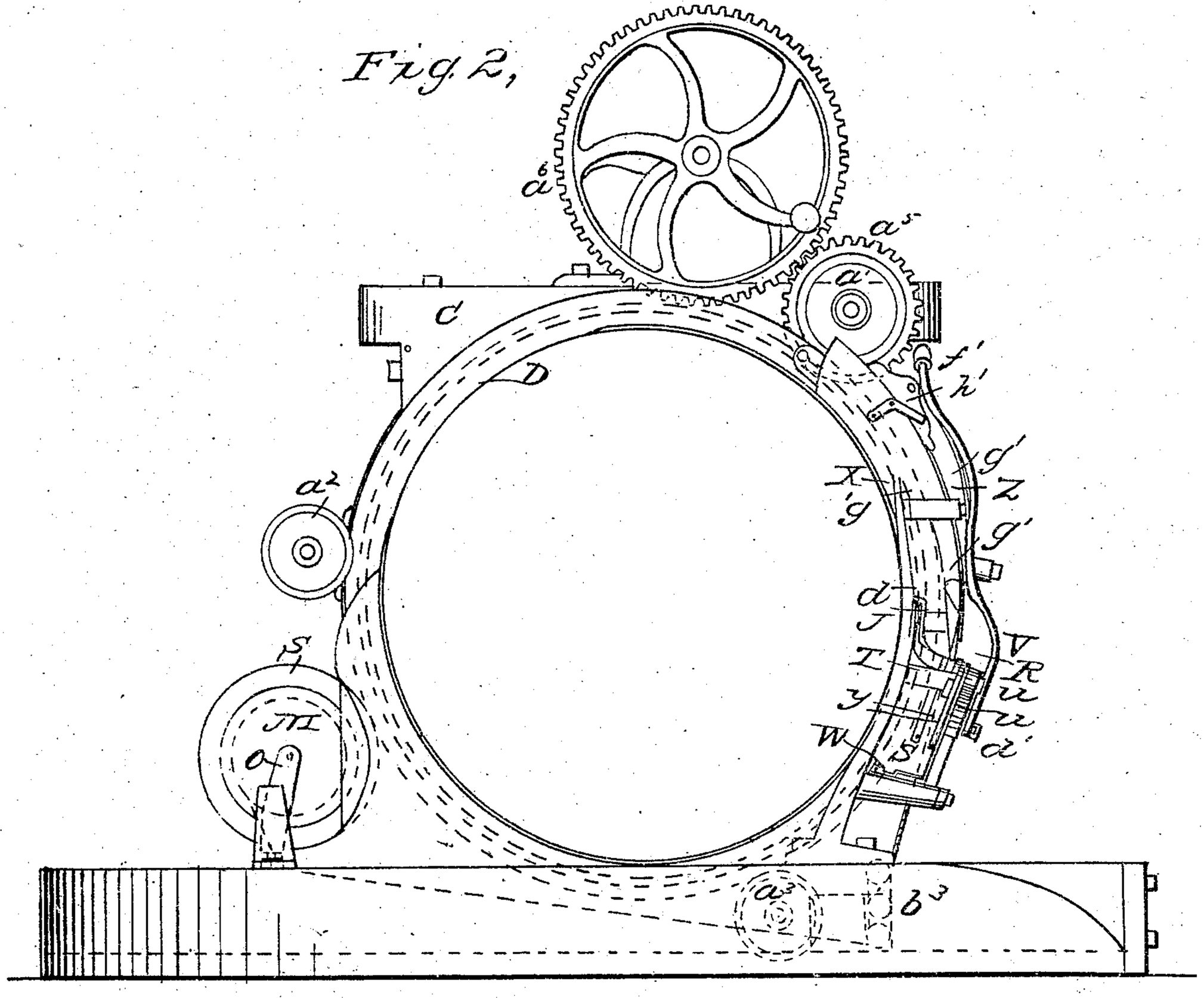
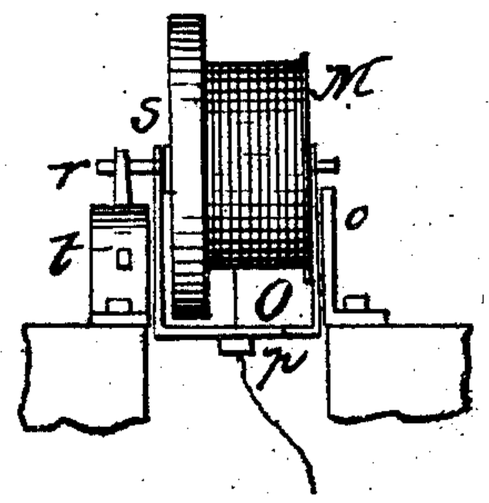


Fig. 2,a



Witnesses:
Das S. Ferguson
W. L. Bennem

Inventor:
Jacob Behel
by his Attorney
C. S. Penwick

4 Sheets—Sheet 3.

J. BEHEL.

Grain Binder.

No. 49,970.

Patented Sept. 19, 1865.

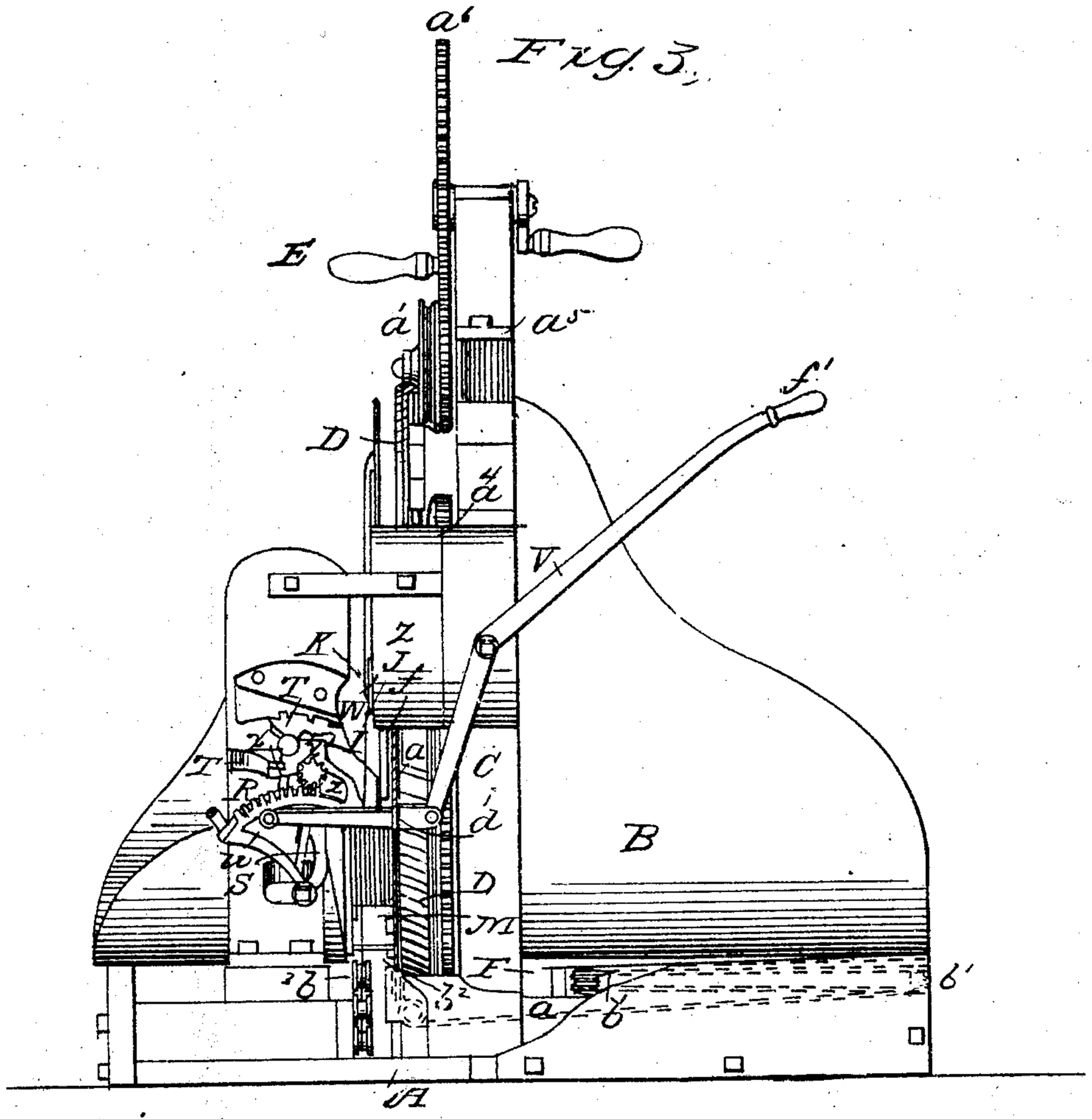


Fig. 19,

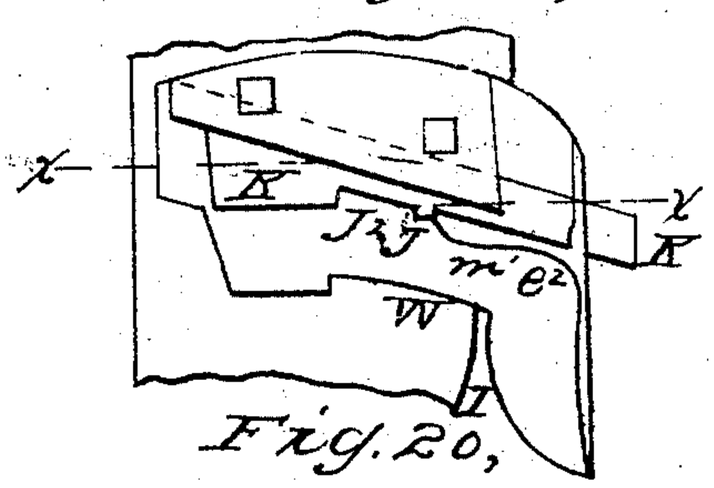


Fig. 20,

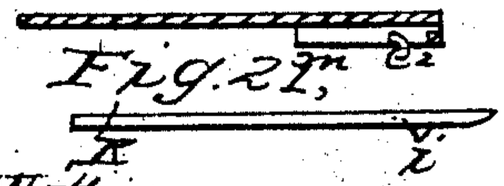


Fig. 21,

Witnesses:
Jas S. Ferguson
H. L. Bennett

Inventor
Jacob Behel
by his att.
C. F. Fennich

4 Sheets—Sheet 4.

J. BEHEL.

Grain Binder.

No. 49,970. Patented Sept. 19, 1865.

Fig. 6,

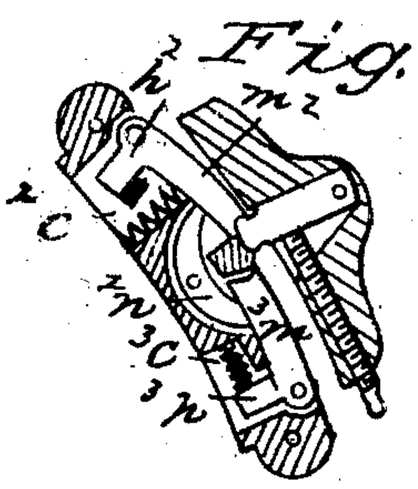


Fig. 5,

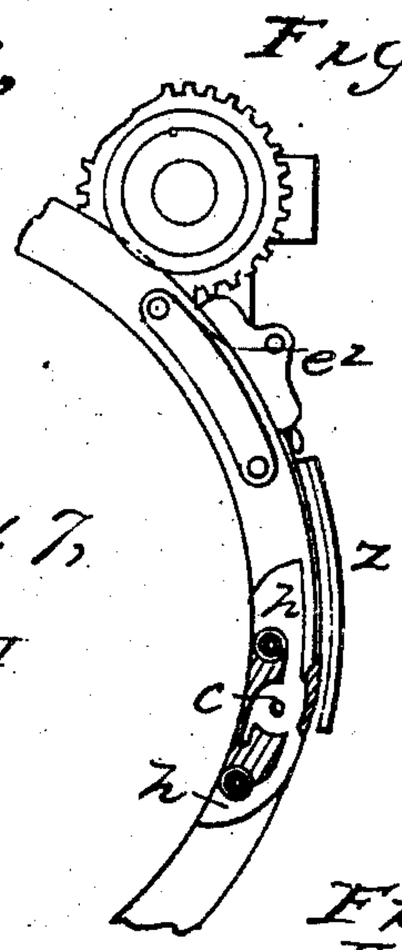


Fig. 4,

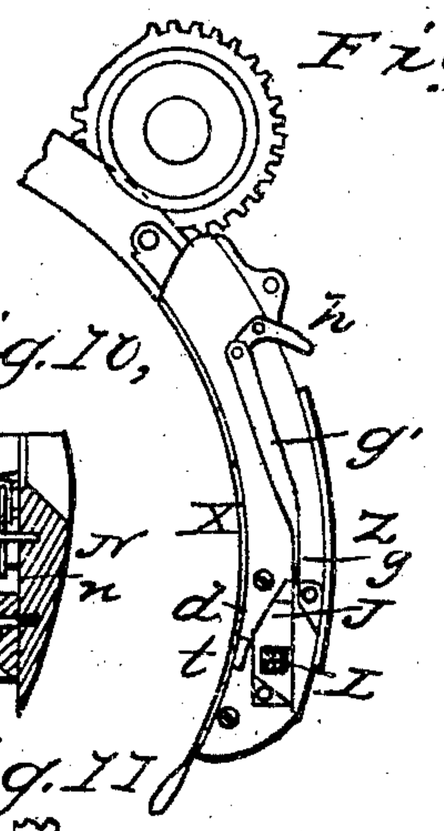


Fig. 10,

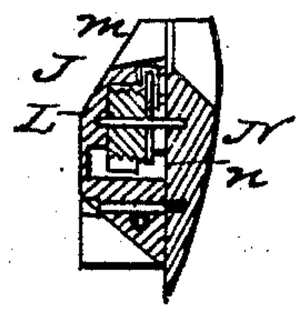


Fig. 11

Fig. 7,

Fig. 8,

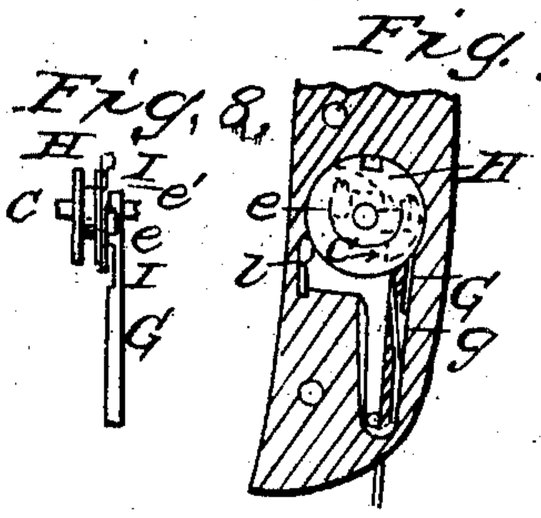


Fig. 9,

Fig. 12,

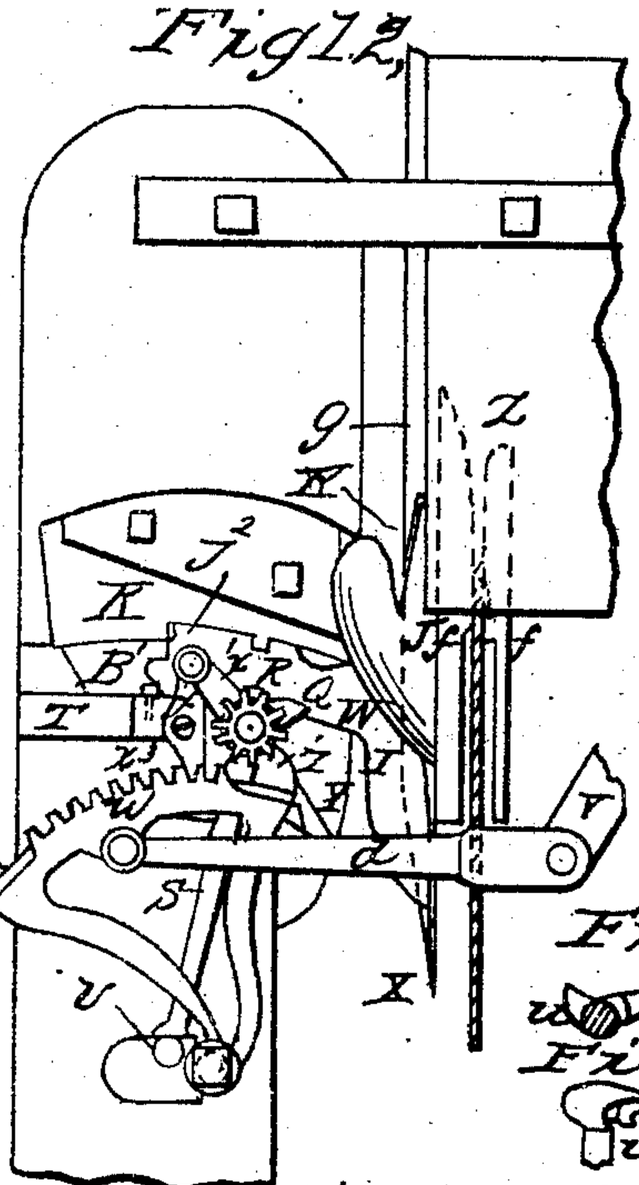


Fig. 13

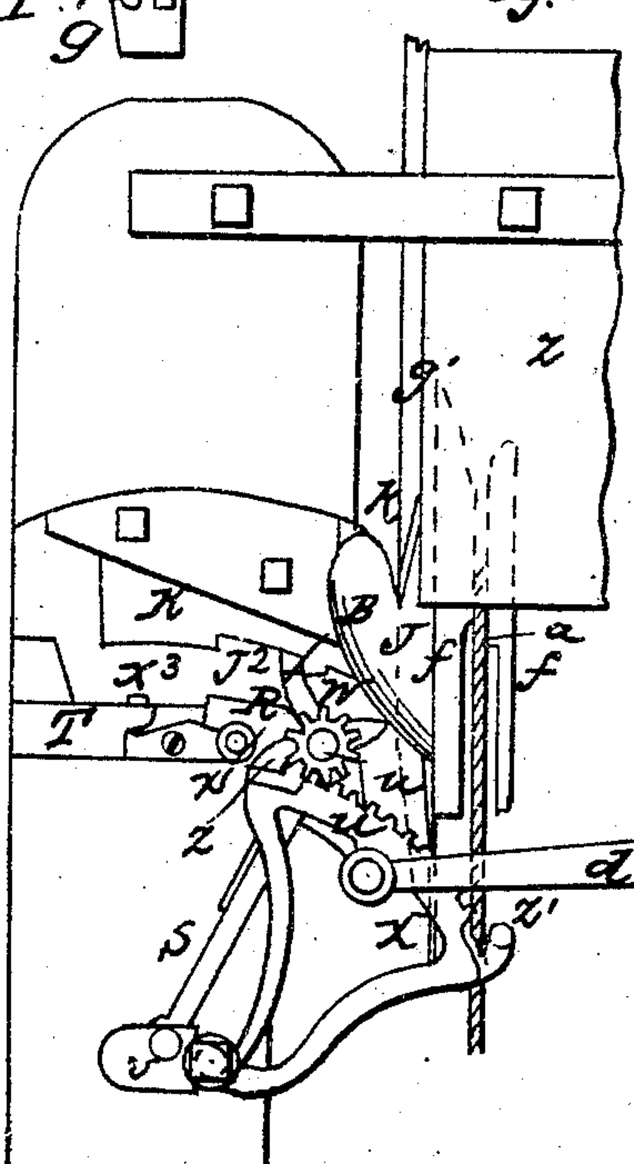


Fig. 18,

Fig. 17,

Fig. 15, Fig. 14, Fig. 14.a

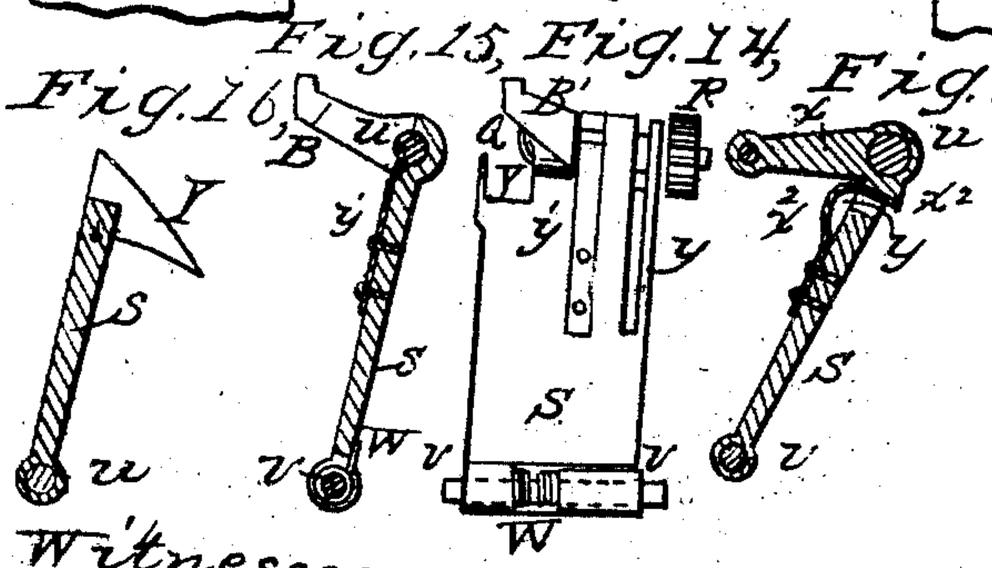


Fig. 16,

Witnesses:
Jas. S. Ferguson
H. C. Bennett.

Inventor:
Jacob Behel
by his att
C. F. Pennock.

UNITED STATES PATENT OFFICE.

JACOB BEHEL, OF ROCKFORD, ILLINOIS.

IMPROVEMENT IN BINDING ATTACHMENTS TO REAPING-MACHINES.

Specification forming part of Letters Patent No. 49,970, dated September 19, 1865.

To all whom it may concern:

Be it known that I, JACOB BEHEL, of Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Binders for Reaping-Machines; and that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 represents a plan of a binding-machine embodying my invention. Fig. 2 represents a rear view of the same. Fig. 3 represents a side view of the same. Figs. 4 and 5 represent fragmentary portions of the ring-carrier and some of its appurtenances; and Figs. 6 to 21 represent views of parts of the machine drawn upon a larger scale than the previous figures, and denoted by the same letters of reference as are applied to the same parts in the said previous figures.

Whereas machines have been devised for binding grain in which a compressing-strap and the binding-cord are carried around the gavel of grain to be bound by a ring-carrier, which is used in connection with means for securing the band of cord around the gavel of grain by twisting its ends together; and whereas I invented certain new devices for tying binding-cord into a knot, and for holding the ends of such cord, for which Letters Patent of the United States were granted to me the 16th day of February, 1864, which devices were employed by me in connection with reciprocating compressing devices: Now, the object of the invention which constitutes the subject-matter of the present patent is to obtain in one machine the advantages resulting from the employment of a ring-carrier to carry the compressing-strap and binding-cord around the gavel, and the advantages resulting from the tying of the band into a knot, and also to improve certain members of the binding apparatus. To this end the first part of my present invention consists of the arrangement of the cog-wheel that transmits motion to the ring-carrier upon the axle of one of the wheels which holds the ring-carrier in its place, so that the teeth of the said cog-wheel are prevented from engaging too deeply with the teeth of the cog-wheel upon the ring-carrier.

The object of the second part of my invention is to obtain, in a binding apparatus fitted with a ring-carrier, the advantages resulting from the employment of a vibrating standard to make tension upon the compressing-strap by which the gavel of grain is compressed, and to render up and take back the compressing-strap. This part of my invention consists of the combination, in the same machine, of a ring-carrier to carry the compressing-strap around the gavel, and a vibrating tension-arm to control the compressing-strap.

The object of the third part of the invention is to permit the employment, in a ring-carrier binding apparatus, of a rope as the material of the compressing-strap, a rope being less costly than the leather strap hitherto used in such a machine, and being also capable of replacement by any farmer. This part of my invention consists of the combination of a ring-carrier with a detachable holder of suitable size and form to hold the knotted end of a rope compressing-strap, and to seize the same when the compressing-strap is withdrawn from the sheaf.

The object of the fourth part of the invention is to relax the compressing-strap slightly when the tying-bill begins to operate upon the cord-band around the gavel of grain, and consists of the combination of a detachable compressing-strap holder with an escapement operating in such manner that the said strap-holder is first permitted to move sufficiently to relax the strap without letting it go, and is subsequently permitted to move a farther distance for the purpose of letting go the end of the strap.

The fifth part of the invention consists of the combination of a turning cord-holder with a ring-carrier, whereby the necessity of feeding anew the end of the cord to the cord-holder of the ring-carrier, previous to the binding of each sheaf, is avoided.

The object of the sixth part of the invention is to guide the binding-cord into the turning cord-holder, so that it may be seized thereby with certainty. This part of my invention consists of the combination of the turning cord-holder and ring-carrier with a cord-holder case, grooved or indented at the forward side, so as to direct the cord into the gripe of the cord-holder.

The object of the seventh part of the inven-

tion is to relax the tension upon the binding-cord at the time it is being applied to the gavel of grain. This part of my invention consists of the combination of the cord spool or reel, the unwinding of which is impeded by a friction apparatus with a swinging frame, and with a cord-guide secured to said frame in such manner that the pulling of the cord through the cord-guide tends to move the swinging frame and relieve the friction upon the spool.

The object of the eighth part of the invention is to prevent the tying-bill from being moved beyond the position it is to occupy during the turning of the binding-cord upon it, and to hold it securely in that position as long as required in the operation of the machine. This part of my invention consists of the combination of the moving frame-work of the tying-bill with the fixed frame-work of the binding apparatus by means of toggle-jointed links, which prevent the movement of the tying-bill beyond the proper distance, and hold it rigidly until their joint is flexed by the operation of the machine.

The object of the ninth part of the invention is to place the ends of the band surrounding the gavel in the proper position to be operated upon by the tying-bill. This part of the invention consists of the combination of a slotted plate placed between the tying-bill and the position of the gavel of grain, with a guide-plate to guide the ends of the band into the slot of the slotted plate, which is in the proper position to hold the ends of the band for the tying-bill.

The object of the tenth part of the invention is to prevent the cord proceeding from the gavel, being bound to the spool, from being griped by the cord-holder until the requisite quantity of cord is withdrawn from the spool. This part of my invention consists of the combination of the cord-holder with a movable protector to prevent the cord from passing into the cord-holder until the required quantity has been delivered from the spool.

The eleventh part of the invention consists of the combination of the tying-bill with a movable knife for severing the cord after the tying-bill has tied the knot.

The twelfth part of the invention consists of the combination of the knife with the instrument that imparts motion to the escapement of the compressing-strap holder, so that the knife and escapement are operated by the movement of a single instrument.

The object of the thirteenth part of the invention is to permit the ring-carrier to retrograde slightly during the tying of the band, and consists of the combination of a pair of spring-dogs secured to the ring-carrier, with a yielding stop secured to the frame of the machine, so that the stop, which stops the ring-carrier, and also prevents it from running backward, yields to the strain produced by tying the band.

The binding apparatus represented in the drawings is an example of the best mode of embodying all the parts of my invention which I have thus far devised. It is mounted upon a platform, A, which may be an extension of the raking-platform of the reaping-machine. The cradle of this apparatus, in which the gavel of grain is received for the purpose of being bound, is formed of wood, lined with sheet metal, and has a flaring mouth, B, by which the gavel is entered into the frame C, which sustains the ring-carrier D, that carries the compressing-band and binding-cord around the gavel. The ring-carrier D is of a T-section, its web being received in the grooved peripheries of three guide-wheels, a^1 a^2 a^3, which hold it in place and guide it when revolving. Its interior cylindrical surface is slightly overlapped by the hinder edge of the sheet metal with which the cradle is lined, so that the grain can be easily entered into it, and its exterior is fitted with an annular cog-wheel, a^4, whose teeth engage with those of a pinion, a^5. The teeth of the pinion also engage with those of a wheel, a^6, which is provided with a crank-handle, E, to which one hand of the operator can be applied for the purpose of turning the wheel a^6, the pinion a^5, which it drives, and the ring-carrier D, which the pinion drives by acting upon its annular cog-wheel a^4. The shaft of the wheel a^6 is fitted with a crank, E', to which the other hand of the operator can be applied, so that he has the means of exerting his whole strength, if necessary, in moving the ring-carrier. The pinion a^5 is applied to the arbor of one of the guide-wheels a^1, so that the rim of the latter not only sustains the ring-carrier when turning, but also prevents the teeth of its annular cog-wheel and driving-pinion from engaging too deeply in gear.

The ring-carrier holds and carries the end of the compressing-strap by which the gavel is compressed, and also the end of the binding-cord, so that, by turning the ring-carrier, both of these are caused to encircle the gavel of grain lying in the cradle. The compressing-strap a is most cheaply and conveniently made of rope. As it must always be held with sufficient tension to compress the gavel, must be rendered up to encircle the gavel, and must be taken back when loosed from the sheaf after the binding is completed, it is passed to and fro around two sets of sheaves, the one set, b, stationary and the other set, b^1, secured to the end of a swinging arm, F, controlled by a spring, H, (represented in dotted lines in Fig. 1,) which exerts the requisite tension upon the strap. This arm is substantially the same instrument as the swinging standard for the same purpose described in the patent granted to Behel and Hedges the 6th day of September, 1864. One extremity of the rope is made fast to the frame of the machine at b^2; the other end is formed into a knot which can be griped by a holder secured to the ring-carrier

for the purpose of carrying the strap around the gavel. The ring-carrier in the present machine is arranged to move always in the same direction, and, consequently, the strap-holder must be constructed and operated in such manner that it will let go the end of the compressing-strap, after the sheaf is bound, to permit the strap to be drawn off the sheaf by the retrograde movement of the tension-arm F, and also that it will again seize upon the end of the strap, so that it may be carried around the next succeeding gavel. Moreover, as the strap is a round rope, the strap-holder must be fitted to act upon such an article. The strap-holder H, therefore, consists of a wheel, turning upon a pivot, *c*, secured to the ring-carrier, and having three curved forked arms, the construction of which is best seen at Figs. 7 and 8, the fork of each arm being of sufficient width to admit the round body of the rope, but too narrow to permit the knotted end to pass between the tines. Consequently, the knot hangs upon one of the forks, as shown in dotted lines at Fig. 7, until the partial turning of the strap-holder permits it to escape. This strap-holder is partially covered by a casing, *d*, and as the strap extends from the sheave b^2 to the strap-holder in the direction of a tangent to the circle of the ring-carrier when the strap-holder is at the starting and stopping point of its revolution, the effect of carrying the end of the strap round the gavel is to cause the strap-holder, toward the completion of the revolution, to pass upward between the gavel in the cradle and the tangential portion of the strap. Moreover, the outer edge of the casing of the strap-holder is slit so that its edges form cheeks *f f*, which then permit the tangential portion to enter the strap-holder and guide it between the tines of the forked arms. Hence, when the strap-holder is permitted to turn a third of a revolution, and thereby let go the knotted end of the compressing-strap, and this strap is drawn off the sheaf, and through the slit of the casing, by the action of the arm F, the next succeeding forked arm is brought into the position to seize upon that end and hold it ready to be carried around the next gavel to be bound. The strap-holder is prevented from turning to let go the knotted end of the compressing-strap until the sheaf is bound, and is then detached, or liberated, by means of an escapement consisting of a vibrating forked detent, G, whose arms *e* e^1 are provided with pallets which engage alternately with three pins, *i i i*, projecting from the disk-face of the strap-holder. This detent is held by a spring in the position shown at Fig. 7, with the pallet of one of its arms *e* in the position to stop the revolution of the pin corresponding with that one of the forked arms of the strap-holder which is holding the knotted end of the strap. When the detent is vibrated in the direction indicated by the arrow in Fig. 7, the pallet of the arm *e* is removed from the pin of the strap-holder, and at the same time the second pallet (that of the arm e^1) is placed within the range of movement of the pins, so that the strap-holder is permitted to turn a short distance until one of its pins strikes the second pallet, (arm e^1.) When the detent is vibrated in the reverse direction to the arrow in Fig. 7, the second pallet (arm e^1) is removed from the pin that bears upon it, and the strap-holder is permitted to turn until the pin which corresponds with the next succeeding forked arm to that which held the end of the strap comes in contact with the first pallet (arm *e*) of the detent, whereby that forked arm is placed in the position for catching and holding the knotted end of the rope-strap. The movement of the detent in the direction of the arrow in Fig. 7 is effected by forcing the wedge-formed end of a slide, K, Figs. 3, 19, 21, 12, 13, between the edge of the detent and the face of the adjacent socket, in which it is contained, an opening, *l*, Figs. 4 and 7, being made in the casing of the strap-holder to permit the entrance of the end of the slide for this purpose. The return movement of the detent is effected by its spring *g*, as soon as the slide K is withdrawn. The mode of moving the slide will be described hereafter. In order to lessen the friction of the compressing-strap when it is drawn from the sheaf, the strap-holder is preceded and succeeded by friction-sheaves *h h*, upon which the rope-strap runs when it is drawn off.

In order that the ring-carrier may hold the end of the binding-cord and draw it round the gavel, it is combined with a cord-holder, which is contained within a casing, *j*, made fast to it. This cord-holder is a turning cord-holder, constructed substantially as described in the patent granted to me the 16th day of February, 1864, with a cylinder, L, Figs. 9 and 10, whose barrel is ribbed, and with a spring-shoe, I. The cylinder is prevented from turning backward by a pawl, *m*, acting upon the teeth of a ratchet-wheel, N, and a belay-wheel, *n*, is provided, all substantially as described in my said patent. The end of the binding-cord is held in this cord-holder between the barrel of its cylinder and its spring-shoe, and by the turning of the ring-carrier is caused to encircle the gavel of grain. Moreover, as the cord is led to the cord-holder from a sheave, b^3, which is below the cord-holder when it is at the starting and stopping point of its revolution, the effect of carrying the cord around the gavel is to cause the cord-holder, toward the completion of its revolution, to pass upward between the gavel and the portion of the cord extending from the gavel to the sheave b^3, so that this portion bears upon the casing of the cord-holder. The forward end of this casing has a V-formed groove, *k*, made in it, so that the cord, bearing upon the casing as it is moved upward, is guided by the groove directly into the crotch formed by the spring-shoe and the barrel of the cylinder L, which, turn-

ing by the pressure, gripes it without letting go of the end of the cord, so that both extremities of the portion of the cord around the gavel are held by the cord-holder, and as this portion is severed from the remainder (as will be hereinafter described) at a point between the cord-holder and the gavel, leaving the new end of the cord in the cord-holder, this combination of a turning cord-holder with the ring-carrier avoids the necessity of feeding the end of the cord anew to the cord-holder of the ring-carrier previous to the binding of each sheaf.

The supply of cord is drawn from a spool or reel, M, which is situated at one side of the frame of the binding apparatus, and is conducted thence to a set of sheaves, b^3, at the opposite side of the binding-frame, and from them upward to the cord-holder. The spool (shown in elevation at Fig. 2) is pivoted in a swinging lever-frame, O, which is provided with a cord-guide, p, the cord-guide being situated at one side of the pivots o, on which the frame swings, and the axle of the spool M being situated at the other side of the said pivots. One end of the spool-axle projects beyond the spool-frame, and a spring, r, is provided to bear against it and push the spool toward the ring-carrier D. One of the heads s of the spool is made larger than the other, and the spool-frame is so situated that this enlarged head is in the same vertical plane as the rim of the ring-carrier, and is pressed against it by the spring r, so that the ring-carrier, when turned, tends to turn the spool, by frictional contact with the spool-head, in a direction to wind up the cord. This mechanism, therefore, tends not only to resist the drawing off of cord from the spool, and thereby makes tension upon it by friction, but also causes the spool to wind up any slack cord which may be formed in the process of binding. In order to adjust the tension of the cord, a set-screw, t, is provided to press the spring r with greater or less force against the spool-axle, and thereby cause more or less friction between the spool-head and the ring-carrier. As the cord-guide p and spool-axle are at opposite sides of the pivots of the spoolframe, it acts as a lever, and the drawing of the cord from the spool tends to draw the spool-head from the rim of the ring-carrier, and consequently the cord is under less tension while it is being carried round the gavel than it is at other times.

The mechanism for tying the cord into a knot operates upon the same principle as that described in my aforesaid patent, dated the 16th day of February, 1864, the principal instrument being a turning tying-bill. This mechanism is situated at the side of the apparatus opposite that at which the cord-spool is placed. The tying-bill Q is constructed as described in my said patent, and is secured to the end of a shaft, u, whose opposite end is fitted with the pinion R, by means of which tying-bill is turned. The shaft turns in bearings carried by the swinging frame S, which is arranged to swing toward and from the ring-carrier D, upon a pivot, v, and, when tying is not being effected, is held in the position in which it is represented at Fig. 12, by a spring, w, coiled upon its pivot, v. The upper extremity of the swinging frame is connected with a stationary bracket, T, projecting from the frame-work, by means of a pair of toggle-jointed links, x x^1, which, when the frame is swung forward (as represented at Fig. 13) to the proper position for the tying-bill to commence to operate upon the cord, are by that forward movement extended in line with each other, and are held there by a spring, y, Figs. 14 and 14^a, acting upon the spur x^2 of one of the links, while a set-screw, x^3, passing through the bracket T in a position to act upon the heel of the other link, determines the position of both. When the links are so extended, the swinging frame is held stationary until the links are tripped by the application of pressure to the face of the spur x^2, the effect of which is to flex the joint of the links and liberate the swinging frame, thereby permitting it to be pushed back to the position whence it was moved. As the links are pivoted to the bracket T and to the swinging frame, they prevent the swinging frame and tying-bill from being moved beyond their proper distance. The tying-bill is turned, and it and the swinging frame are moved to and fro, by a swinging sector, U, provided with a segmental rack of sufficient length to act upon the pinion R of the tying-bill, and turn it a complete revolution, and also with two lugs, z z', one of which, z, is in the proper position to bear against the hinder side of the swinging frame and push it forward, while the other, z', is in the proper position to bear against the front side of the swinging frame and push it backward after the rack has turned the tying-bill. The latter lug, z', is fitted with a pin which projects from it in a proper position to bear against the face of the spur x^2 of the link x^1, and trip the link just before the lug is borne against the swinging frame, so that the swinging frame is liberated before the swinging sector tends to push it back to its normal position. The sector is connected by a link, d', with one end of a lever, V, which is pivoted to the frame of the binding apparatus, and has a handle, f', formed upon its other end, to which the hands of the operator of the mechanism can be applied. The pivot of the swinging frame and that of the swinging sector are eccentric to each other; hence, when the two are swung forward together, the pinion R gradually approaches the rack, and when the tying-bill reaches its most forward position the pinion-teeth are engaged with the last tooth of the rack, as seen at Fig. 13. When, therefore, the swinging sector is moved back by the lever V, the rack turns the pinion and tying-bill, and

when the swinging frame is shoved back to its normal position, the pinion-teeth are disengaged from the rack. The tying-bill is held so as to point in the proper direction when moving forward by means of a spring, y', which engages in a recess of the pinion-shaft a, as seen in the sectional view, Fig. 15, and also prevents the tying-bill from being accidentally turned in the wrong direction.

In order that the ends of the band of cord around the gavel may be placed in the proper position for the tying-bill to act upon them, the tying-bill and its appurtenances are separated from the gavel of grain by a plate, W, having a forked slot, I, into which the ends of the band (which are carried upward by the upward movement of the cord-holder as it approaches the end of its revolution round the gavel) are guided by the flanged rim of a guide-plate, X, which is secured to the ring-carrier D, and moves with it. The fork of the slot I is below the range of motion of the tying-bill, so that the ends of the band are separated by the plate W from the gavel, and are carried upward together past the range of the tying-bill. Moreover, as the inner side of the cord-holder is a short distance from the gavel, the ends of the band extending across the space between the end of the slot I and the cord-holder diverge from the plate W a sufficient distance to permit the beak of the tying-bill to enter between the ends of the band and the plate. In order that the ends of the band may not escape from their positions in the forked slot during the tying, a segmental shield-plate, Y, is secured to the swinging frame S in such position that when this frame moves forward to apply the tying-bill to the band, this shield passes across the slot I below the band, thus preventing the latter from escaping from the slot. When the knot is completed, this shield is withdrawn by the backward movement of the swinging frame that carries it.

As the cord extends from the sheaves b^3 to the gavel in a straight line, and the sheaves are below the stopping-point of the cord-holder, the cord-holder case bears against the cord leading from the sheaves some time before it reaches its stopping-point, and as the cord must of necessity be permitted to run over the cord-holder case until the cord-holder nearly reaches its stopping-point, a protector, consisting of a notched slide, g, is provided to prevent the cord from entering within the gripe of the cord-holder until that time. This slide is arranged to move in and out of a recess in the cord-holder case, and is connected with an elbow-lever, h^1, which is pivoted to the guide-plate X, secured to the ring-carrier. In order to operate it, a plate, Z, is secured to the frame of the apparatus in such position that the end of the elbow-lever h^1 bears against its inner curved face, and holds the fork of the slide sufficiently above the crotch of the cord-holder case to prevent the cord from engaging in the cord-holder. The length of the plate Z is such that it continues to operate upon the elbow-lever h^1, and hold the slide until just before the cord-holder reaches its stopping-point, when, the end of the elbow-lever escaping, permits the slide to sink in its recess and let the cord enter the cord-holder.

In order that the band around the sheaf may be severed from the cord leading from the spool, the lower edge of the slide K is provided with a knife, i^1, and the lower guide m^1 of the slide has a notch, e^2, formed in it in the line in which the cord extends from the end of the slot I to the cord-holder. When the slide is in its normal position, it overlaps this notch and closes it. When the slide is moved forward, it carries the knife back foremost across this notch and opens it to receive the cord, and when the slide is drawn backward, the knife-edge, acting upon the cord held in the notch, severs it. As the knife is above the tying-bill, and between it and the cord-holder, the cutting takes place between the knotted band and the remainder of the cord, and the end of the cord leading from the spool is left fast in the cord-holder. The slide which carries the knife also operates the escapement of the compressing-strap holder, as before described. In order that it may be moved by the lever V, to which the power is applied for working the tying-bill, the under side of the slide has a recess formed in it with two shoulders, j^1 j^2, and an arm, B^1, is secured to the swinging frame in the proper position to act against the front shoulder j^1 of the slide when the swinging frame is moved forward, and against the rear shoulder j^2 when the swinging frame is moved backward, thus imparting the proper motions to the slide and to the knife, and to the escapement of the compressing-strap holder which the slide operates upon. As the slide requires to be moved a less distance than the swinging frame, it is arranged to slide at an angle to the general direction in which the end of the arm B′ is moved, so that the latter separates from the rear shoulder j^2 of the slide after the arm B′ has moved the slide the requisite distance, and does not engage with the forward shoulder until it has nearly completed its forward movement.

It is important that the revolution of the ring-carrier should be stopped automatically when it has carried the cord-holder and compressing-strap to the positions which they are to occupy during the tying of the band. It is also important that the ring-carrier should be prevented from running backward when the hands of the operator are removed from the crank-handles E E′. In order to perform these operations, a stop, e^2, is secured to the frame of the apparatus, and a pair of dogs, m^2 m^3, are secured in a case, G^2, to the ring-carrier in proper positions for their ends to act upon the opposite sides of the stop when the ring-carrier reaches the required position for stopping.

The dogs point in opposite directions, and are pivoted at their butts to the case G^2. They are combined by a lever, n^2, Fig. 6, so that when the end of the forward one, m^2, is depressed into the case in which it is pivoted, the end of the rear dog m^3 is of necessity raised out of the casing. The forward dog m^2 is acted upon by a spring, c^2, which raises its end from the case, and when it has been raised by the spring the distance required to act upon the stop e^2, its further movement is prevented by a rest, g^2, against which a spur, h^2, of the dog then abuts. The end of the rear dog m^3 is depressed into its case by the action of a spring, c^3, upon a spur, h^3, projecting from its butt, and consequently its end cannot protrude from the case unless it is raised by pressure applied to the forward dog m^2, and propagated through the lever n^2. From this combination of dogs it results that when the ring-carrier approaches the completion of its revolution, the forward dog m^2 is carried beneath the stop e^2, and is thereby depressed into its case, while the rear dog m^3 is at the same time caused to protrude so as to abut against the stop e^2 and stop the movement of the ring. As the end of each dog is notched, and the opposite sides of the stop have each a tooth formed upon them to engage in the notches of the dogs, the rear dog continues engaged with the stop as long as it is pressed against it, while the forward dog rises the moment it passes beyond the stop so as to prevent the ring-carrier from running backward. As soon as the movement of the ring-carrier is stopped, the hands of the operator are withdrawn from the crank-handles E E′, whereupon the strain of the compressing-band draws back the ring-carrier until the forward dog m^2 bears firmly against the stop. As this slight retrograde movement of the ring-carrier withdraws the end of the rear dog from the stop sufficiently to disengage its notch, the action of its spring, c^3, withdraws it into its case, so that it is out of the way when the next gavel is to be encircled with cord.

In the operation of the machine, it is advantageous that the ring-carrier should be permitted to retrograde slightly when the tying-bill is operating upon the cord, as such movement tends to prevent the cord from breaking in the operation of tying. Such retrograde movement is permitted in this machine by hinging the stop e^2 to the frame of the machine so that its lower end may move to and fro in the direction in which the adjacent part of the ring-carrier moves, and by providing a spring, k^2, to press it forward, the tension of the spring being adjustable by a screw, l^2. Hence, when the strain to move the ring-carrier backward exceeds the power of the spring k^2, the stop yields, and permits the desirable retrograde movement. It is also advantageous to relax the strain upon the compressing-band when the tying-bill takes hold of the cord. Such slackening is permitted by the operation of the escapement G, because when the slide K disengages the pallet of the escapement from the pin with which it is in contact, the strap-holder is permitted to turn until its further movement is prevented by the action of the other pallet of the escapement, and this partial turning relaxes the compressing-strap without letting it go, that operation being effected when the slide K is withdrawn as the knot is being completed.

The mechanism thus described permits the employment of common rope as the material for the compressing-band in a machine having a ring-carrier to carry the strap round the gavel, and as a considerably longer piece of rope may be placed in the machine than is required at any one time, the surplus being coiled up at the place where the rope is secured to the frame, this surplus forms a reserve which is drawn forward as the knot is worn off by use, thus permitting the free end of the rope to be formed into a new knot. The cost, therefore, of keeping the compressing-strap in working order is considerably less than it would be if it were a flat leather strap such as has heretofore been used in connection with a ring-carrier, and when it is worn out it may be easily replaced by any farmer.

Having thus described a machine embodying all parts of my invention in the best form which I have thus far produced, I claim as my invention and desire to secure by Letters Patent.

1. The arrangement of the cog-wheel that transmits motion to the ring-carrier of a binding apparatus upon the axle of one of the wheels which holds the ring-carrier in its place, substantially as set forth.

2. The combination, in the same binding apparatus, of a ring-carrier and a vibrating tension-arm to control the compressing-strap, substantially as set forth.

3. The combination of the ring-carrier of a binding apparatus with a strap-holder of suitable size and form to seize and hold the knotted end of a rope compressing-strap, substantially as set forth.

4. The combination of the detachable strap-holder with an escapement which permits the compressing-strap to relax its grasp upon the grain and subsequently to be withdrawn from the sheaf, substantially as set forth.

5. The combination of the turning cord-holder with the ring-carrier, substantially as set forth.

6. The combination of the turning cord-holder and ring-carrier with a grooved case, substantially as set forth.

7. I do not claim to have invented the combination of the spool with the ring-carrier, so that the former is turned by the latter by friction, nor the movement of such a spool relatively to the ring-carrier for the purpose of relaxing the tension upon the binding material; but I claim the combination of the cord-spool and its friction apparatus with a swing-

ing frame and cord-guide, substantially as set forth, so that the tension is relaxed by drawing the binding material from the spool.

8. The combination of the moving-frame of the tying-bill with the fixed frame-work of the binding apparatus by toggle-jointed links, substantially as set forth.

9. The combination of the slotted plate for holding the cord-band with the guide-plate for guiding it into the slot of the said plate, substantially as set forth.

10. The combination of the cord-holder with a movable protector, substantially as set forth.

11. The combination of the tying-bill and movable knife, substantially as set forth.

12. The combination of the knife and the instrument for transmitting motion to the escapement of the compressing-strap holder, substantially as set forth.

13. The combination of a pair of spring-dogs upon the ring-carrier with a yielding stop upon the frame-work of the binding apparatus, substantially as set forth.

In witness whereof I have hereunto set my hand this 6th day of February, A. D. 1865.

JACOB BEHEL.

Witnesses:
W. F. BEHEL,
J. G. MANLOVE.