No. 682,449. Patented Sept. 10, 1901.

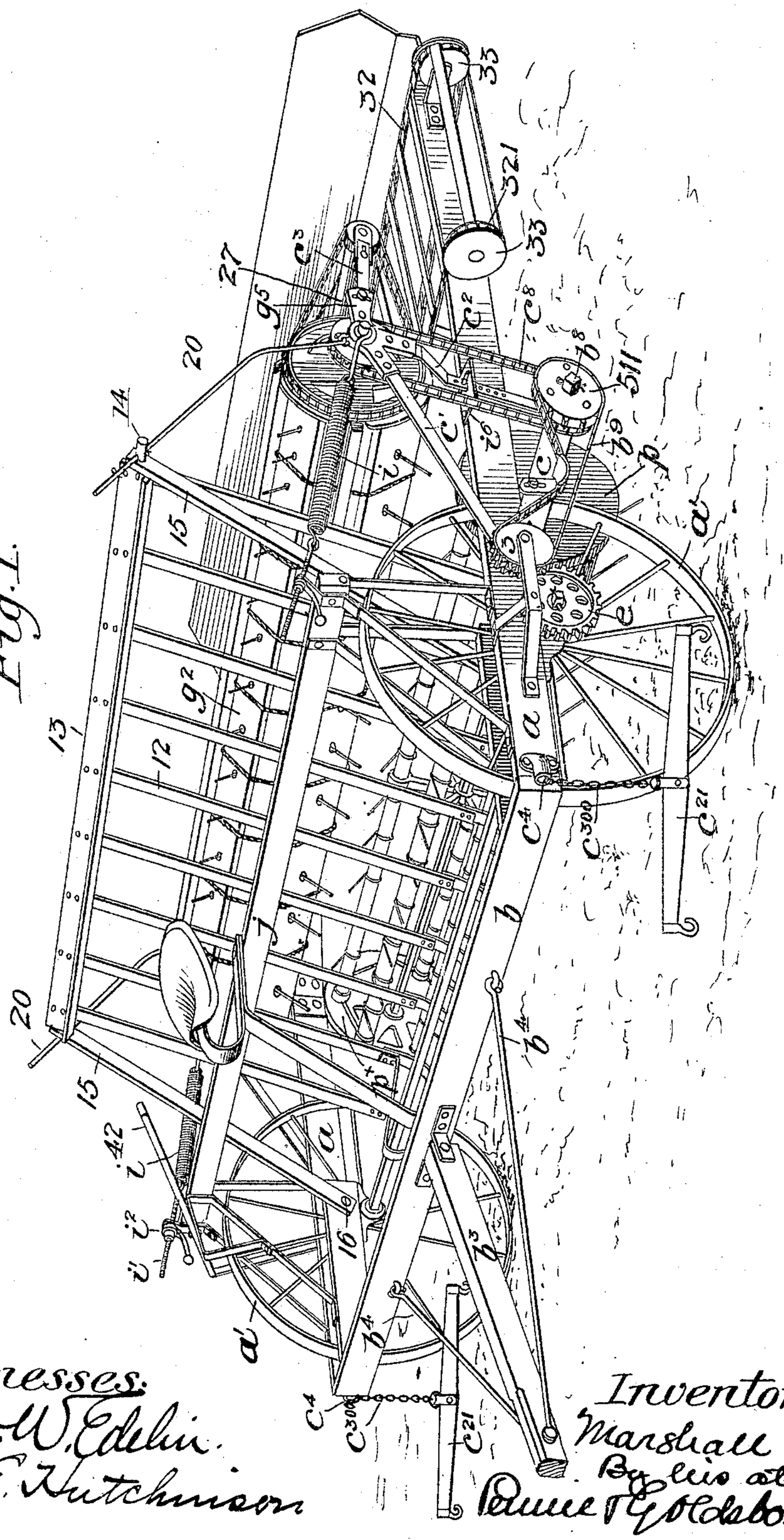
M. BECK.

MACHINE FOR GATHERING AND HANDLING HAY.

(Application filed Apr. 10, 1901.)

(No Model.) 10 Sheets—Sheet 1.

Fig. 1.



Witnesses:
D. W. Edelin.
J. E. Hutchinson

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Pennie & Goldsborough

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(No Model.) 10 Sheets—Sheet 2.

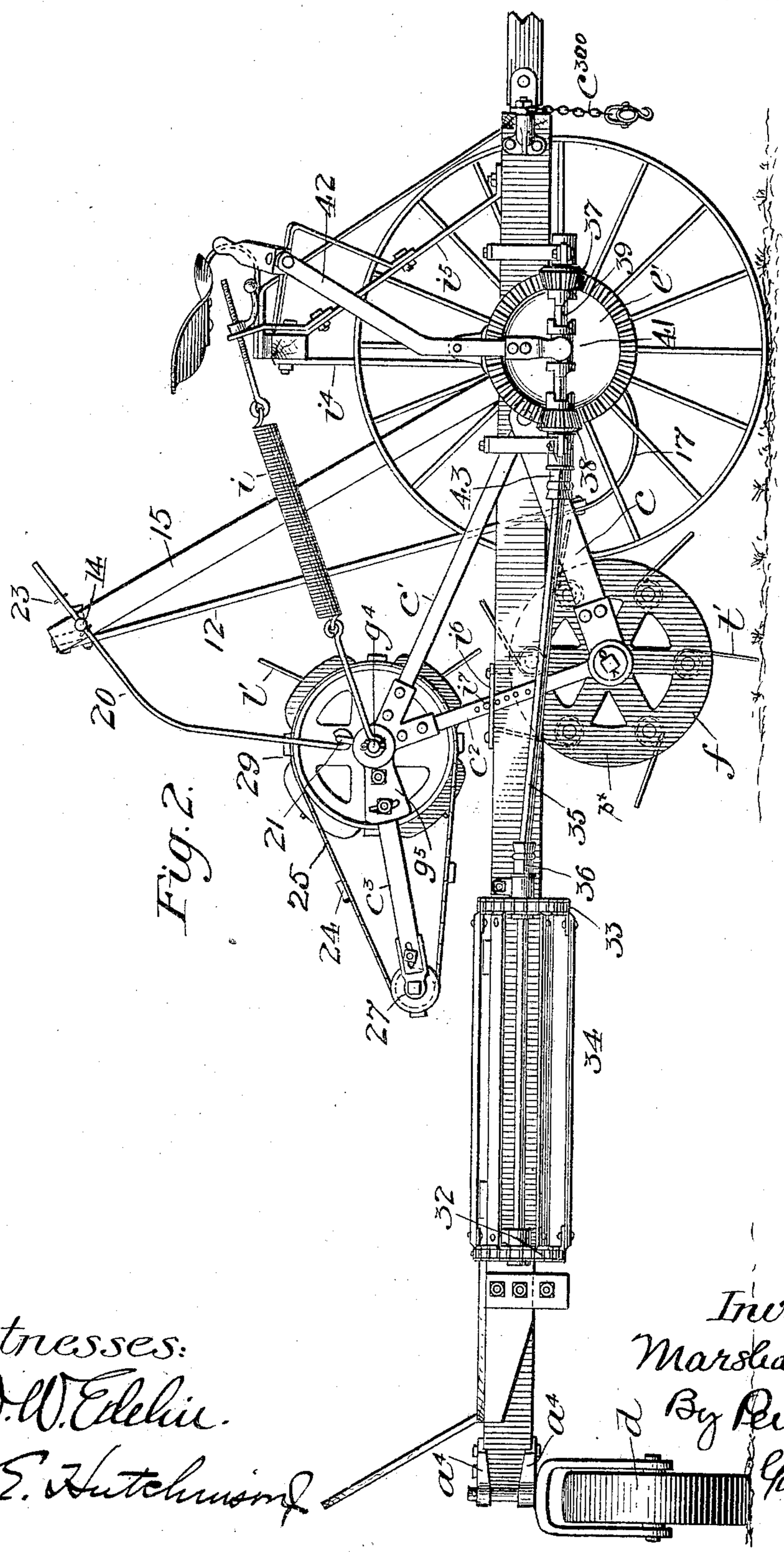

Fig. 2.

Witnesses:
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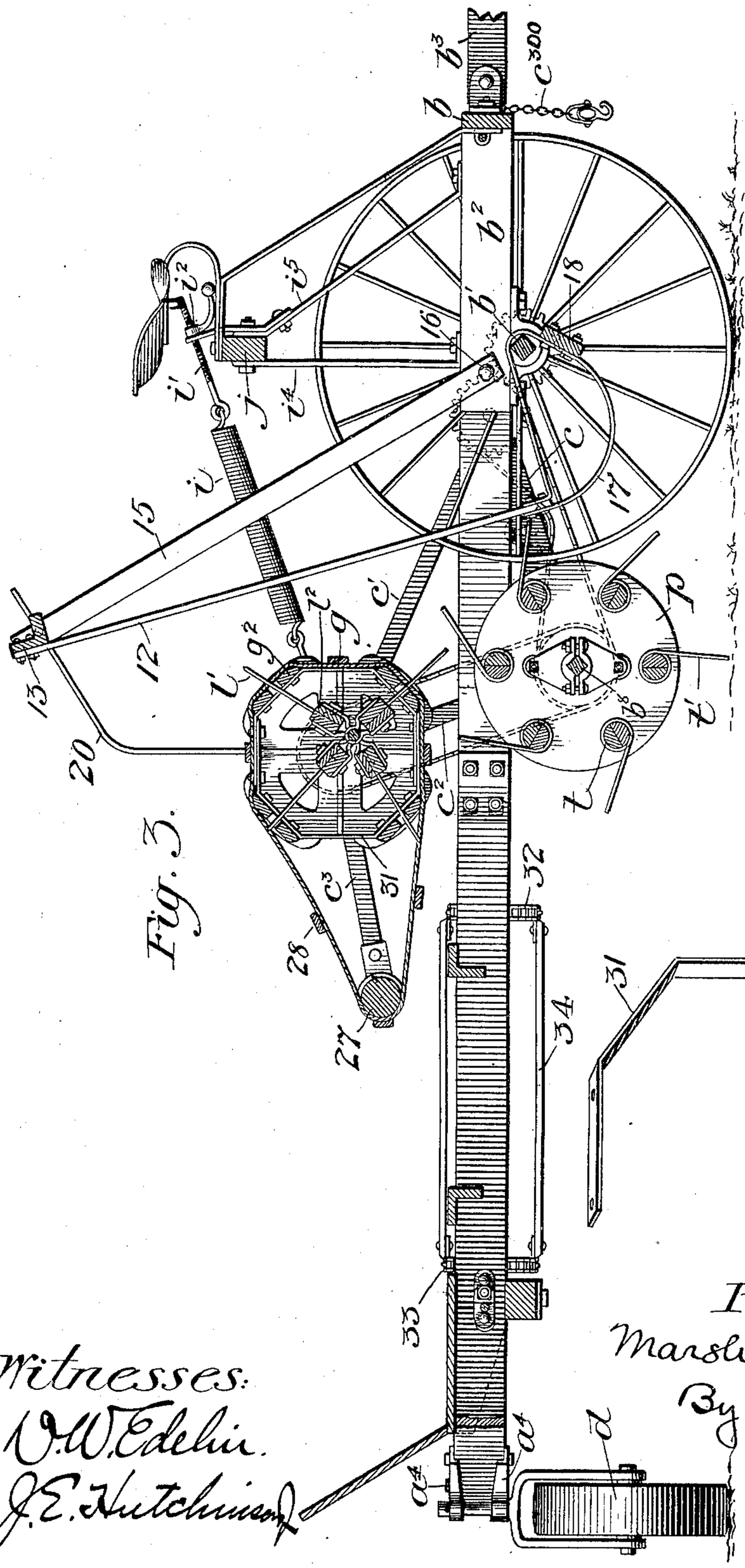

Fig. 3.

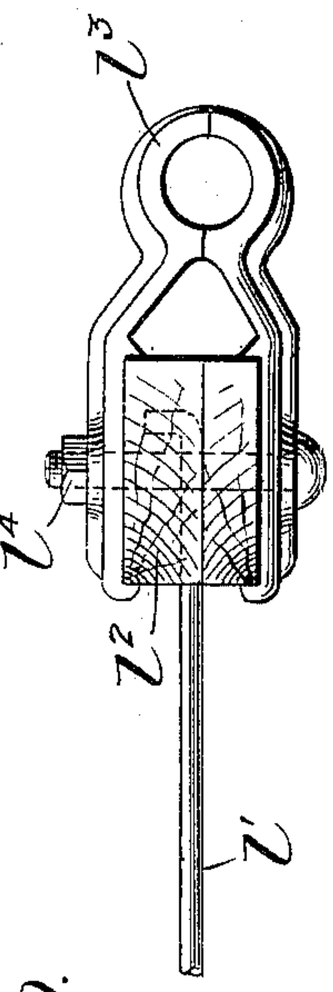

Fig. 18.

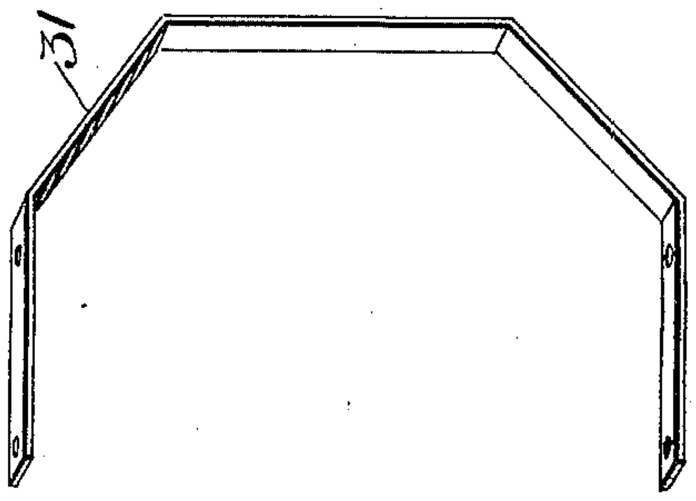

Fig. 19.

Witnesses:
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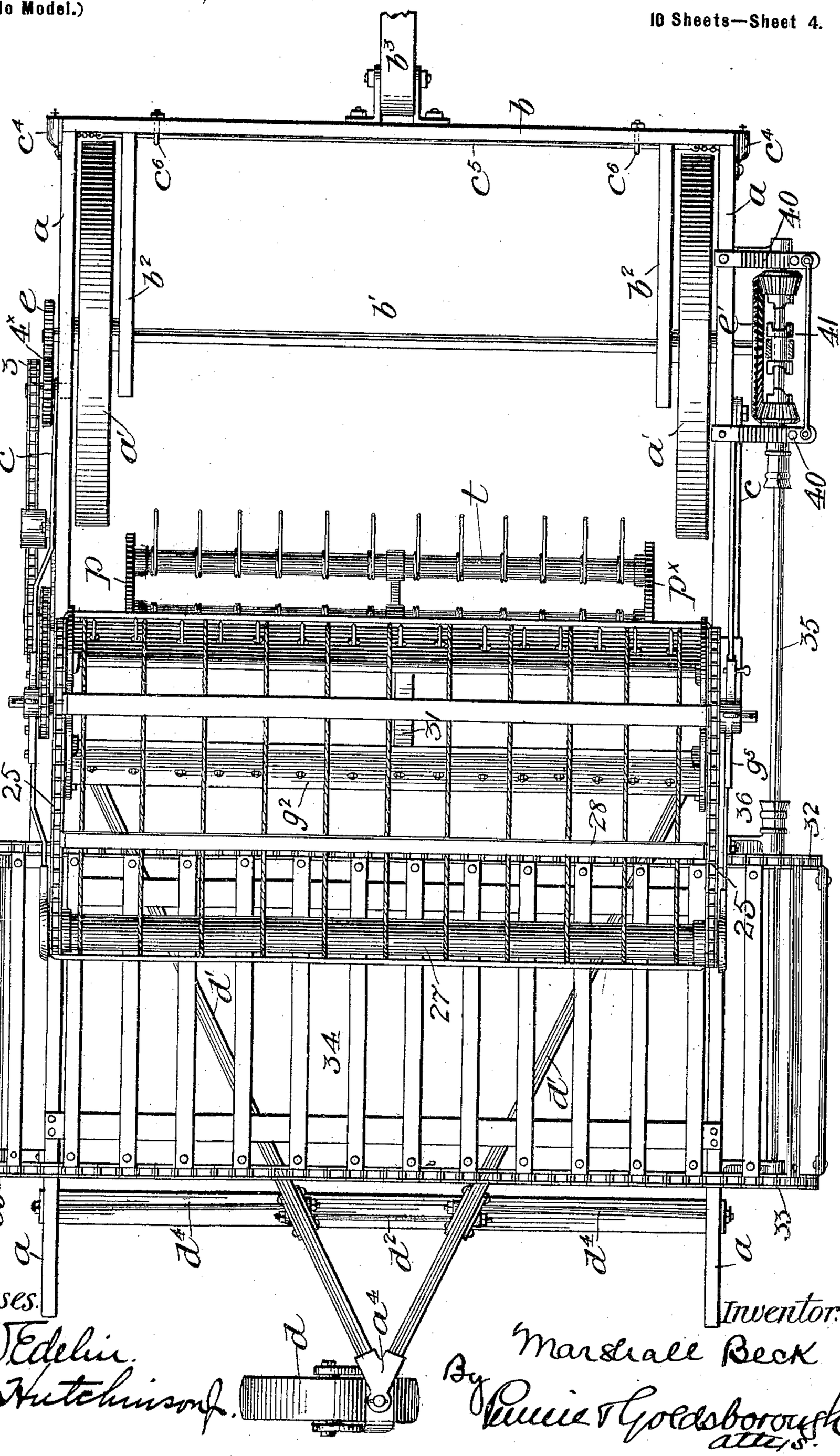
(No Model.) 10 Sheets—Sheet 4.

Fig. 4.



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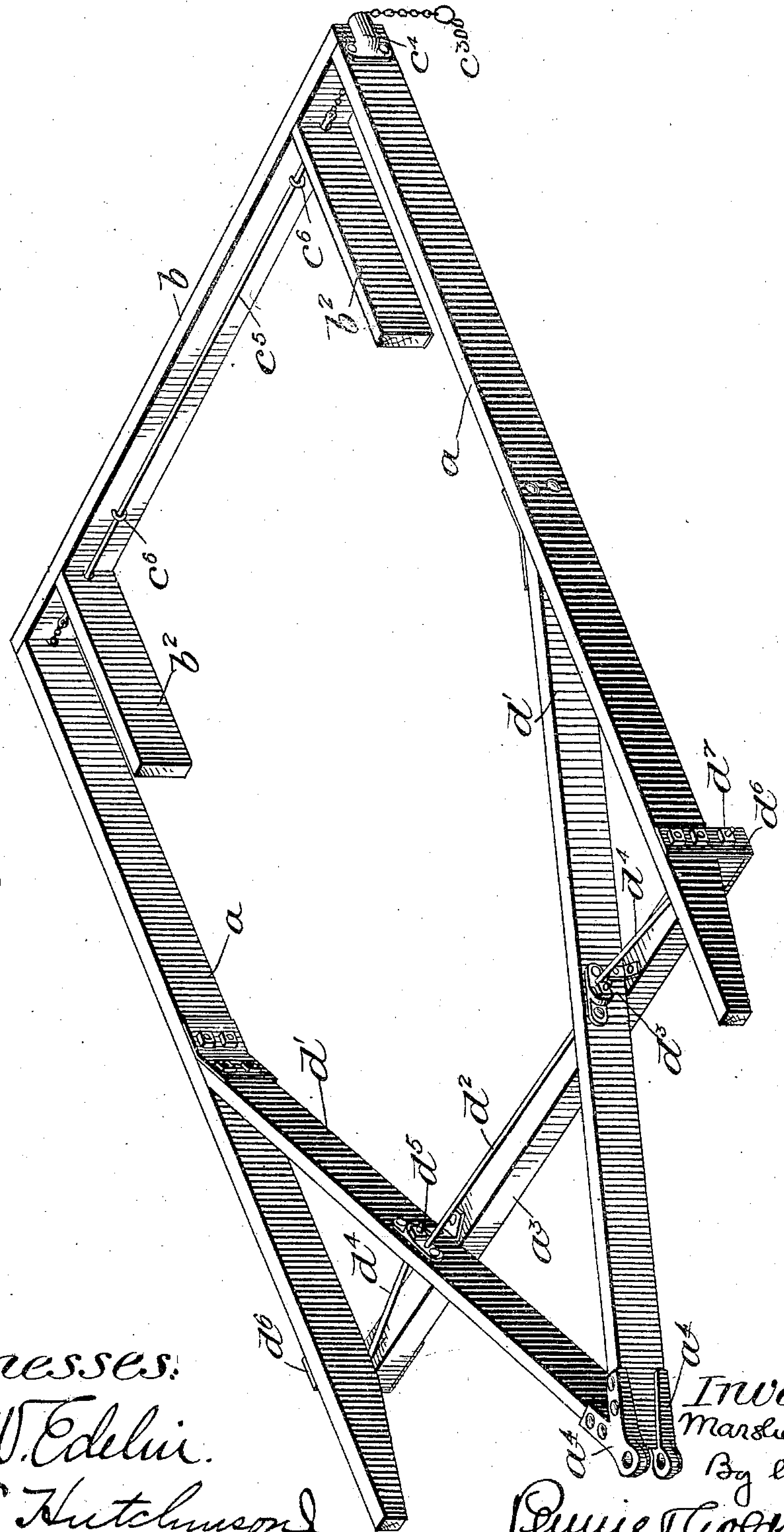
(Application filed Apr. 10, 1901.)

(No Model.) 10 Sheets—Sheet 5.

Fig. 5.



Witnesses:
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(No Model.) 10 Sheets—Sheet 6.

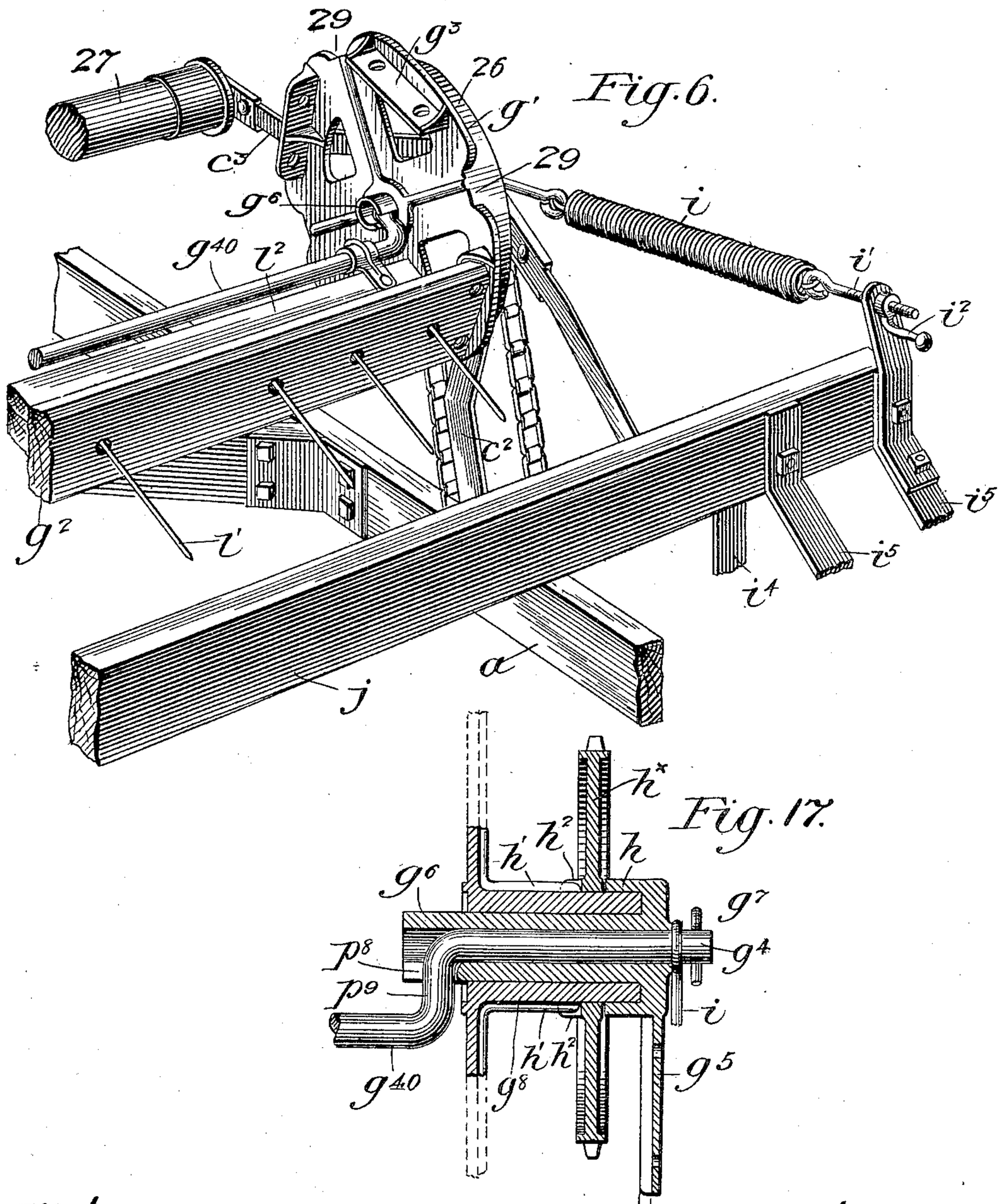

Fig. 6.

Fig. 17.

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Fig. 11.

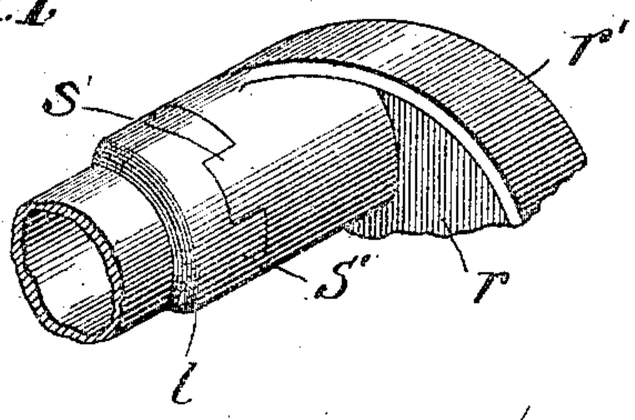


Fig. 7.

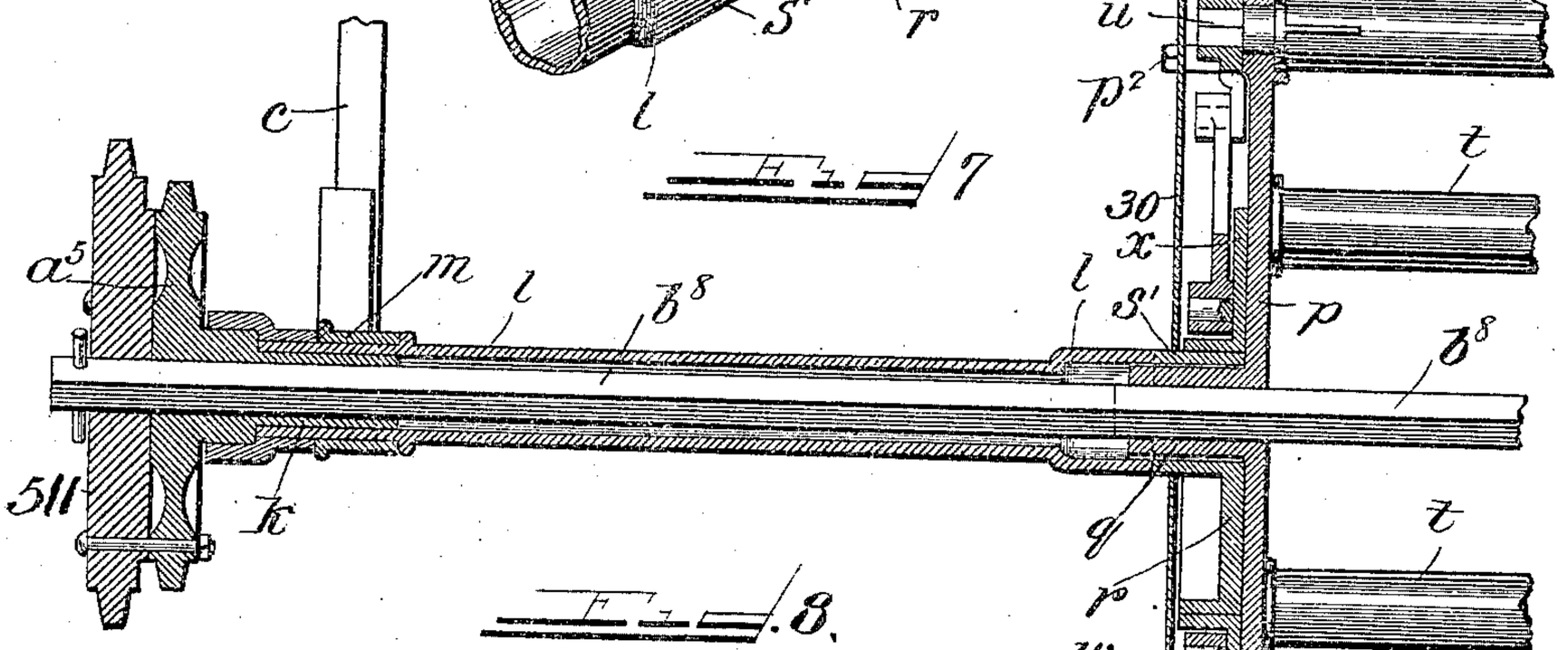


Fig. 8.

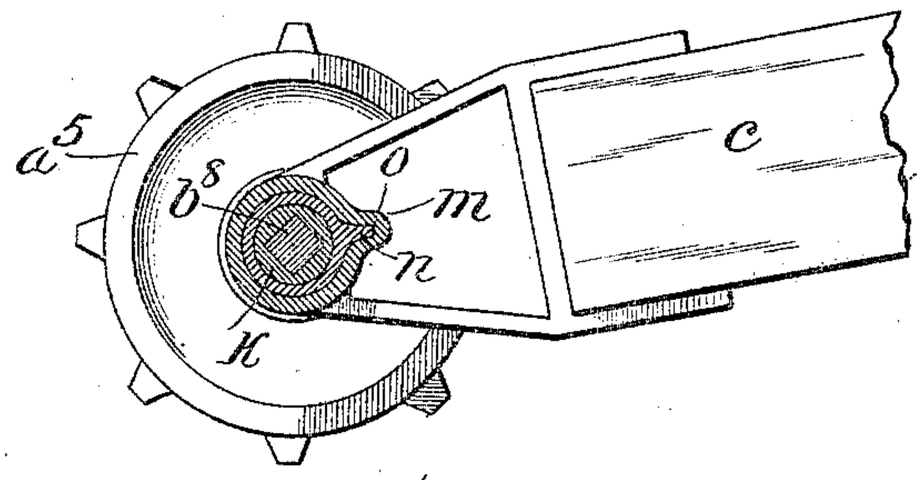


Fig. 9.

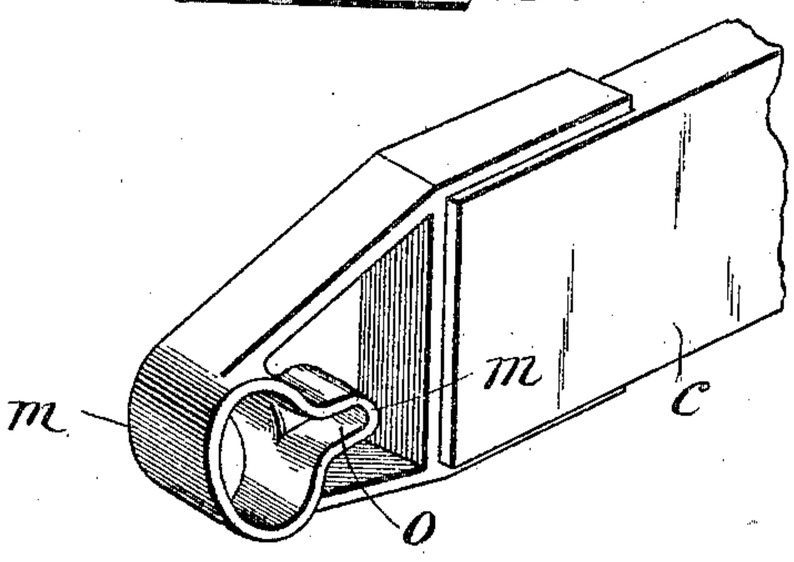
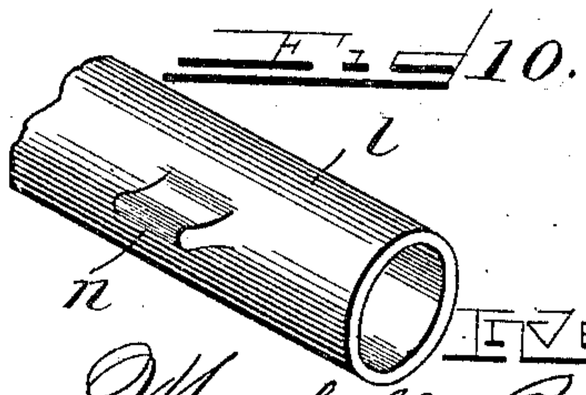


Fig. 10.



Witnesses
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Fig. 12.

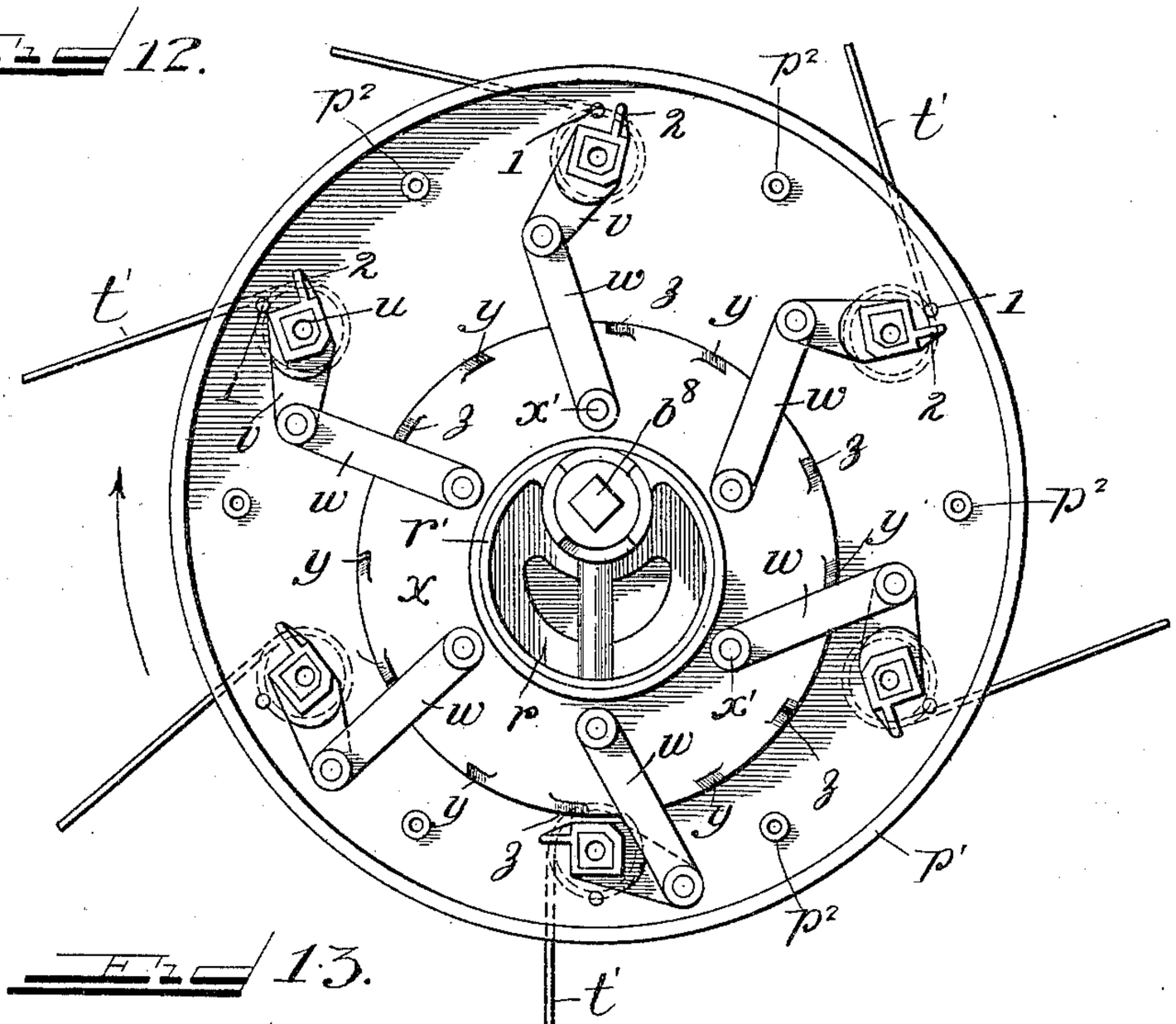

Fig. 13.

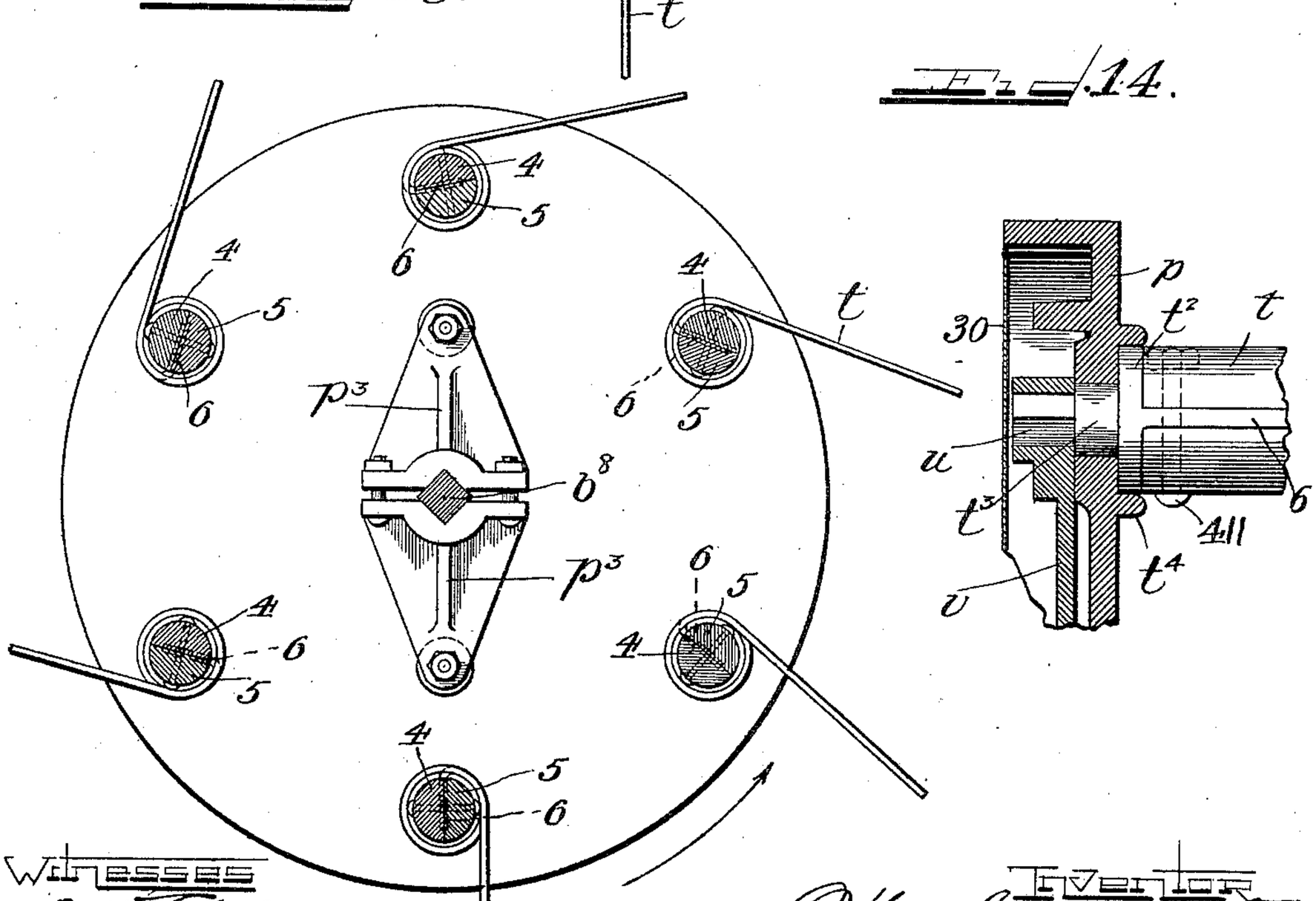

Fig. 14.

Witnesses
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(Application filed Apr. 10, 1901.)

(No Model.) 10 Sheets—Sheet 9.

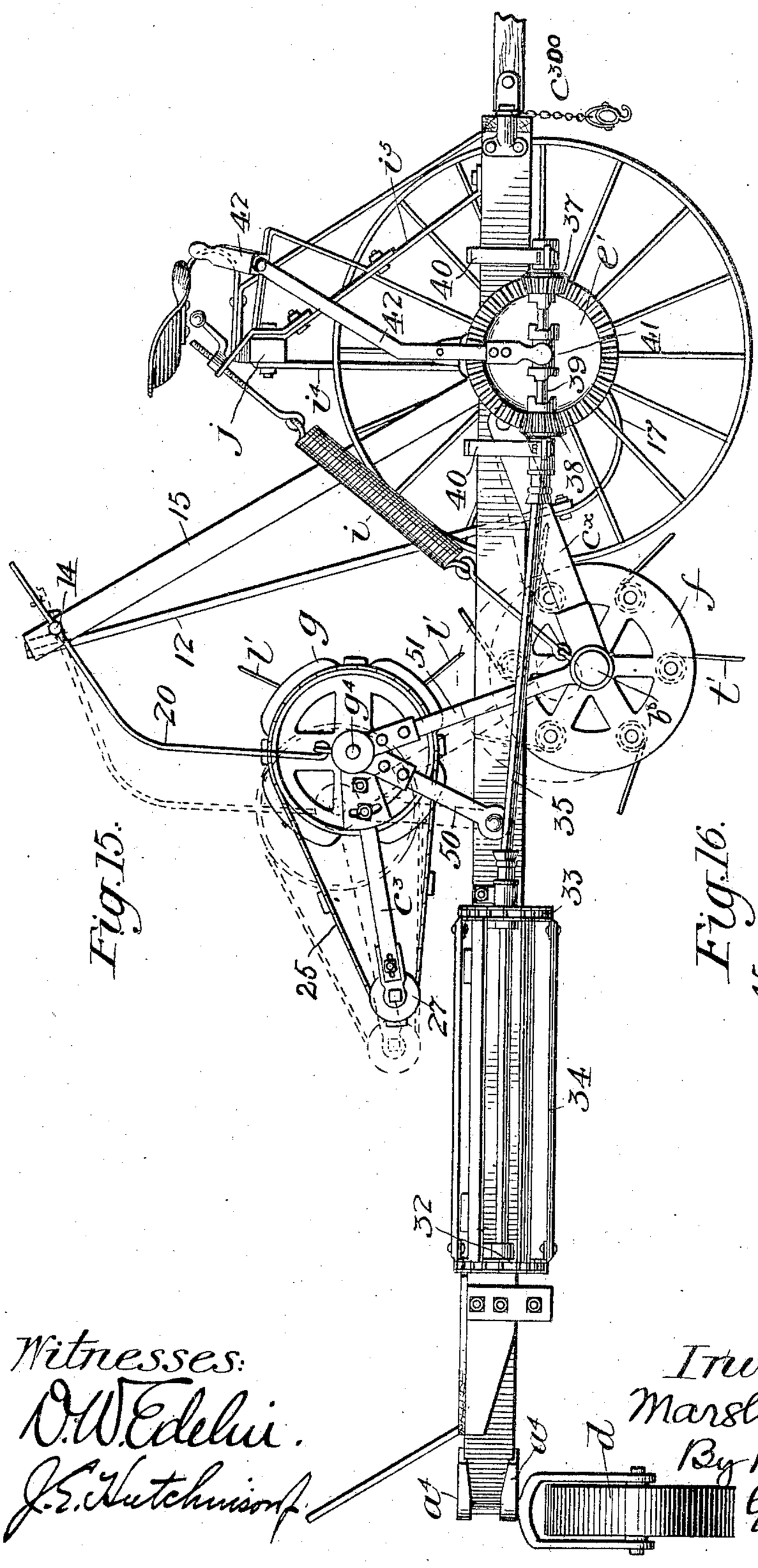

Fig. 15.

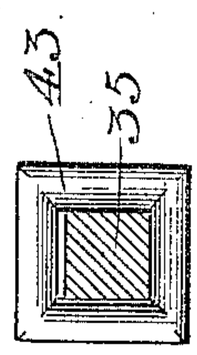

Fig. 16a.

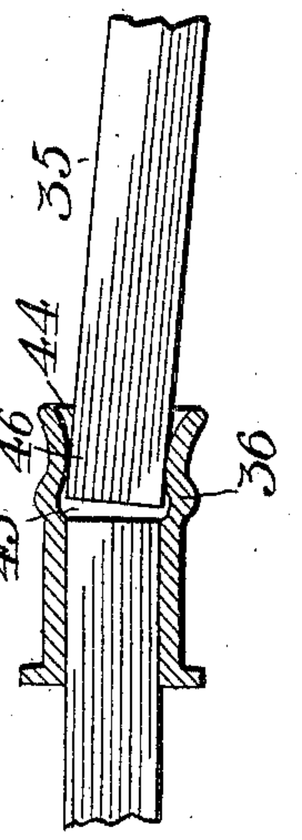

Fig. 16.

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No. 682,449. Patented Sept. 10, 1901.

M. BECK.

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(Application filed Apr. 10, 1901.)

(No Model.) 10 Sheets—Sheet 10.

Fig. 21.

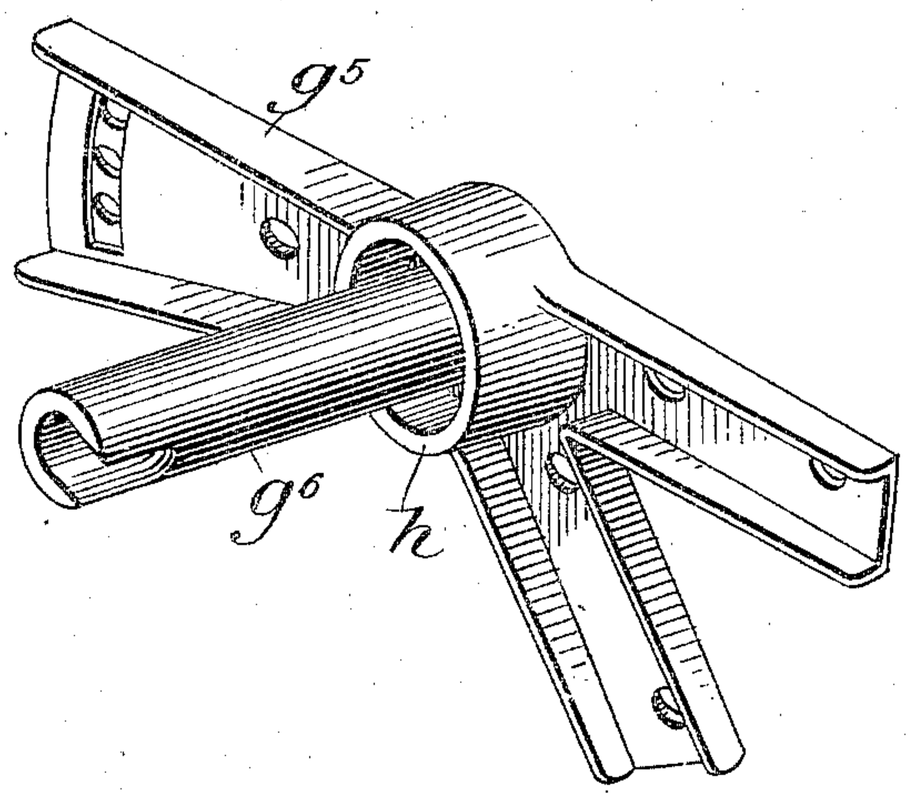


Fig. 22.

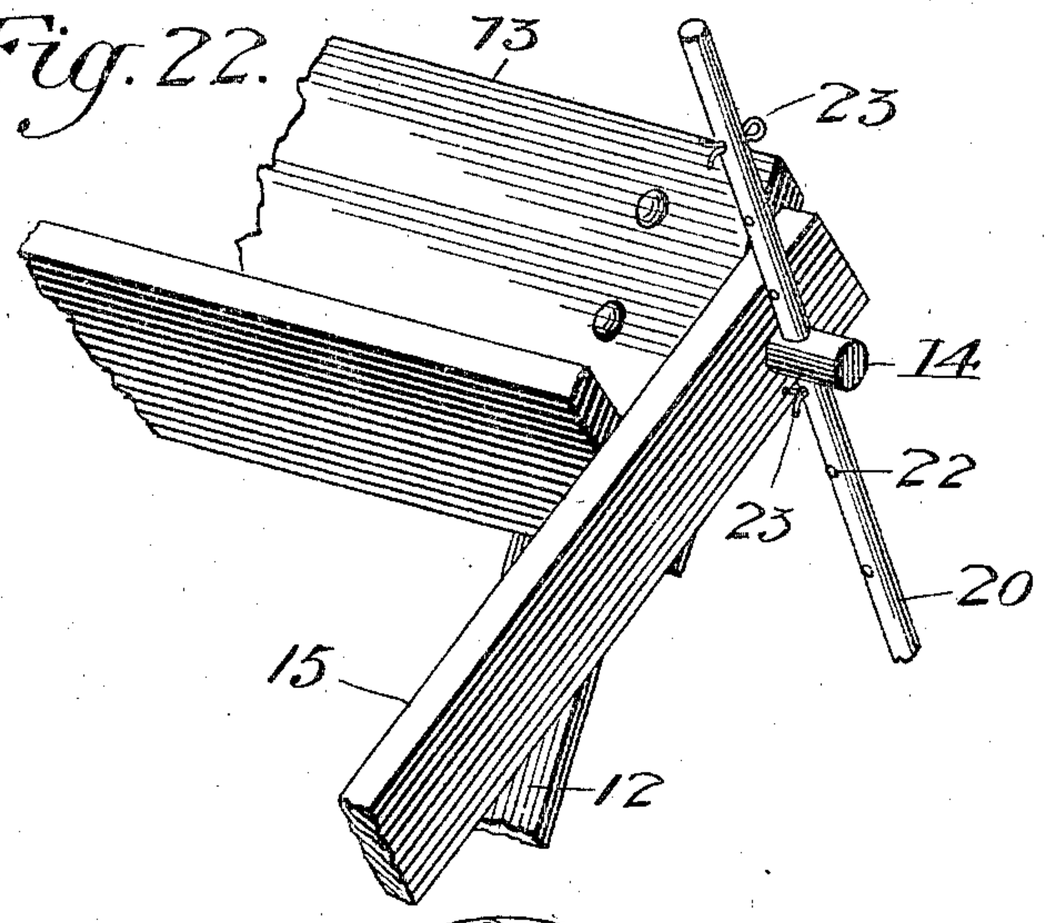
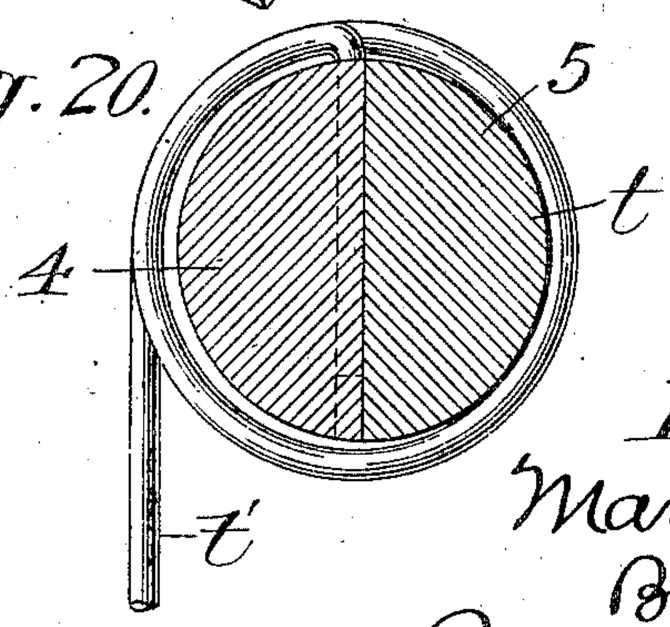


Fig. 20.



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Marshall Beck
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UNITED STATES PATENT OFFICE.

MARSHALL BECK, OF MOLINE, ILLINOIS, ASSIGNOR OF TWO-THIRDS TO JACOB W. SKINKLE AND DAVID K. HILL, OF CHICAGO, ILLINOIS.

MACHINE FOR GATHERING AND HANDLING HAY.

SPECIFICATION forming part of Letters Patent No. 682,449, dated September 10, 1901.

Application filed April 10, 1901. Serial No. 55,201. (No model.)

To all whom it may concern:

Be it known that I, MARSHALL BECK, a citizen of the United States, residing at Moline, county of Rock Island, State of Illinois, have invented certain new and useful Improvements in Machines for Gathering and Handling Hay; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention has to do with that class of hay-making machines known as "side-delivery rakes or gatherers," the machines of this class being designed to gather up the hay from the ground and to deposit it in a windrow at the side of and in the direction of travel of the machine.

The objects of the invention are in general to provide a machine of this kind which is adapted to do its work by traveling lengthwise the swaths and in the direction in which the mower traveled and with which the windrows may be finished from either side, so as to gather the hay in the order of time in which it was cut and to leave the windrows in the best form for the subsequent action of the windrow-loader; to provide a machine in which the hay may either be gathered and laid in windrows, as above described, or deposited in bunches at intervals lengthwise the mowed land in positions to be loaded on the wagon by hand; to provide a machine of this class with a floating toothed cylinder adapted to rise and fall freely to accommodate itself to the inequalities of the ground and acting to pick up the hay from the surface without rolling it, and to combine with the same an elevating-cylinder having a constant relation with the gathering-cylinder and following it in all its movements, so as to take the hay picked up by the gathering-cylinder and pass it onward to the cross-carrier; to provide a novel form of guard and retainer for coöperation with these cylinders to retain the hay upon them and direct its passage upward along the front sides of both cylinders, and to provide for supporting the rear end of the frame on a single trailing wheel without weakening this part of the structure. Incidentally the invention also includes improvements in certain details of construction, as will appear from the following description.

The invention is illustrated in the accompanying drawings, wherein Figure 1 is a perspective of the entire machine from the front left-hand corner. Fig. 2 is a right-hand side elevation. Fig. 3 is a central longitudinal vertical section. Fig. 4 is a plan view, certain parts at the forward and under sides of the machine being omitted for greater clearness. Fig. 5 is a perspective view of the frame of the machine dissociated from the wheels, the draft devices, and the operative parts. Fig. 6 is an enlarged perspective of one end of the elevating-cylinder, showing the construction of the cylinder and the manner of operating the fingers. Fig. 7 is an enlarged section of one end of the gathering-cylinder to show more particularly the arrangement for securing the finger-rocking eccentric in non-rotating position upon the hub of the gathering-cylinder head. Figs. 8, 9, and 10 are details of the manner of mounting the cylinder-shaft in the side bars of the floating frame which carries it. Figs. 11 and 14 are details of the left-hand head of the gathering-cylinder to show more clearly the means for operating the gathering-fingers. Fig. 15 is a side view similar to Fig. 2, showing a modified form of floating frame and connections for preserving a more constant relation between the elevator-cylinder and the cross-carrier. Figs. 16 and 16ª are details of the shafting by means of which the cross-carrier is driven from the main drive-gear on the axle of the supporting-wheels. Fig. 17 is a sectional detail of one end of the elevating-cylinder, showing how the shaft which controls the projection of the fingers is connected with the floating frame and related to the cylinder-heads. Fig. 18 is an end view of one of the finger-heads of the elevating-cylinder, showing how the fingers are mounted and the construction of the hinge of the head. Fig. 19 is a perspective view of one of the skeleton middle braces of the elevating-cylinder. Fig. 20 is a detail, showing the manner of mounting the teeth of the floating gathering-cylinder. Fig 21 is a detail in perspective of the casting which forms the stud-journal of the

elevating-cylinder heads and unites the several parts of the floating frame together. Fig. 22 is an enlarged detail of the stop-rod connection between the upper end of the cylinder-guard and the floating frame.

Similar letters and figures of reference in the several views indicate the same parts.

Referring more particularly to Figs. 1, 4, and 5, *a a* denote the side bars of the machine, and *b* the front end bar. This frame is supported at its front end by ground-wheels *a' a'*, having a backing-ratchet connection with a through-shaft *b'*, which is journaled within the hollow hubs of the wheels, the wheel-hubs being journaled in boxes secured to the side bars. Any suitable backing-ratchet connections may be made between the ground-wheels and the shaft; but I prefer the arrangement illustrated and described in my application for machines for gathering and loading hay filed of even date herewith, Serial No. 55,202. I do not deem it necessary to illustrate this connection herein, for the reason that it forms no part of the present invention, and also because hay-raking machines are often provided with similar arrangements, the object being to permit the wheels to revolve forwardly together or to allow them to rotate independently of each other, and yet always to turn the axle when either wheel is moving forward.

Projecting rearwardly from the end bar *b* at either side of the frame and in proximity to and parallel with the side bars *a a* are supplemental side bars b^2 b^2, which extend rearwardly a little aft of the shaft *b'* on the inner sides of the wheels and constitute inner journal-bearings for the ground-wheels, which have elongated hubs turning in the boxes, secured to the under sides of the bars. This wheel-mount forms no part of the invention claimed herein, but is claimed in my application for hay gathering and loading machines above referred to. No further description of the arrangement, therefore, is deemed necessary herein.

The rear end of the machine-frame is supported upon a swiveled trailing wheel *d*. This wheel is mounted in the center line of the machine at the meeting ends of two hounds *d' d'*, that are secured rigidly to the inner sides of the side bars *a a* about midway of their length and project rearwardly some distance beyond the end of the frame. The meeting ends of the hounds are securely fastened together by bracket-castings a^4 a^4, in which are also the bearings for the pin of the swivel carrying the trailing wheel. It will be readily understood that if the side bars could be brought together at their rear ends on the center line of the frame plan and mounted on the swivel-wheel direct without the intervention of hounds no further trussing nor balancing of the frame would be necessary, since the frame would then be triangular in form, having a wheel under each corner; but to provide the space required by the gathering and elevating actions and to provide suitable supports for the cross-carrier and for the bearings for its shafts it is necessary to construct the main frame in the rectangular form shown in the drawings.

To carry the support of the swivel-wheel to the rearwardly-extended and free ends of the side bars, a truss-rail a^3 is secured to the hounds midway of their length and at right angles to the side bars, as best illustrated in Fig. 5, the ends of the truss-rail being extended sufficiently to form supporting-seats for the bars and the bars being secured in their seats and held in parallel arrangement by being bolted against the truss-brackets d^6 d^6.

To further prevent the "sagging" of the overhanging rear corners of the rectangular frame, truss-rods d^4 d^4 are carried from the end brackets of the truss-rail under the side bars upwardly to and through the hounds, these rods being provided with adjusting-nuts d^5 d^7 on their inner and outer ends, respectively. To prevent the weight of the overhanging corners of the main frame when exerted upon the truss-rods d^4 d^4 from straining the hounds apart and out of vertical plane, a supplemental rod d^2 is passed through the hounds as a tie and as nearly as practicable in line with the outer rods, the tie-rod being provided with an adjusting-nut d^3 on one or both of its ends. The three-rod truss, as shown, is a preferable construction, for the reason that when a single continuous rod is employed it tends to shift endwise when an excess of weight is thrown upon one only of the overhanging corners, thus permitting one corner to "sag" below level, while the other stands correspondingly above the level. In the truss plan shown it will be understood that by means of the adjustment-nuts d^5 or d^7 either end of the truss-rail with the side bar seated thereon can be brought up to level independently of the like parts on the opposite side of the frame. It will also be noted that the tension of the truss-rod d^4 comes on the ends of the truss-rail and that there is no tendency to draw the rear ends of the side bars together, the latter being merely supported upon the ends of the truss-rail without connection with the hounds or truss-rods at their rear end.

The framing of the machine being as thus described, it will be noted that the entire weight of the rear end and its superimposed parts is carried by the single trailing wheel, and the particular object of the hounds and the truss-rods above described is to strengthen the rear part of the frame and prevent the torsional strains to which it is subjected in operation from twisting and warping it out of shape.

The preferred draft devices consist of a tongue b^3, freely pivoted at the center of the end bar *b* of the frame and braced by diagonal tie-bars b^4 b^4, pivotally connected to the

front end bar some distance beyond either side of the tongue and rigidly connected with the tongue at a point considerably in advance of the machine, the pivotal connections of the tongue and tongue-braces with the front bar of the frame being in line each with the others, and thus freely permitting the outer end of tongue to be raised and lowered. Heretofore the horses have usually been hitched to these machines by means of a doubletree mounted upon the tongue and having the usual singletrees at its outer ends. This arrangement, however, causes the team to travel in such a line as to trample the swaths, and the present invention contemplates what I call a "spread-hitch," whereby the tongue is relieved of the draft and this draft is applied directly to the frame of the machine in line with the ground-wheels, so as to give the widest possible base to the draft devices for the purpose of steadying the machine, relieving the team as far as possible of side-draft strains and locating them so that they do not trample the swaths, the left-hand horse always walking on the raked ground and the right-hand horse following in the path made by the mower between swaths. In order to effect this spread-hitch arrangement, I connect the singletrees c^{21} c^{21} to the outer ends of short chains c^{300} c^{300}, which pass through fair-leaders c^4 c^4, secured to the outer front corners of the side bars of the machine and connected at their inner ends to the opposite ends of a draft-rod c^5, which is slidingly supported by hangers c^6 c^6, projecting from the inner side of the front end bar b. This draft-rod slides through perforations in the supplemental side bars b^2 b^2 under the action of the pull of the team, thereby equalizing the draft strains and diminishing the lateral swerving of the frame and greatly relieving the team from side strains. The horses being thus located so far apart, it is necessary to provide at the outer end of the tongue a neck-yoke of a corresponding length, or, if preferred, the tongue and neck-yoke may be entirely dispensed with, since they perform only the function of spreading the team, and any other spreader-stick arrangement may be employed to take the place of the neck-yoke.

The power to drive the operative parts of the machine is taken from the through-shaft b' by means of a spur-gear e on the left-hand end of the shaft and a beveled gear e' on the right-hand end, both gears being outside of the side bars. The spur-gear e drives all the mechanism concerned in gathering the hay from the ground and elevating it and depositing it upon the cross-carrier to be presently described, and the beveled gear e' drives this carrier.

The cylinder for gathering the hay from the ground is denoted by f. It consists generally of heads p p, mounted at opposite ends upon the square shaft b^8, which is journaled in the rear ends of the bars c c, that are pivoted to the outer sides of the side bars a a and are free to rise and fall, as will be more fully described later on. This gathering-cylinder has journaled in its heads a number of tooth-carrying bars t t, to which are secured elastic teeth t', that are constructed, connected, and operated in a manner that will be presently described, so as to take hold of the hay lying on the ground and pick it up as the machine advances and deliver it to another toothed cylinder, which lifts it still further and carries it backward and delivers it upon the cross-carrier.

The gathering-cylinder is driven so that its under side revolves forwardly as the machine advances, and motion is communicated to its shaft b^8 by means of a chain b^9, passing around a sprocket-wheel 3, which is rigidly secured to a spur-gear $4^\times$, that is journaled on a stud on the left-hand side bar a in mesh with the gear e, heretofore described, the stud of the gear $4^\times$ constituting also the pivot of the left-hand swinging bar c. The chain b^9 passes from the sprocket-wheel 3 around another sprocket-wheel 5^{11} on the extreme end of the shaft b^8 of the gathering-cylinder, and thus the cylinder is driven without interfering with its rising-and-falling movement, the center upon which it swings being the axis of the chain-gear arrangement for driving it. The hub of the wheel a^5 is denoted by k and has a square bore, as shown in Fig. 8, so that it drives the shaft b^8. The hub of the wheel also forms the journal for the shaft to turn on, and for this purpose is circular on the exterior and fits snugly into the tubular sleeve 1.

The swinging bars c c, as before described, are pivoted to the outer sides of the side bars a a. The heads of the gathering-cylinder are, however, located some distance inside the side bars, and were not some provision made for shielding the portion of the shaft b^8 between the sprocket-wheel a^5 and the head p there would be considerable liability of the hay wrapping and twisting around the shaft. I therefore inclose the ends of the shaft in a tubular sleeve 1, the outer end of which has a lug n, which fits in a corresponding recess o in a bracket-casting m, which is secured to the lower end of the swinging arm c, the lug serving to prevent the sleeve from turning in the casting. At its opposite end the sleeve 1 has a clutch connection s' with the mechanism for controlling the movement of the finger-carrying bars, which mechanism will be described farther on.

The elevating-cylinder heretofore referred to is denoted by g. It is driven by means of a chain c^8, which passes around the sprocket-wheel a^5 on the end of the gathering-cylinder shaft b^8. The cylinder g comprises disk-like heads g' at opposite ends, that are connected together by longitudinal side boards g^2, the opposite ends of which are securely fastened to seats g^3, suitably spaced apart around the periphery of the heads on their inner sides. In the present instance four of these side bars

are shown, the same being located at diametrically-opposed points around the axis of the cylinder. Any desired number of these bars may, however, be employed. The cylinder is journaled upon spider-brackets g^5 g^5, which are rigidly secured upon the upper ends of inclined bars c' c' and vertical bars c^2 c^2, these four bars, together with bars c c, forming the two triangular pivoted frames, upon which the gathering-cylinder is also carried, as before described. The inwardly-projecting studs or bosses g^6 of the spiders are tubular in form, and their hollow centers provide a free mount for the non-rotating cranked rod or shaft g^4 concentric with the cylinder journaled upon the outer surface of these bosses.

The ends of the cranked rod pass outwardly through the hollow bosses beyond spiders, and being provided with cotters g^7 or other securing means acting against the outer faces of the spiders the rod serves as a tie for the upper corners of the two sections of the pivoted frame, positively securing them from spreading apart.

The heads g' g' of the elevating-cylinder are provided with hubs g^8 g^8, which fit over the tubular bosses g^6 g^6 of the spiders and by means of which the cylinder-heads are rotatively journaled upon these bosses, there being preferably provided on each of the spiders an annular flange h, encircling the outer ends of each hub g^8. The chain c^8, which drives the elevating-cylinder, as before described, passes around the sprocket-wheel $h^\times$, that is slipped over the hub g^8 on the left-hand head of the cylinder and is interlocked therewith by means of ribs h', fitting between lugs h^2 on the wheel, as clearly represented in Fig. 17, thereby securely locking the sprocket-wheel and the cylinder-head together in a manner convenient for assembling and dismantling the machine.

The arms c, c', and c^2 on each side of the machine are thus rigidly secured together in a triangular arrangement, forming a rigid frame that is pivotally secured at its front corner to the machine-frame and carries at its lower corner the gathering-cylinder, as already described, and at its upper corner the elevating-cylinder, as also described, so that the relation between these two cylinders is constant, and the whole structure is free to rise and fall independently of the main frame of the machine and the cross-carrier to which these cylinders ultimately deliver the hay. The two skeleton frames which these bars compose, therefore, constitute a unitary floating-frame structure that as thus far described has only a pivotal connection with the machine-frame; but for the purpose of elastically suspending it I provide stout coiled springs i i, the rear ends of which are connected in any suitable manner to the projecting ends of the through-shaft g^4 of the elevating-cylinder and the forward ends of which are adjustably connected by means of a screw-rod i' and adjusting-nut i^2 to an upstanding bracket projecting from the seat-bar j of the machine, this seat-bar being supported in an elevated position on vertical standards i^4 i^4, that are braced by diagonal struts or trusses i^5 i^5 at either side of the machine. The floating frame carrying the elevating and gathering cylinders is therefore elastically suspended, so as to permit the cylinders to rise and fall freely as required by the character of the surface over which the machine travels and the character, condition, and heft of the crop.

The parts held in suspension by the coiled springs are necessarily somewhat heavy, and being so evenly balanced by the adjustable tension of the springs that they rise or fall at a slight touch it becomes necessary to provide a means for limiting their downward movement, as otherwise the floating section would be pulled down in lifting heavy hay till the gathering-fingers would strike the ground unnecessarily, and in rough ground, as will be understood, every unusual "jolt" felt on the main frame from the contact of the carrying-wheels with surface obstructions would "whip" the floated section much below its working position, when the gathering-fingers, striking upon the ground, would be sprung back by the force of the descent, and their recoil, with the recoil of the overdrawn float-springs, would toss the floated sections so far above working position that it would instantly whip too low again, and thus go forward by a succession of leaps, missing the hay passed over while above working height. I therefore provide down-stops for limiting the descent of the floating frame, such stops consisting, preferably, of pins or cotters i^7 i^7, seated in any of the several height-adjustment perforations provided in the vertical arms c^2 c^2, the stop-cotters striking upon the top faces of the straps or plates i^6 i^6, secured to the side bars of the machine, and having slots or openings through which the vertical arms of the frame pass, the projecting cotters thus forming a dead-stop to adjustably determine the extent of downward movement of the frame and cylinders.

The pick-up teeth t' of the gathering-cylinder are formed of stout spring-wire and are further elastically connected to their supporting-bars t in the manner illustrated in Fig. 20, where it will be noted that the bars are formed in longitudinal sections 4 5, with the teeth coiled around them at their inner ends and having the extremities of the coils clamped between the sections. The ends of these bars are secured by bolts 411 to disk-like heads t^2, having fins or webs 6, to which the sections are secured by the bolts passing through them. The heads t^2 are provided with gudgeons t^3, that are journaled in bearings in the heads of the gathering-cylinder, annular seats t^4 being preferably provided on the inner sides of the cylinder-heads to further support and protect the disk-like heads of the tooth-bars.

In order to secure free action of the pick-

up teeth t', I arrange their coils eccentrically to their supporting-bars, as best illustrated in Fig. 20. It will be understood from the drawings that the working pressure upon the finger is exerted in the direction to close the coils upon the bars which they encompass rather than to open them and that to prevent the coils from being locked upon the bar and the finger made rigid too soon the interior diameter of the coils must be somewhat greater than the diameter of the cylindrical bar. Excess of looseness of the coils upon the bar is objectionable, as it permits the coils to pivot upon the clamped end, swinging the finger too far toward the right or left. To meet these conditions, the coils are set eccentrically forward, collecting all the looseness at the front side of the bar, the rear side of the coils touching to prevent the pivoting action upon the bar. The advantage of this arrangement of the parts is seen in the fact that the working strain on the finger tends at first to press the coils toward the front side of the bar and away from the rear side and that a given looseness so disposed will give the free end of the finger the greatest range of action before locking the coils. In order to effect the rocking action of the teeth, the gudgeon t^3 of each tooth-bar t has a projecting square end u, that is provided with a short crank-arm v. The cylinder-head p has a hub q, having a squared opening, so as to fit the shaft b^8 of the cylinder and be rotated thereby. Sleeved upon the circular periphery of this hub and secured against rotation by teeth s' interlocking with the adjacent end of the shaft-guard l, as best illustrated in Fig. 11, is a disk r, that is eccentric to the shaft of the cylinder, as shown in Fig. 12, and has an annular flange r' around its edge, the point of greatest eccentricity of the disk being in the vertical plane of the shaft b^8. An annular plate or ring x is loosely journaled upon the flange r' of this eccentric disk, and the crank-arms v of the tooth-bars t are pivotally connected to pins x' on this ring by links w, as illustrated in Figs. 7 and 12, and around the edge of the ring are laterally-projecting lugs y and z, between which the links pass, these lugs being suitably spaced apart, so as not to interfere with the swinging or pivoting movement of the links. It will be understood that only one of the cylinder-heads (that one at the left-hand side of the machine) is provided with these operating devices for the tooth-bars. This head is rotated in the direction indicated by the arrow in Fig. 12. In order to prevent the links w and the arms v from passing the center, and thereby preventing the return movement of the teeth, each of the crank-arms v is provided with a lug 2, which is intended to engage a pin 1 on the cylinder-head and limit the movement of the crank-arm in case excessive wear on the pivots should have the same effect as the shortening of the link, thereby permitting the swinging ends of the link and arm to approach too near the line connecting the two fixed pivots involved.

That one of the cylinder-heads p which carries the above-described tooth-operating mechanism is provided with a periphery flange p', and the tooth-operating devices are concealed and protected by means of a circular plate 30, which fits inside the flange p' and is bolted to the head p at convenient points, as p^2. Both the head p and the head at the opposite end of the cylinder are secured from shifting their positions upon the shaft b^8 by means of clamps p^3 p^3, which are bolted against the inner faces of the heads and clamp-bolted upon the shaft, as illustrated in Fig. 13.

From the foregoing description of parts involved and from the clear illustration in Fig. 12 it will be well understood that the mechanical principle employed in this finger-rocking action is applied by arranging the finger-bars upon an outer circular orbit of rotation, while arranging the link-controlling pins x' upon an orbit of rotation within and eccentric to the outer one. By this arrangement each bar t and the corresponding pin x' travel their respective orbits in unison, but necessarily in constantly-varying distances from each other.

The eccentric r is set with its greatest eccentricity below and in the vertical plane of the shaft of the cylinder, thus causing the finger-bar and the pin x' to approach nearest each other when passing nearest the ground, drawing gradually apart during the forward upward half of their simultaneous rotation and again gradually approaching each other during their rearward and downward travel.

The definitely-controlled variation of distances between these parts operates through the links and crank-arms connecting them to pull the outer ends of the crank-arms inwardly during the upward movement, thus rocking the finger-bars backward in their free seats until at the top line of the cylinder the fingers have been delayed or rocked back from their vertical radial position at the ground-line to a horizontal tangential position at the upper line, the links operating during the downward travel to push the outer ends of the crank-arms outwardly, thus rocking the fingers forward and accelerating the travel of their outer ends, so that at the ground-line they are again in radial position and so that as applied to the working positions of the fingers they are presented vertically to the hay on the ground when in the plane of the axis of the cylinder and are gradually rocked backwardly as they rise until they reach the point where the hay is taken by the elevating-cylinder, when after they have withdrawn from the hay they are again gradually rocked forwardly until they reach the ground-line. It will also be understood that the same rocking action can be obtained without the intervention of the annular plate x and the link-pins x' by pivot-

ing the inner end of the links directly upon the eccentric r, the objection to such construction being that each link would necessarily occupy a separate plane upon the flange r' of the eccentric, making the rocker-action section very deep and cumbersome and requiring a separate pattern-form for each link.

In the preferred construction shown the introduction of the link-plate x, having the several link-pins x', provides for the duplicating of the links and for mounting them in a single shallow plane. This plate being loosely sleeved upon the non-rotating eccentric requires to be positively driven to insure its uniform travel with the cylinder-head and to compel each link-pin x' to maintain a moving position substantially upon a direct line between the axis of its corresponding finger-bar and the center of the eccentric, as is necessary to obtain the finger control as designed. Without such driving means the link-ring would trail behind as far as permitted by the combined length of the link and crank-arm, the delaying of the ring operating destructively to draw the pivot-point connecting the link and arm onto the dead-center between their opposite ends and also drawing the fingers into false and non-operative angles.

By projecting the lugs y and z rigidly from the face of the ring into the plane of the links a simple and positive means is provided both to prevent the ring from delaying, as compared with the rotation of the cylinder, and from traveling momentarily ahead of the cylinder, as it might otherwise do from some accidental cause.

The constant advancing and retreating of the link-pins and the finger-bar centers toward and from each other, taken with the elbow-like connection between the link and arm, result in a pendulum movement of the outer end of the links in the plane of their travel, the edgewise-swinging movement being once forward and back in each rotation and requiring the considerable space between the lugs shown in Fig. 12.

The degree of control of the ring depends entirely upon the relative placing of the lugs, it being practicable to so place them with reference to the link-movement that while no locking action can develop the ring is driven and restrained with such accuracy that it is substantially without separate individul movement.

The rotating power of the shaft b^8 passing consecutively through the cylinder-heads, the finger-bars, and the crank-arms v imparts positive motion to the outer ends of the links through their pivot connection with the crank-arms. At a point within the upward travel of each link around the eccentric the link engages the corresponding lug z and is locked upon the link-plate in the driving direction, imparting to the plate positive movement of the other rocking parts mounted in the cylinder-head. By means of the "timed" arrangement of the links and lugs at the instant a link enters the driving-arc and engages its corresponding lug the link next in advance being at the end of the driving travel begins gradually to fall behind its companion lug z, until within the downward travel it has so far delayed as to become engaged upon its rear edge by its companion "holdback-lug" y, the link thus also serving to restrain the plate from excessive forward movement while passing through the "holdback-arc," and at the end of which the link begins gradually to swing forward away from the holdback-lug, overtaking and engaging the driving-lug in entering the driving-arc.

Excepting at the driving and holdback points in their travel the links are not in engagement with either series of lugs, though by means of the endless succession of the links in turn relieving each other at both the driving and restraining points a positive even rotation of the link-plate is provided, thereby securing a definite and constant rocking control of the gathering-fingers.

As the hay is picked up from the ground by the teeth of the gathering-cylinder it is carried to the upper side of the cylinder, where it is taken by the teeth l' of the elevating-cylinder, which revolves forwardly at the lower side, and carried still farther upward over the cylinder and backward and deposited on the cross-carrier. The elevating teeth are clamped at their inner ends between the longitudinal sections of tooth-heads l^2 and are operated as the cylinder revolves, so as to be projected through holes in the side boards g^2, as best illustrated in Figs. 3 and 6, the point of greatest projection of teeth being preferably at the forward side of the cylinder, where they lift the hay vertically away from the gathering-cylinder, and the teeth are operated so as to be gradually withdrawn within the cylinder as they rise until they reach the rear side, where the hay is taken by an endless carrier which strips it from the elevating-cylinder and its teeth and transfers it onto the cross-carrier. In order to obtain this movement, I provide the through-shaft g^4 of the elevating-cylinder with a crank portion g^{40}, extending from one end of the cylinder to the other between the heads g' g', as best illustrated in Figs. 6 and 17, which crank portion is thereby made eccentric to the axis of the cylinder constituting the axis around which the elevating-teeth are carried as the cylinder rotates. The tooth-heads l^2 are pivoted or hinged upon this crank portion of the shaft g^4 by means of the clamp-like hinges l^3. (Shown in detail in Fig. 18.) These hinges consist of duplicate parts which clamp the sections of the tooth-heads between them and have eyes at their inner ends which loosely encircle the shaft g^4, the sections of the hinge being fastened together by bolts l^4, which also pass through the sections of the tooth-heads, thereby securing the sections together and clamping the hinge around the shaft.

As already described, the cylinder-heads g' rotate upon the hubs g^6 of the bracket-castings g^5, and in order to secure the shaft g^4 against rotation I form notches p^8 in the inner ends of the hubs g^6, through which the radial parts p^9 of the shaft g^4 pass. The shaft is thereby held firmly against rotation, while the cylinder-heads are permitted to revolve freely.

In order to retain the hay upon the elevating and gathering cylinders, I provide a guard or retainer 12, composed of vertical slats that are secured at their upper ends to the cross-bar 13, having trunnions 14, by means of which it is pivoted to the upper ends of the supporting-arms 15, these arms in turn being pivoted at their lower ends to the inner sides of the supplemental sills b^2 b^2 of the wheel-mount at the point 16. The lower ends of the slats of this guard 12 are provided with metallic strips 17, which pass forwardly and are secured at their front ends to a bar or yoke which extends crosswise between the side bars of the machine just under the axle, and for the purpose of limiting the movement of the slats toward the cylinders the end straps are continued upwardly from the cross-bar 18 around the axle b' and fastened to the opposite side of the end slats, as clearly shown in Figs. 1 and 3. This guard or retainer has an additional function of slightly compressing the hay upon the cylinders, and by means of the strap connection just described with the axle the slats are allowed to swing toward and from the cylinders around their upper end pivots as may be required. The retainer and compressor is also permitted to yield as a whole by reason of the pivotal connection of the side bars 15 at their lower ends, and the amount of movement of these side bars is determined and the upper ends of the bars themselves supported by means of stop-rods 20, which are connected at their lower ends to the upper rear corners of the floating frame, which carries the elevating and gathering cylinders. This connection is preferably made by hooking the lower ends of the rods into the eyes 21 on the spiders g^5, and the upper ends of the rods are bent inwardly, as illustrated in the drawings, and passed loosely through the eyes into trunnions 14 of the head-bar 13 of the guard-retainer, thereby permitting the upper ends of the bars 15 to swing toward and from the elevating-cylinder. The upper ends of the stop-rods 20 20 are provided with a series of perforations 22, in any one of which cotters 23 are secured for the purpose of adjustably limiting the movement of the upper end of the guard with respect to the elevating-cylinder.

The stripper and transfer carrier for the elevating-cylinder is denoted at 24. It consists of chains 25, traveling around the cylinder-heads on the flanges 26 and also around the roller 27, which is journaled in the rear ends of side arms c^3, which are secured to the spiders g^5 and project over the cross-carrier, as illustrated in many of the figures. To the chains 25 are secured cross-slats 28, and these slats are spaced apart on the chain, so as to fit into notches 29, that are formed in the flanges of the heads g' of the elevating-cylinder, this arrangement also serving to space the slats apart, so that they come between the side boards g^2 of the cylinder and more effectually prevent the entrance of hay between these bars. The slats 28 are thus supported at their opposite ends by the cylinder-heads, and interiorly of the cylinder, midway between its ends, I secure to the inner sides of the side boards the skeleton middle braces 31. (Illustrated in detail in Fig. 19.) These braces are half-rings, and when their ends are lapped, as shown in Fig. 3, they present octagonal faces, upon which are secured the side boards g^2, and thus these boards are not only supported and the whole cylinder strengthened, but an additional support is provided for the slats 28 of the stripping-carrier. The cross-carrier consists of endless chains 32, passing around driving-sprockets 33 on the right-hand side and flanged pulleys on the left-hand side, these sprockets and pulleys being journaled in brackets near the rear ends of the side bars a a of the main frame of the machine. These chains are connected together by cross-slats 34, and the carrier is driven by means of a shaft 35, which has an angular end in cross-section, as shown in Fig. 16^a, and fits into the open end of a socket-coupling 36, mounted on the shaft extending through the sprocket-wheels at the right-hand end of the cross-carrier. This shaft 35 is driven from the wheel e' on the right-hand end of the main axle b' through the intermediacy of bevel pinions 37 and 38, that are loosely sleeved upon a counter-shaft 39, which is journaled in brackets 40, projecting from the right-hand side bar of the machine, said shaft extending diametrically across the face of the bevel-wheel e', so that the pinions are continually operating in reverse directions. Secured upon this squared counter-shaft by means of a square central opening, so as to permit it to slide thereon and rotate therewith, is a clutch 41, which is controlled by a pivoted hand-lever 42, which extends upwardly within convenient reach of the driver while in his seat. The shaft 39 has upon its rear end an open-ended socket 43, which is shaped like the socket 36, mounted against the hub of the wheel 33 of the carrier, and these sockets are hollowed interiorly, as best illustrated in Figs. 16 and 16^a, so as to have a flaring mouth 44 and an enlarged rear end 45, the bore of the sockets at the intermediate points being choked or contracted, as at 46, so as to fit rather snugly onto the squared ends of the shaft 35, this arrangement permitting the free and easy driving of the cross-

carrier from the counter-shaft, notwithstanding the latter is in a lower plane than the sprocket 33 of the cross-carrier.

The pinions 37 and 38 being loosely sleeved on the counter-shaft, do not drive it until locked thereto by the clutch 41, and as these pinions rotate in opposite directions it will be understood that when the lever 42 is operated to ship the clutch into engagement with one of the pinions the cross-carrier will be operated in one direction and when shipped to engage the other pinion the carrier will be operated in the reverse direction; also, that when the clutch is located in the intermediate position, disengaged from both the pinions, the counter-shaft will not be driven at all and the cross-carrier will remain stationary. Such being the method and means of driving this cross-carrier, it will be understood that the machine may be controlled by the driver without leaving his seat, so as to deliver the hay from the carrier in continuous windrows on either side of the machine, or that by intermittently connecting and disconnecting either of the pinions with the counter-shaft he may interrupt the operation of the carrier, so as to accumulate the hay thereon and drop it in bunches at the right or left hand side of the machine.

In the constructions illustrated in all the figures of the drawings except the fifteenth the elevating-cylinder is so connected with the floating frame carrying the gathering-cylinder that as the latter rises it is also lifted, and the stripping-carrier and its roller 27 being rigidly connected with the elevating-cylinder boards also rises and increases the distance between the upper surface of the cross-carrier and the stripper-roller. It is desirable, however, that the stripper-roller should preserve as nearly as possible a uniform distance from the cross-carrier, and under some conditions of operation the elevation of this roller above the carrier might result in the hay being carried off the front edge of the carrier by the under ply of the stripper and dropped on the ground between the side sills of the machine.

In Fig. 15 I illustrate a modified arrangement of the floating frame which carries the elevating and gathering cylinders, whereby the vertical relation between the elevating-cylinder, its stripping-carrier, and the cross-carrier is not materially disturbed by the rising and falling movements of the gathering-cylinder. This is effected by dispensing with the diagonal upper side bars c' c' of the floating frame and supporting the elevating-cylinder by vertical arms 50, that are pivotally connected at their lower ends to the side bars of the machine-frame and are also pivotally connected with the shaft g^4 of the elevating-cylinders at their upper ends. The rear ends of the bars $c^\times$ $c^\times$, which in this form correspond with the bars c c of the frame illustrated in Fig. 2, are connected to the shaft g^4 of the elevating-cylinder by means of pivotal links or bars 51 51, which are loosely sleeved on the projecting ends of the shafts of the two cylinders. In this arrangement the rear ends of the springs i are connected to the sleeves at the lower ends of the links or bars 51 or other convenient point near the axis of the gathering-cylinder in order that they may have a more direct upward lift than in the other construction. The movements of the parts when thus modified are clearly illustrated in dotted lines in Fig. 15 and are as follows: When the floating-frame arms $c^\times$ $c^\times$ rise, instead of carrying upward with them the elevating-cylinder the latter is moved rearwardly, being prevented from rising by the pivotal side arms 50, which convert the rising-and-falling movement of the side arms $c^\times$ $c^\times$ into a horizontally-swinging movement of the elevating-cylinder, thereby preserving a constant relation between the cross-carrier and the overhanging roller of the stripping-carrier. This movement is due to the pivotal connection between the arms $c^\times$, 51, and 50, which for convenience I have termed a "flying pivot arrangement," from the fact that the pivots or axes of the two cylinders although connected together so as to be always the same distance apart are, nevertheless so arranged that when the gathering-cylinder moves vertically the elevating-cylinder moves horizontally.

It will be understood that the elevating-cylinder is of considerably greater length than the gathering-cylinder, the ends of the former projecting over the side sills of the machine-frame, while the heads of the latter are located some distance inside of these sills. This relative length of the cylinders is important not only structurally, but because it enables a better separation of the hay that is picked up by the gathering-cylinder from that which remains on the ground.

The location of the sills relatively to the positions of the cylinder ends is also important and gives the sills a distinct function in the process of separating the hay. They limit the width of the web of hay which can be lifted by the gathering-cylinder and guard the overhanging ends of the elevating-cylinder in such manner that the hay in elevating cannot spread beyond the cylinder length and become entangled in the floating frame at the cylinder ends, but must all land directly upon the fingered section of the elevating-cylinder, thereby insuring its prompt elevation and control. The sills also act as guards for the ends of the gathering-cylinder. It will be understood that in separating a web of hay from that remaining on the dividing side, especially in a heavy yield, the hay at the side being interlocked with that taken up inclines to follow and collect increasingly immediately outside the drum end at a point where the gathering-fingers cannot reach and control it, and unless this inclination is overcome by a proper relative position of the machine parts the following hay will finally

mass sufficiently to clog the machine. If the sills and other side limits were removed, such an excess of hay would follow the web taken up as to cover and wrap on all the end parts, while if they were set close against the gathering-cylinder end the tendency to clog would be fatally increased, since there would be no interval of space nor time in which the separating action could take place and the end fingers having to beat fruitlessly against the under side of a mass of trailing hay held down by the falsely-located sills. By so shortening the gathering-cylinder relatively to the entire width between the sills as to leave twelve inches or more between the end gathering-fingers and the inner sill-faces all the hay directly engaged by the gathering-fingers can freely rise to be taken hold of by the elevating-fingers, for the reason that instead of being held down by a close-set sill a considerable portion of the hay which lifts beyond the raking-line has also room to rise with the web proper in reach of the end elevating-fingers which overhang the dividing-space between the gathering-cylinder ends and the inner faces of the sills. Thus part of the interlocked and following hay goes over the elevating-cylinder as part of the web, the remainder, having been detained by the sills and the trunnions of the gathering-cylinder, dropping to the ground when the web edge is pulled away from it by the power of the overhanging ends of the elevating-cylinder.

Although I have illustrated and described herein many details of construction, I do not desire to be understood as limiting the claims to these specific features, except where expressly so specified in the claims themselves, it being obvious that the individual parts of the machine admit of considerable variation within the skill of the mechanic without departing from the real spirit and scope of the invention.

Having thus described my invention, what I claim is—

1. In a machine for gathering hay, the combination of a cross-carrier, mechanism for gathering the hay from the ground and delivering it to the carrier, mechanism for driving the carrier including a means for reversing the direction thereof, and means within reach of the driver in his seat, whereby the reversing means may be operated at will without stopping the machine to cause the carrier to deliver the hay on the ground in a continuous stream at either side of the machine without changing the position of the carrier on the machine.

2. In a machine for gathering hay, the combination of a cross-carrier, mechanism for gathering the hay from the ground and delivering it to the carrier, gearing for driving the carrier including a clutch, and a lever extending within reach of the driver in his seat, whereby the clutch may be operated at will without stopping the machine to cause the carrier to deliver the hay on the ground in a continuous stream, or to deposit it in bunches at intervals without changing the position of the carrier on the machine.

3. In a machine for gathering hay, the combination of a cross-carrier at the rear of the machine, a gathering-cylinder in front of the cross-carrier revolving forward at the ground-line, and an elevating-cylinder located above the gathering-cylinder, said elevating-cylinder revolving in the same relative direction as the gathering-cylinder, and operating to take the hay from the latter and carry it up and over itself backward to the cross-carrier.

4. In a machine for gathering hay, the combination of a cross-carrier at the rear of the machine, a gathering-cylinder in front of the cross-carrier and revolving forward at the ground-line, an elevating-cylinder located above the gathering-cylinder, and revolving in the same relative direction, and a rear delivery-carrier for stripping the hay from the elevating-cylinder, said carrier overhanging the front edge of the cross-carrier.

5. In a machine for gathering hay, the combination of a cross-carrier, a gathering-cylinder rotating forward at the ground-line, an elevating-cylinder revolving in the same relative direction and taking the hay from the gathering-cylinder, a guard in front of and extending above said cylinders, and a rear delivery-carrier projecting from the elevating-cylinder over the cross-carrier.

6. In a machine for gathering hay, the combination of a cross-carrier, a gathering-cylinder rotating forwardly at the ground-line, an elevating-cylinder revolving in the same relative direction and taking the hay from the gathering-cylinder, a guard in front of and extending above said cylinders, and a rear delivery-carrier projecting from the elevating-cylinder over the cross-carrier, said gathering and elevating cylinders and rear delivery-carrier having a constant relation to each other, and being mounted in an elastically-supported frame.

7. In a machine for gathering hay, the combination of a gathering-cylinder rotating forward at the ground-line, an elevating-cylinder located above and revolving in the same relative direction as the gathering-cylinder, and a guard in front of and extending above said cylinder, said guard being adapted to yield at its upper or lower end.

8. In a machine for gathering hay, the combination of a gathering-cylinder rotating forward at the ground-line, an elevating-cylinder located above and revolving in the same relative direction as the gathering-cylinder, and a guard in front of and extending above said cylinders, either end of said guard being adapted to yield independently of the other, and both ends being adapted to yield simultaneously.

9. In a machine for gathering hay, the combination of a gathering-cylinder rotating forward at the ground-line, an elevating-cylinder located above and revolving in the same rela-

tive direction, and taking the hay from the gathering-cylinder, and a guard in front of and extending above said cylinders, said guard consisting of slats pivoted at their upper ends to arms that are pivoted at their lower ends, whereby the guard is adapted to yield at either or both ends to accommodate the hay on cylinders.

10. In a machine for gathering hay, the combination of a gathering-cylinder rotating forward at the ground-line, an elevating-cylinder located above and revolving in the same relative direction, and taking the hay from the gathering-cylinder, and a guard in front of and extending above said cylinder, said guard consisting of slats pivoted at their upper ends to arms that are pivoted at their lower ends, the rearward movement of the slats being limited by strap-loops engaging the axle, and the rearward movement of the pivoted arms being limited by stop-rods connected to the elevating-cylinder.

11. In a machine for gathering hay, the combination of an elastically-suspended floating frame, a gathering-cylinder, carried by said frame, an elevating-cylinder also carried by said frame above the gathering-cylinder, and a guard in front of said cylinders, said guard being pivoted at its lower end and connected at its upper free end by means of stop-rods extending down to the floating frame so as to keep it at a predetermined distance from the elevating-cylinders.

12. In a machine for gathering hay, the combination of an elastically-suspended rotating cylinder, resilient gathering-fingers carried by the cylinder, and a stop to limit the downward movement of the cylinder.

13. In a machine for gathering hay, the combination of a trailing frame pivotally connected at its forward end to the machine, and elastically suspended at its opposite end, a cylinder rotating forwardly at the ground-line mounted in said frame, resilient gathering-fingers carried by the cylinder, and a stop to limit the downward movement of the cylinder-carrying end of the frame.

14. In a machine for gathering hay, the combination of an elastically-suspended, pivoted, trailing frame, a gathering-cylinder mounted in said frame and rotating forwardly at the ground-line, and resilient pick-up fingers carried by the cylinder.

15. In a machine for gathering hay, the combination of an elastically-suspended floating frame, a rotating cylinder mounted in said frame, resilient gathering-fingers carried by the cylinder, and means for positively rocking said fingers.

16. In a machine for gathering hay, the combination of a rectangular frame carrying the operative parts of the machine, and mounted on wheels at its front end, a triangular supplemental frame connected to the main frame at a point intermediate of its ends and projecting rearward beyond the same, a caster-wheel mounted at the apex of the triangular frame, and tie-rods connecting the inclined bars of the triangular frame with opposite ends of the rear cross-bar of the main frame.

17. In a machine for gathering hay, the combination of a rectangular frame carrying the operative parts of the machine, and mounted on wheels at its front ends, a triangular supplemental frame connected to the main frame at a point intermediate of its ends and projecting rearward beyond the same, a caster-wheel mounted at the apex of the triangular frame, and tie-rods connecting the inclined bars of the triangular frame with opposite ends of the rear cross-bar of the main frame and with each other.

18. In a machine for gathering hay, a rotating cylinder comprising heads at opposite ends, a fixed crank-shaft projecting through the heads and having finger-carrying heads pivoted to its cranked portion, slats secured to the cylinder-heads at intervals around the cylinder periphery through which slats said fingers project, and skeleton braces secured to the inner sides of the slats at suitable distances apart along their length to prevent them from binding or engaging.

19. In a machine for gathering hay, a rotating cylinder comprising heads at opposite ends, side brackets carrying hollow journals projecting inwardly through and beyond the heads, slats secured to the heads at intervals around their periphery, and a cranked shaft extending through the cylinder having finger-carrying heads pivoted to its cranked portion, the fingers of which heads project through the slats, the outer concentric ends of the shaft projecting outwardly through the hollow journals beyond the cylinder-heads, and the inner ends of the journals being notched to lock the cranked shaft by engaging its radial sections.

20. In a machine for gathering hay, a rotating cylinder comprising heads at opposite ends, a frame in which the cylinder is mounted, said frame comprising side bars provided with brackets carrying hollow journals upon which the heads revolve, a fixed shaft extending through the cylinder and hollow journals and projecting beyond the side brackets, and cutters in the end of the shaft, whereby the side brackets and the side bars of the frame are prevented from spreading away from the cylinder-heads.

21. In a machine for gathering hay, the combination of a gathering-cylinder inclosed within the side bars of the machine with an intervening space between its ends and said bars, an elevating-cylinder located above the side bars and the gathering-cylinder and exceeding the latter in length, and a driving-chain extending from a sprocket-wheel on the gathering-cylinder shaft to a sprocket-wheel on the elevating-cylinder outside the side bars.

22. In a machine for gathering hay, the combination of a revolving cylinder, a stationary shaft within the cylinder having a portion eccentric to the axis of the cylinder, and finger-

carrying heads consisting of parallel strips having fingers clamped between them, hinged to the shaft, said hinges consisting of clips encircling the shaft at one end and belted together through the finger-carrying strips at the other.

23. In a machine for gathering hay, the combination of a revolving cylinder having finger-carrying bars, and resilient fingers carried by said bars, the fingers being rigidly secured at their inner ends only to the bars, and provided with unsupported coils surrounding the bars the latter being eccentric to the circle of the coils.

24. In a machine for gathering hay, the combination of an elastically-suspended gathering-cylinder, and resilient pick-up fingers carried by the cylinder.

25. In a machine for gathering hay, the combination of a gathering-cylinder revolving forward at the ground-line and provided with teeth projecting in such proximity to the ground as to pick up the hay therefrom without the intervention of raking or gathering teeth, and an elevating-cylinder located above the gathering-cylinder, said elevating-cylinder revolving in the same relative direction as the gathering-cylinder and operating to take the hay from the latter and carry it up and over itself backward.

26. In a machine for gathering hay, the combination of a gathering-cylinder revolving forward at the ground-line, an elevating-cylinder located above the gathering-cylinder and revolving in the same relative direction, side sills between which and the ends of the gathering-cylinder there is an intervening space, and the elevating-cylinder having its ends extended to span said intervening space.

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

MARSHALL BECK.

Witnesses:
JAMES BARCLAY,
WILSON P. HUNT.