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J. S. DAVIS.

HARVESTER.

No. 272,377.

Patented Feb. 13, 1883.

Fig. 1.

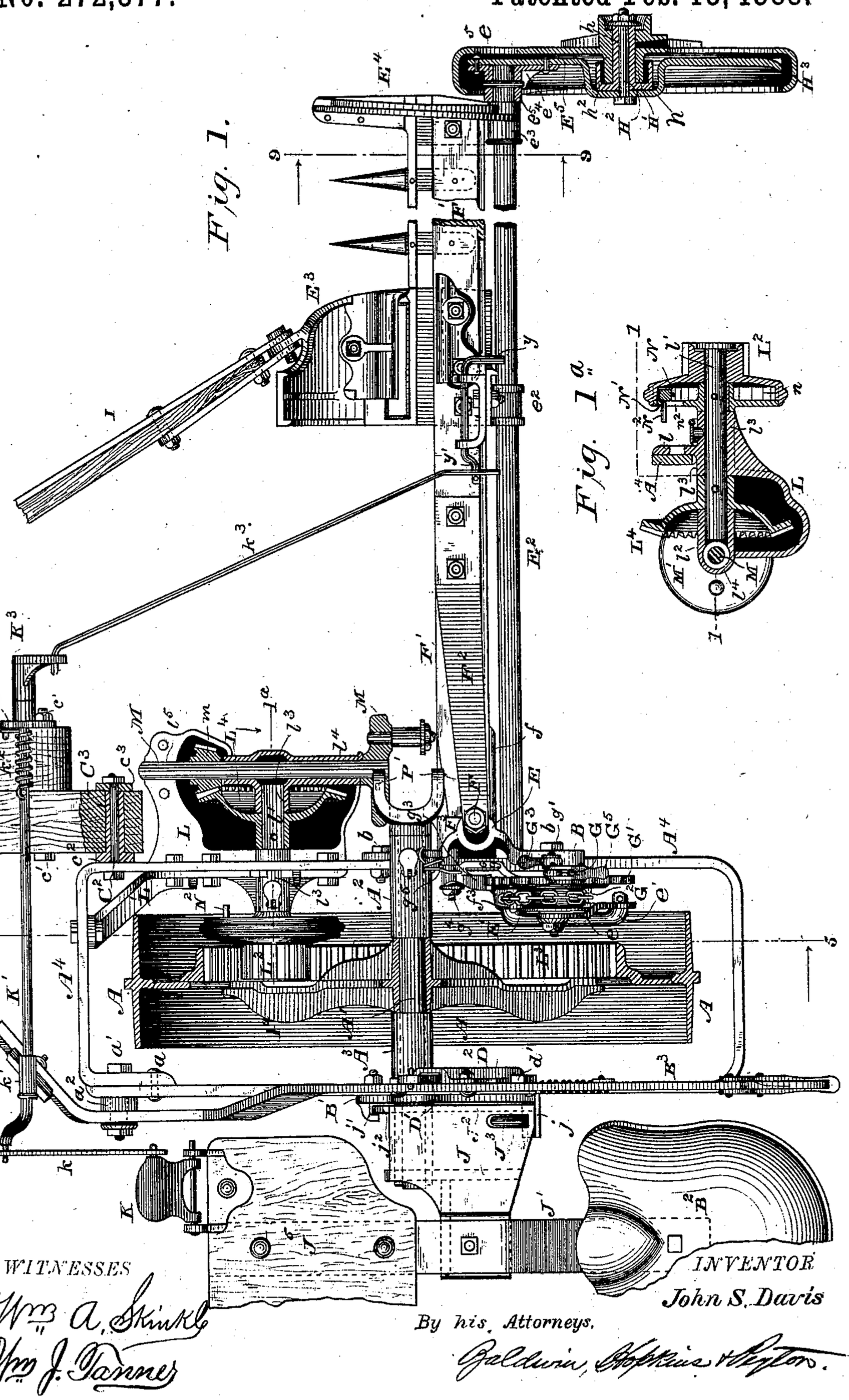

Fig. 1a.

WITNESSES

Wm A. Skinkle

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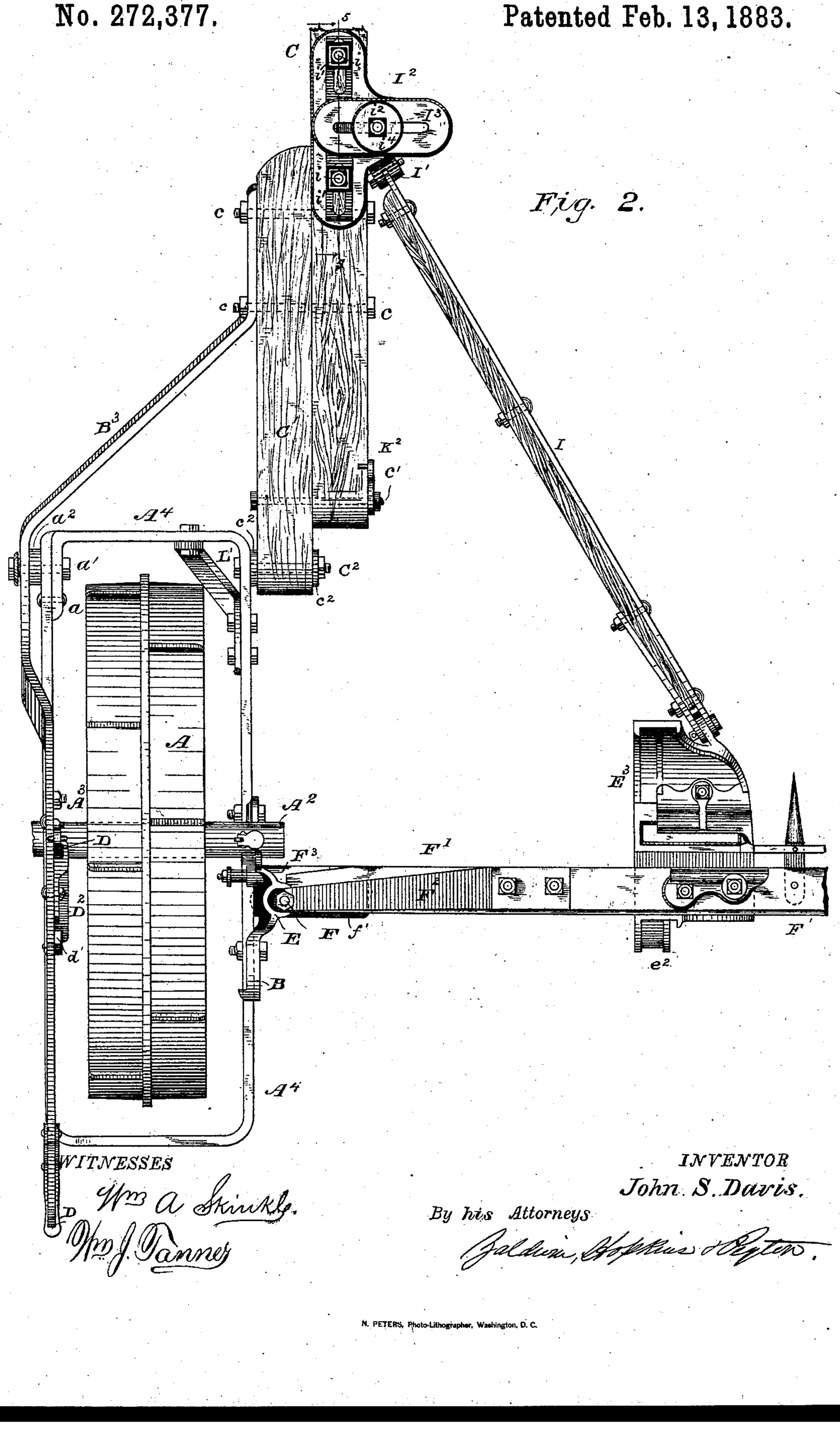

Fig. 2.

WITNESSES

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Fig. 25

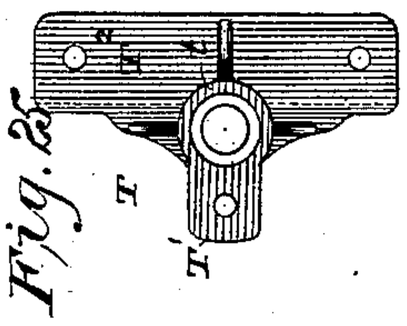

Fig. 26

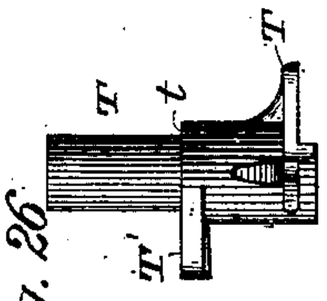

Fig. 27

Fig. 24

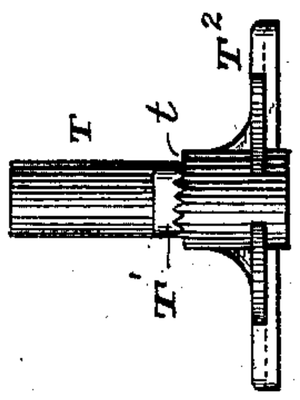

Fig. 23.

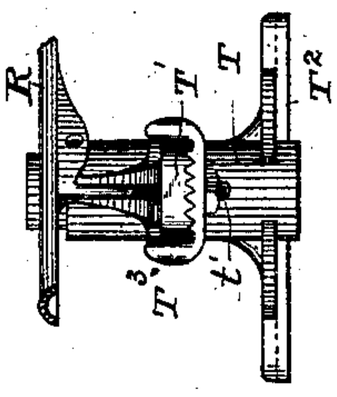

Fig. 3

Fig. 28.

WITNESSES

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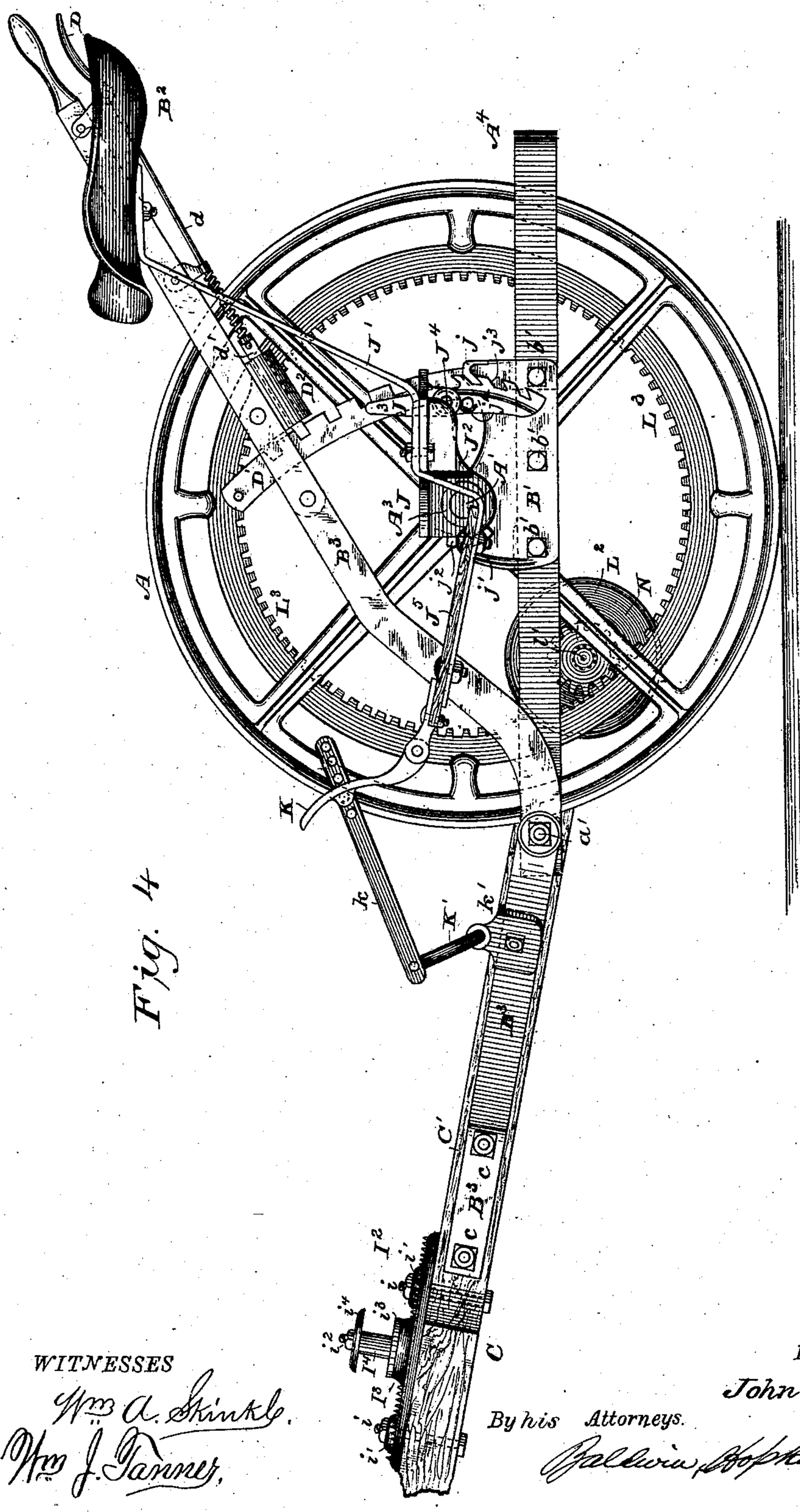

Fig. 4

WITNESSES

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No. 272,377.

Patented Feb. 13, 1883.

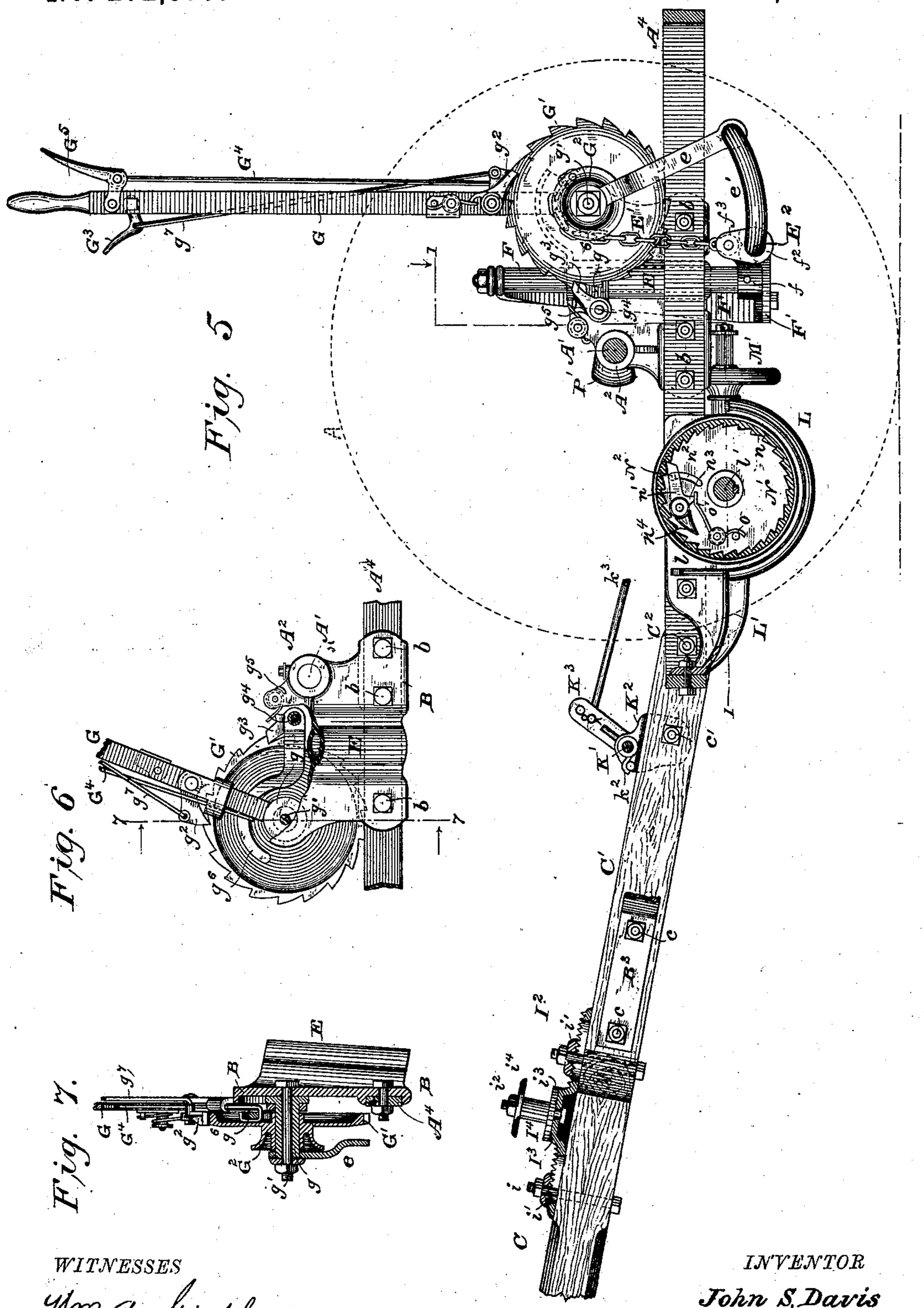

Fig. 5

Fig. 6

Fig. 7.

WITNESSES

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Fig. 8.

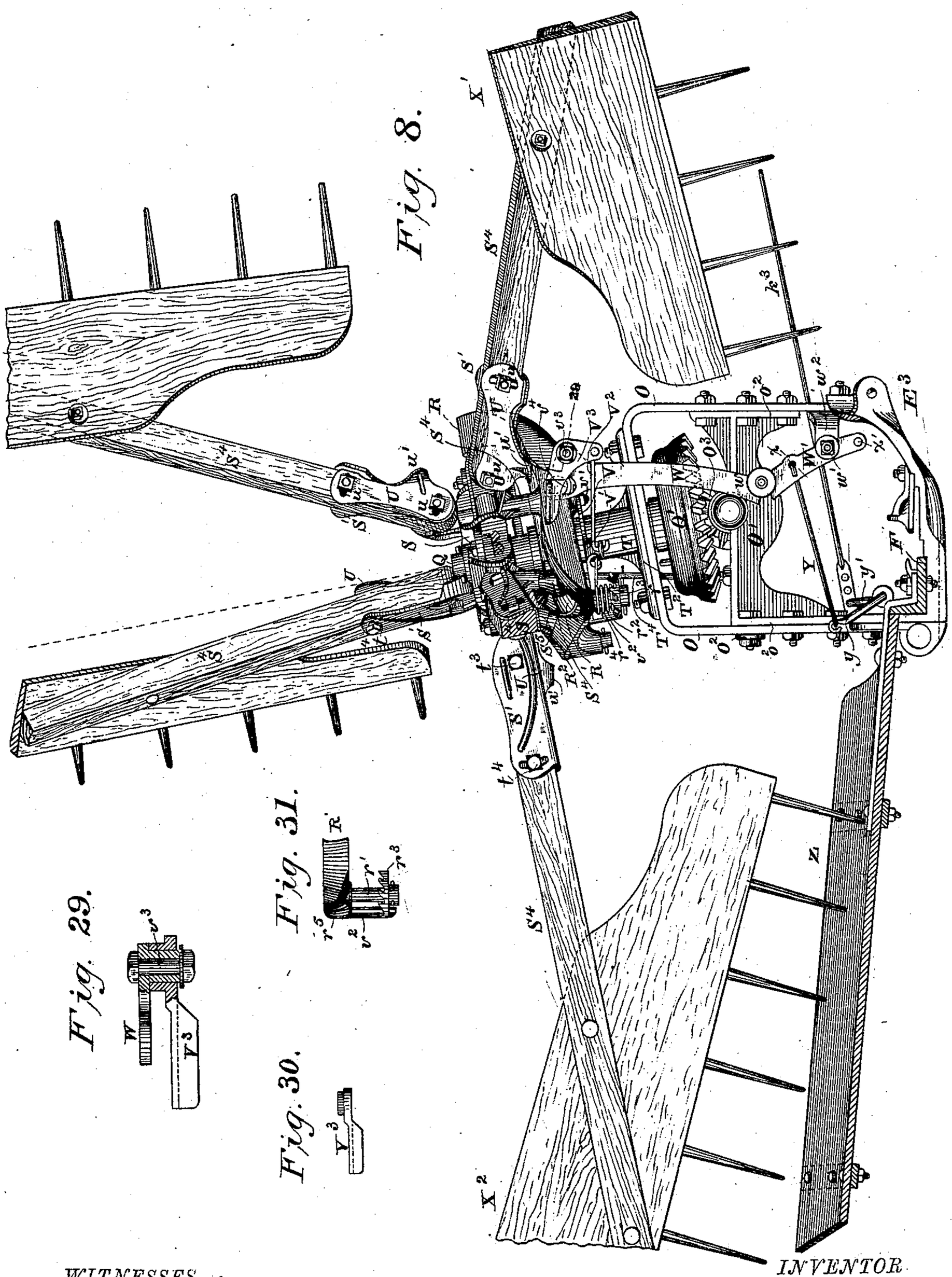

Fig. 29.

Fig. 31.

Fig. 30.

WITNESSES

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HARVESTER.

No. 272,377. Patented Feb. 13, 1883.

Fig. 9.

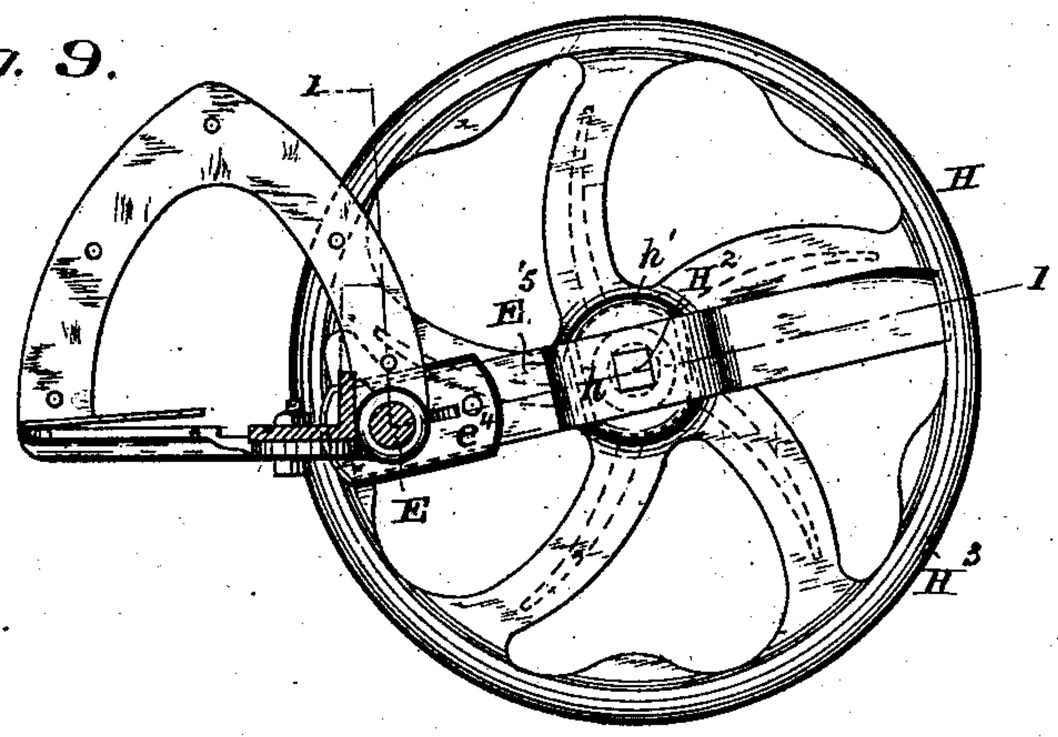


Fig. 10.

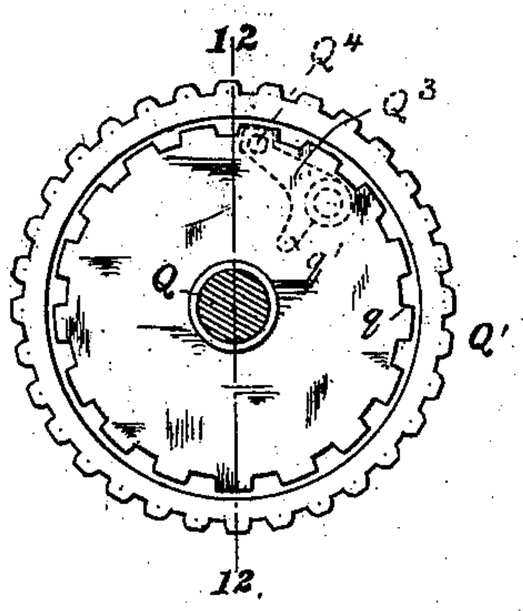


Fig. 11.

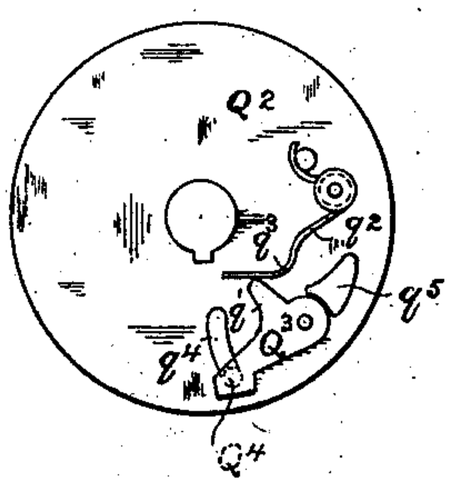


Fig. 12.

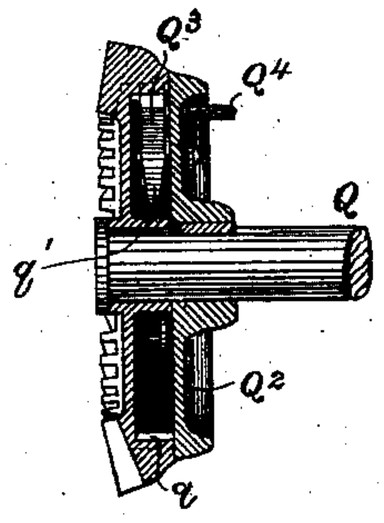


Fig. 13.

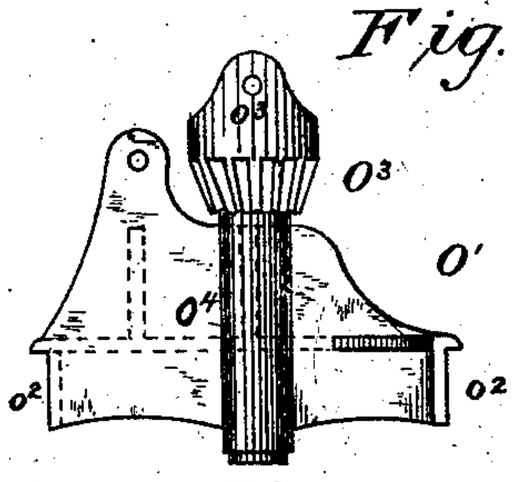
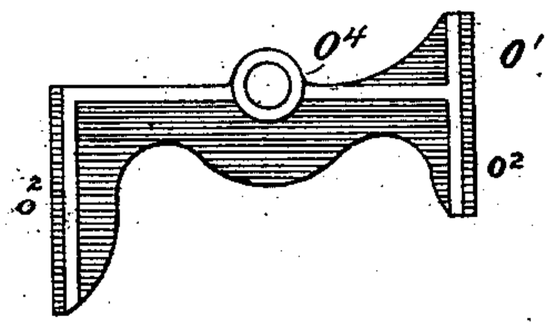


Fig. 14.



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No. 272,377. Patented Feb. 13, 1883.

Fig. 15.

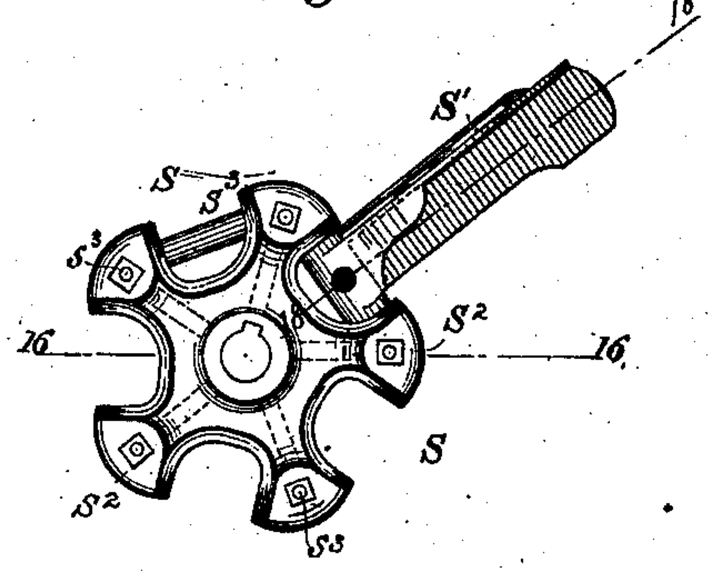


Fig. 16.

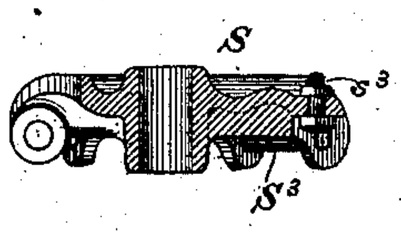


Fig. 17.

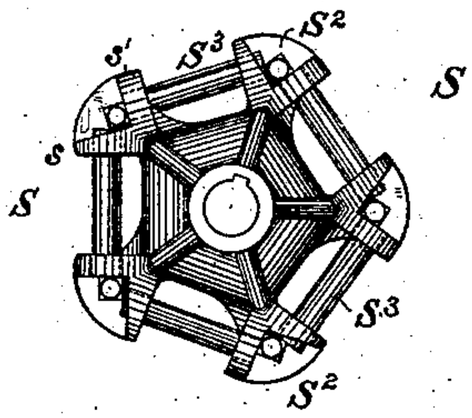


Fig. 18.

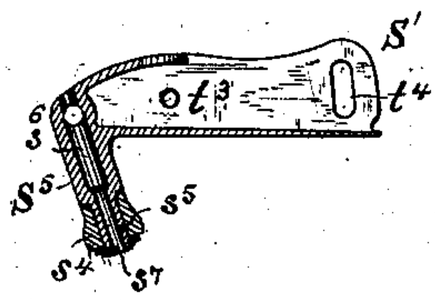


Fig. 19.

Fig. 20.

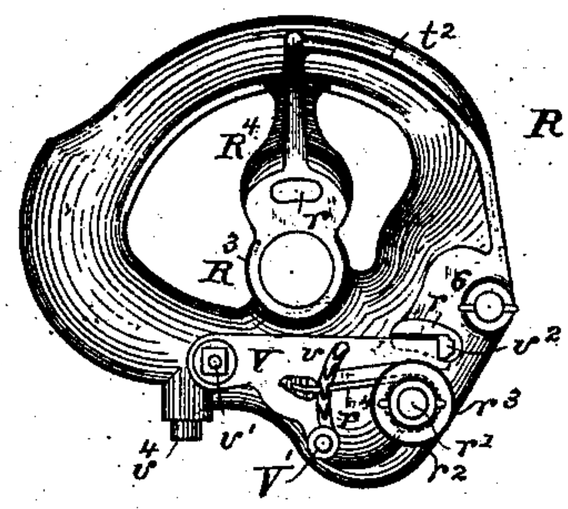


Fig. 21.

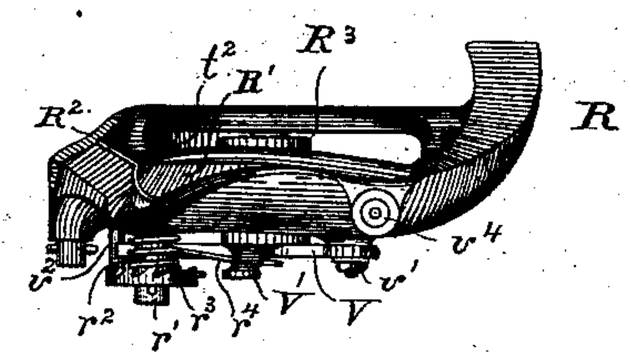
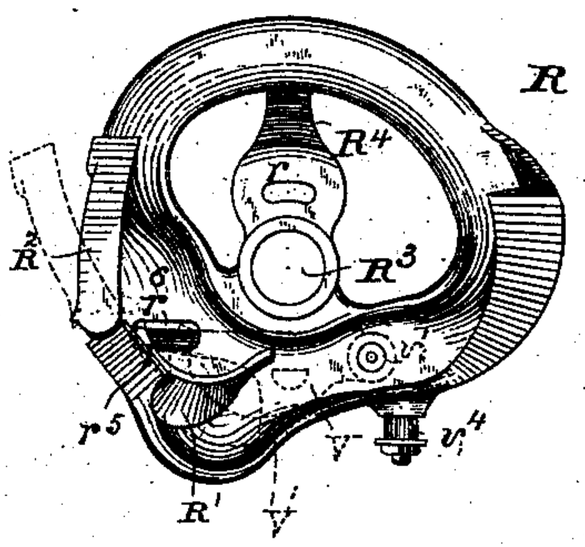


Fig. 22



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UNITED STATES PATENT OFFICE.

JOHN S. DAVIS, OF TOLEDO, ASSIGNOR TO THE TOLEDO MOWER AND REAPER COMPANY, OF LUCAS COUNTY, OHIO.

HARVESTER.

SPECIFICATION forming part of Letters Patent No. 272,377, dated February 13, 1883.

Application filed June 29, 1882. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. DAVIS, of Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Harvesters, of which the following is a specification.

My invention relates to improvements in harvesters, applicable chiefly to machines of the class which are provided with continuously-rotating rising and falling combined rakes and reels of the type in which the rake-heads are adapted to be caused to pass over the platforms clear of the cut grain thereon while accumulating to form gavels, and to sweep off the grain in gavels.

My improvements, as will hereinafter be distinctly claimed, pertain to certain novel features of construction and combinations of devices involving mechanism for supporting the rakes, means for attaching the rakes, and rake tripping and controlling devices.

The accompanying drawings represent a suitable application of my improvements to a one-wheeled hinged-tongue machine. Such old features of a fully-organized machine as are neither illustrated by the annexed drawings nor in detail described herein may be of any desired and proper construction to complete the machine in all respects, and some of my improvements may be used without the others and in machines differing in some respects from that shown by the drawings and particularly described.

Figure 1 is a view partly in plan and partly in section on the lines 1 1 of Figs. 5 and 9, the rake, platform, and some other features being omitted and parts broken away. Fig. 1^a is a view partly in front elevation and partly in section on the line 1^a 1^a of Fig. 1, showing the cutter-driving gearing and the gear block or support and casing for the gearing. Fig. 2 is a plan or top view, showing the drive-wheel, main frame, portions of the tongue and finger-beam, and the tilting-lever, most of the remaining features of the machine being omitted. Fig. 3 is a rear elevation, parts being broken away and some features omitted. Fig. 4 is a side elevation, omitting parts inside the drive-wheel and inside and in rear of the tongue. Fig. 5 is a view partly in elevation and partly in section on lines 5 5 of Figs. 1 and 2, the driving-wheel being shown by dotted lines, and many features inside thereof omitted. Fig. 6 is a side elevation, with parts broken away, showing a casting which serves as one of the main frame-boxes for the axle, as well as a means for connecting the finger-beam and main frame and for mounting and sustaining the raising and lowering devices, which are partly represented. Fig. 7 is a view partly in rear elevation and partly in section on the line 7 7 of Fig. 6. Fig. 8 is a view in elevation as seen from the inside—the grain-wheel side of the machine—with parts in section and other parts broken away, showing the raking mechanism, most of the remaining features of the machine being omitted. Fig. 9 is a view partly in elevation and partly in section on the line 9 9 of Fig. 1, showing the grain-wheel and its connections. Fig. 10 is a plan or top view of the doubly-toothed rake-driving gear-wheel with its pawl-carrier or dog-plate removed. Fig. 11 is a view of the dog-plate removed, showing its inner face or under side, which comes next the internal or ratchet teeth of the rake-driving gear-wheel. Fig. 12 is a sectional view on the line 12 12 of Fig. 10, the dog-plate being represented as secured in position upon the rake-shaft in proper relation to the rake-driving gear-wheel mounted loosely thereon. Fig. 13 is a plan or top view showing the tumbling-shaft pinion for actuating the gear on the rake-shaft, and the casting in which said pinion is mounted and by which it is supported on the rake-stand. Fig. 14 is an end view of the casting for supporting the pinion of the tumbling-shaft. Fig. 15 is a plan or top view of the rotating rake-carrier or rake-shaft head, to which the short rake-carrying arms are hinged, one of such carrying-arms being shown in place and the pivot-rod of another in position. Fig. 16 is a section on the line 16 16 of Fig. 15. Fig. 17 is a bottom view of the rotary rake-carrier, the pivots of the rake-carrying arms being shown as in place and secured. Fig. 18 is a section on the line 18 18 of Fig. 15, showing one of the short rake-carrying arms and its shouldered and inclined roller-carrying pipe-projection or hollow stud; and Fig. 19, a view of a rivet for use in secur-

ing the roller upon its stud in event of its separation therefrom. Fig. 20 is a bottom view of the rake-controlling cam; Fig. 21 a side view, and Fig. 22 a top view, thereof. Fig. 23 is a side elevation viewed from the direction of the drive-wheel, showing the devices for mounting the cam upon the rake-stand, the cam being secured to a pipe-box adapted to be fitted loosely about the rake-shaft and to be bolted to the rake-stand. A portion only of the cam is shown. Fig. 24, a similar elevation of the cam-securing pipe-box detached; Fig. 25 a plan or top view, and Fig. 26 a rear elevation, thereof. Fig. 27 is a plan view of a clip-washer used in adjusting and locking the cam upon its pipe-box support. Fig. 28 is a view of one of the cross-shaped double knuckles of the rake-driving tumbling-shaft. Fig. 29 is a view partly in plan and partly in section on the line 29 of Fig. 8, showing details of the rake-controlling or switch-tripping mechanism; Fig. 30, a top view of the trigger of the tripping mechanism detached, and Fig. 31 a view of the tripper-actuated switch or cam-gate detached.

A driving and main supporting wheel, A, is keyed fast to the main axle A′, which is loosely mounted near its ends in boxes A^2 A^3, secured to a main frame, A^4, which is thus suspended from the axle. The main frame encompasses the driving-wheel and is substantially rectangular in shape. As shown, it is made of a single flat piece of wrought-iron formed into shape, the ends of the bar being brought together and lapped at the outer front corner of the frame, and secured by a rivet, *a*, and a bolt, *a′*.

The respective main-frame boxes A^2 A^3 for the axle are formed with castings B and B′, respectively. The casting B is attached to the frame by bolts *b*, and the casting B′ secured in place by bolts *b′*.

A seat, B^2, for the driver is mounted outside the drive-wheel.

A tongue, C, has hinged connection at its heel with the main frame, for a well-known purpose. Instead of being directly jointed to the inner front corner of the main frame, the tongue is shown as rigidly connected to a heel-piece or tongue-stump, C′, by bolts *c c c′*, and this heel-piece is pivoted to the main frame by means of a bolt, C^2, which passes through the main-frame bar and through a headed sleeve or thimble, C^3, fitted in the tongue-stump. By means of a washer, c^3, bearing against the end of the thimble opposite that which has the head c^2, injurious binding of the parts is prevented, as will fully appear from inspection of Fig. 1, and the frame is adapted to be vibrated about the tongue as rocked about the axle to tilt the finger-beam, &c.

A lever, B^3, serves to tilt or vibrate the main frame about the tongue, and also as a bracing-connection between the tongue in advance of its pivot and the main frame. This combined tilting-lever and tongue-brace is pivoted to the outer front corner of the frame by the before-mentioned bolt *a′*, which passes through a thimble or sleeve fitted loosely in the pivot-hole of the lever, and having the head a^2 between the frame and lever. The lever B^3 extends diagonally forward from its pivotal connection with the frame to the tongue-stump C′, to which it is secured by the bolts *c c*, thus forming a strong brace, and the rearward and upward extension of the lever from its pivot locates the lever-handle within convenient reach of the driver when in the seat B^2. The lever and tongue pivots are located directly in line with each other, for an obvious purpose.

Suitable detent devices for holding the lever B^3 in its adjusted position are provided, and, as shown, consist of an ordinary spring-actuated slide-rod, *d*, jointed at one end to the crank-handle D, pivoted on the lever, and actuating the plug or slide *d′*, which engages with one or other of the spaces between the teeth of the curved bar D′, which is bolted to the main frame at its lower end. The slide *d′* works in a guide-socket formed with a casting D^2, bolted to the lever B^3, and constituting a guideway for the detent-rack D′.

The casting B, with which the main frame-box A^2 for the axle is made, is also formed with a sleeve, E, constituting a guide and support for a nearly upright post, F, on the heel of the finger-beam F′.

The post F is rigidly attached to the finger-beam, and is slightly inclined away from the main frame from its bottom upward. The sleeve E is inclined to correspond with the inclination of the slightly-overhanging post.

The finger-beam heel-post is supported by the diagonal brace F^2, and is secured in place by being fitted in and fastened to a short tube or socket, *f*, in a socket-iron or heel-casting, F^3, securely bolted to the finger-beam, and having a vertical flange, *f′*, against which the rear edge of the beam bears.

The heel-casting F^3, in addition to serving as a means of attaching the post F to the finger-beam, also serves for connecting a lifting-chain, E′, and a grain-wheel-supporting rod, E^2, with the heel of the finger-beam, the casting being formed with a rearwardly-extended perforated portion or bearing-arm, f^2, through which the rod E^2 passes, and with two lugs, f^3 f^3, for the attachment of the chain by passing a pin through them and through a link of the chain.

A lever, G, and a ratchet-wheel, G′, and a grooved pulley or sheave, G^2, are mounted to turn about a support shown as formed by a flanged thimble, *g*, a headed bolt, *g′*, and its nut and washer. The support for the ratchet and the sheave formed therewith, and for the rocking lifting-lever, is secured, as clearly shown, to the casting B in rear of the axle-box A^2 and tubular guide for the finger-beam post. A link, *e*, is also pivoted at one end to swing about the thimble *g*. This link is jointed at its opposite or lower end to a crank-arm, *e′*, at the inner end of the rod E^2.

A pawl, g^2, acted upon by a spring to hold it normally engaged with the ratchet, is mounted upon the lifting-lever and controlled by a trip-handle, G^3, and rod g^7, in well-known way. Another pawl, g^3, is mounted upon a thimble secured to the casting B by a bolt, g^4, and its nut and washer, in manner such as already described in connection with other parts. A spring, g^5, acts upon this pawl with a tendency to force it toward the ratchet when not in contact therewith, and to hold it in its normal position of engagement with the ratchet-teeth. A controller or trip-arm, g^6, serves to connect this pawl with the rod G^4 and trip-handle G^5 of the lifting-lever. The arm g^6 extends from the pivot g^4 of the pawl crosswise of and close to the face of the ratchet-plate G′ opposite that from which the sheave projects, and is curved to pass around the ratchet-hub concentrically with the axis of rotation of the ratchet and with the pivot of the lever, and projects between the lever and ratchet. The lower end of the rod G^4 is looped or otherwise suitably formed to loosely engage the pawl-controlling arm g^6, so that when the lifting-lever is being moved in one direction to raise the finger-beam, &c., by winding the chain E′ about the sheave G^2, to which it is attached, the pawl g^3 is not disturbed by the movement of the lever and ratchet further than to slip over the ratchet-teeth against the force of its spring g^5, and during the rocking of the lever the trip-rod loop slides along the controller-arm of the pawl. When it is desired to reverse the movement of the lever and ratchet to unwind the chain from the sheave G^2 to lower the finger-beam, the pawl g^3 is rocked to withdraw it from the ratchet by actuating the trip-handle G^5, and after the desired amount of oscillation is given the ratchet by the lever and pawl g^2 the trip-handle is released and the detent-pawl g^3 holds the parts as adjusted.

The cranked rod E^2, in addition to being supported in the casting F^3 at the finger-beam heel, so as to be capable of rolling or turning therein as the finger-beam is raised and lowered, is also journaled at the rear of the finger-beam in tubular lug-bearings e^2 e^3, provided at the heels of the inner and outer shoes, E^3 E^4, respectively.

It will be seen that as the finger-beam is raised and lowered the end of the crank e', which is jointed to the link e, is maintained practically at an unvarying altitude, the very slight swing of the link toward or away from the finger-beam as it rises or falls making but a trifling difference in the height of the crank end relatively to the main frame.

The grain-wheel H is journaled in a supporting-arm, E^5, rigidly attached to the rod E^2, and so as to revolve about an axis in line with the link end of the crank e', or at a distance in rear of the rod substantially corresponding with the length of the crank e'.

It will be seen that the altitude of the grain-wheel axis relatively to that of the link end of the crank-arm never changes in the adjustments of the finger-beam, and cramping of parts is thus prevented. The full torsional strength of the rod E^2 is availed of in maintaining the parts against injury by strains.

The grain-wheel-supporting arm E^5 is rigidly attached to the outer end of the rod E^2 by means of a socket-casting consisting of a plate portion, e^4, bolted or riveted to the arm, and a sleeve-socket, e^5, fitting upon the rod and keyed fast thereto. This grain-wheel arm is formed with the central inward bend or bulge, h, thus providing a hub seat or recess for the attachment of the grain-wheel hub H′.

The grain-wheel is secured to its arm by a headed thimble, h', through which, as well as through the arm, passes a bolt, H^2. A washer, bearing against the end of the thimble, and a nut serve to hold the parts in place. The head of the thimble h' is formed with an overhanging annular flange, h^2, between which and the tube or body portion of the thimble is provided a cavity, into which the hub of the grain-wheel projects. The recessed head of the thimble thus serves to protect the joint at the inner end of the hub from dirt, &c. By recessing the outer end of the grain-wheel hub H′ and using the washer therein on the bolt H^2, protection is afforded against the passage of dirt to the bearing from the outer end of the hub.

The grain-wheel is dish-shaped, being provided with the inwardly-projecting flanged tread H^3, and has curved spokes outside the supporting-arm E^5. The rear end of this arm terminates close to the tread and near the spokes, and is slightly curved vertically, so as to give it somewhat the shape of the mold-board of a plow. It is also made sharp at its lower edge. The arm thus serves to clear the wheel of dirt or clogging matter and keep it clean. Lumps of sod or pieces of turf, which are liable to be carried up by the wheel, are severed by a draw cut when brought against the end of the arm E^5 by the action therewith of the spokes of the wheel, and the fragments discharged in part outside between the spokes of the wheel and partly inside at its open face.

The finger-beam, &c., are connected with the tongue C by a diagonal brace or draw-bar, I, pin jointed at its rear end to a lug at the front of the shoe E^3, and pivoted at its front end to a downwardly-projecting slotted lug, I′, of a casting, I^2, serving as a means not only for adjustably connecting the brace to the tongue, but also for attaching and adjusting a double-tree. This casting is attached to the tongue, so as to be adjustable lengthwise thereof by means of bolts i i, passing through the tongue and through slots made in and extending longitudinally of the casting, and nuts bearing on serrated washers i' i', engaging with corresponding serrations at the sides of the slots, to secure the parts together in well-known way. The finger-beam may readily be secured at the proper angle to the main frame by adjusting the combined double-tree and brace-

casting. The double-tree is to be attached by means of the bolt i^2, adjustable in the transverse slot of the raised portion I^3 of the casting, and having the thimble I^4, with its head or flange i^3, and the washer i^4 and nut. The head of the bolt i^2 projects into the space above the tongue provided by the recess under the raised transversely-extending portion of the casting. The draft may, by the means just described, be quickly adjusted as desired, for an obvious purpose.

A seat-support for the attachment of a seat standard or spring is detachably and adjustably secured upon the outer main-frame box, A^3, and casting B′, with which said box is formed. The plate portion of this casting B′, at its top rear corner, is formed with a hooked side lug or lateral projection, having a stop-lug, j, and with a flanged side lug or ribbed lip, j', at its top front corner to form a guideway, for a purpose presently to be explained. The seat-support J is formed of a casting mounted so that it may be rocked vertically on the box A^3 of the casting B′, and be secured by suitable devices, such as presently to be described, in any desired position to adjust and hold the seat B^2, the spring-standard J′ of which is bolted to the support J. As shown, the seat-support J has two downwardly-projecting ribs, J^2 J^2, by bearing-openings, in which the support is fitted upon that portion of the box A^3 which projects outside of the main frame. A short projection or lug, j^2, on the support at the front end of its inner bearing-rib, J^2, fits in the guideway j' and prevents accidental displacement of the support by movement endwise of the box A^3, while allowing of the free rocking movement of the support in adjusting it. A swinging detent-arm is formed with a series of curved teeth, j^3, and correspondingly-shaped intervening spaces for engagement by the stop-lug j. This detent is provided with a lever projection or handle, J^3, and is mounted upon a pivot-pin, J^4, supported in the ribs J^2 J^2. The detent-lever passes up through a slot in the support. A spring, j^4, acts upon the detent with a tendency to hold it engaged with the stop-lug j, or else to move it toward said lug when moved away from it by operating the lever J^3. The teeth of the detent are curved concentrically with the pivot J^4. By so curving the teeth j^3 and using a sufficiently-strong spring, j^4, the seat-support is held against accidental upward movement as well as against downward movement at its rear end.

In adjusting the seat-support to its position upon the axle-box and its casting the support, after being partially slipped into place on the axle-box, is elevated at its rear end to depress its guide-lip j^2 beneath the guideway j', so that it may be slipped home. The elevation of the front end of the support, by rocking on the axle-box, next brings the lip into the guideway.

The spring-standard J′ of the seat is bent and extends forward of the support J, as clearly shown in Fig. 4, and has a foot-board, J^5, bolted to it in advance of the axle-box A^3. A treadle, K, is mounted upon the foot-board. This treadle is adjustably jointed to a link, k, connecting with the cranked end of a rock-shaft, K′. By properly adjusting the pivotal connection of the treadle with the link by securing the treadle pivot-pin in the desired one of the holes in the link, that part of the treadle against which the toe or ball of the driver's foot bears may be located nearer to or farther from the seat B^2 to suit the convenience of the driver, and variations in the relative positions of the treadle or foot-board and the link or rock-shaft arising from adjustments of the seat-support may be compensated by adjusting the treadle-connection with the link. The rock-shaft K′ is mounted near its inner or link-connected end in a bearing, k', secured to the tongue-bracing portion of the tilting-lever B^3, and at or near its opposite end the rock-shaft is supported in a bracket-bearing, K^2, bolted in place on the tongue C. A crank-arm, K^3, is sleeved upon the rock-shaft and fixed thereon by a key or otherwise. A spring, k^2, acts upon the rock-shaft, so as to hold it in its normal position and return it to such position after its actuation by the treadle. A link, k^3, jointed to the crank K^3 and its connecting mechanism, farther on to be described, serve to actuate rake-controlling devices.

A hollow gear block or support and partial casing, L, for the cutter-actuating gearing is attached to the main frame A^4 in advance of the axle, and projects from the frame, to which it is bolted securely by its vertical flange l. A diagonal arm, L′, of the gear-block L serves, as clearly shown, not only to strengthen the attachment of the gear-block to the frame, but to brace the inner front corner of the frame where it is subjected to great strain by the attachment of the tongue.

The shaft l', upon which is loosely secured the pinion L^2, actuated by the internal gear, L^3, of the drive-wheel, is mounted in the gear-block bearings l^2 l^3. The bevel-gear L^4 is fastened on this shaft l' by a detachable cross-pin. This gear is dished for an obvious purpose.

The cutter-actuating crank-shaft M is mounted for the greater portion of its length in a pipe box or long bearing, l^4, in the gear-block, and is also supported at its front end in a bearing, l^5, formed partly in said block and partly in a detachable cap, which is not shown. A bevel-pinion, m, on the crank-shaft is driven by the bevel-gear L^4, and the cutters are actuated by a pitman connected with the wrist-pin of the wheel M′ on the crank-shaft, as well understood.

The drive-wheel-actuated pinion L^2 is formed with a circular plate, N, having a peripheral flange provided with internal ratchet-teeth, n. The pinion and its circumferentially-flanged ratchet-toothed plate are cast in one piece, the pinion being loosely mounted on the shaft l',

as already explained. A hubbed plate or disk wheel, N′, is keyed fast to the shaft l' inside of the pinion, the hub of this plate extending from the pinion to the bearing l^3 to prevent displacement of the parts. The plate N′ is keyed in place before the shaft l' is slid into position. It carries a spring-pawl, n', which is pivoted to rock within the toothed flange of the ratchet-plate. An abutment, n^4, against which the pawl bears, relieves the pawl-pivot from strain. The pawl-plate is made circular, and of a diameter such as to fit within a shouldered recess in the flanged ratchet-plate, as clearly shown in Fig. 1ª. In this way the pawl-and-ratchet mechanism is completely protected. The pawl-carrying plate is provided with a curved slot, n^2, as shown in Fig. 5. A pin, N^2, on the pawl, near its nose, projects laterally therefrom and passes through the slot. (See Fig. 1.) A lug, n^3, projects inwardly from the pawl very slightly in advance of the pivot by which the pawl is mounted on the pawl-carrier N′. A spring, o, suitably mounted on the pawl-carrier, bears against the pawl-lug n^3, and is formed with the bend or curve o' near its free end. The action of the spring normally is to hold the pawl-nose engaged with the ratchet, the spring bearing near its free end and beyond its shoulder or angle formed by the bend upon the pawl-lug. The pinion L^2 is thus clutched with its shaft and the cutter-driving gearing is operated while the machine is at work and advancing. In backing the machine the pawl "clicks" or slips out from the ratchet-teeth, the spring o yielding, and the rocking movement of the pawl being insufficient to cause the lug n^3 to bear against or be presented to the spring inside of its angle or shoulder. When by moving the pawl by means of the pin N^2, so as to rock its nose inward until the lug n^3 has been caused to pass over the angle or curve o', and the spring thus caused to bear inside of its bent end upon the lug, the spring acts to hold the pawl out of engagement with the ratchet. The nose of the pawl is thus held out of the ratchet-teeth or in the position assumed when rocked inward to the extent of the movement allowed by the pin and slot, and the machine may be set in motion without driving the gearing, as the pinion L^2 revolves without rotating its shaft when thus unconnected therewith by the clutch mechanism.

I do not herein claim any of the above-described features by themselves, or otherwise than in connection with raking mechanism, or as specified or implied elements in combinations of devices relating to means for supporting, or driving, or regulating the action of rakes, the novel features of the mechanism so far described being elsewhere claimed by me.

A rake-stand, O O′, secured upon the shoe E^3, is braced by a rod, O^2, which is connected at its opposite ends with the stand and with the top of the finger-beam post F. The rake-stand proper or part, O, is best made of wrought-iron and in yoke shape, and, as shown in Figs. 3 and 8, is secured at its base to the shoe E^3 by bolts connecting the lower ends of the yoke-arms with lugs at the front and heel ends of the shoe. The part O′ of the rake-stand consists of an angular bridge-casting crossing the space between the front and rear arms of the yoke and bolted at its ends o^2 o^2 to the inner surfaces of the yoke-arms. A bevel-pinion, O^3, connected with a tumbling-shaft, P, is mounted in this bridge-casting and drives a bevel-gear on the rake-shaft, as explained further on. The pinion O^3 is mounted by its shaft in a long box or pipe bearing, O^4, in the bridge-casting of the rake-stand.

The tumbling-shaft P, by which motion is communicated to the rake from the main axle A′, is connected with the axle by the doubly-lugged or bifurcated casting P′, which is fitted upon and fastened to the axle in suitable way. A similarly-formed casting, P^2, secured fast to the shaft proper, P, is universally jointed to the casting P′ by means of a doubly-armed or cross-shaped knuckle, p. (Shown in detail in Fig. 28.) The arms of this knuckle are tubular, and are respectively jointed to the castings P′ and P^2 by headed pivots passing through perforations in the casting-lugs and through the knuckles, and secured by cross-pins against displacement, as clearly shown in Fig. 3. The shaft P and its cross-pin fit and work in the sleeve P^3 and its longitudinal slot (or slots) p' to provide for variations in the length of the tumbling-shaft, as usual, and this sleeve is universally jointed by its doubly-lugged or bifurcated end p^2 with lugs o^3 o^3, cast with the pinion O^3. A double knuckle and its pivot-pins p^3 p^3 serve to connect the lugs of the pinion with the lugs of the shaft-sleeve in the same manner that the lugged castings of the axle and shaft are connected, as above described. The double knuckles are each formed in one piece, preferably by casting, and the two arms are arranged so that one crosses at the side of the other instead of their longitudinal axes intersecting at their middles. In this way the openings for the pivots do not cross each other and a very strong joint is secured.

A rotary rake-shaft, Q, is actuated by the tumbling-shaft pinion O^3 and a gear, Q′, driven thereby and connected with the rake-shaft by clutch mechanism, by which the rake-shaft is automatically thrown out of operation and the action of the rake stopped when the machine is backed, and by which the rake-shaft may be disconnected from its driving-gearing, so as not to rotate when the machine is advancing when not at work or in being moved from place to place.

The clutch-connection between the rotary rake-shaft and its bevel-gear Q′ is in all respects the same as or substantially similar to that hereinbefore described in connection with the gearing for actuating the cutters. As clearly shown by Figs. 10, 11, and 12, the bevel-gear Q′ is doubly toothed, the internal or

ratchet-teeth q being on the upper side of the gear—the side opposite that on which are located the bevel-teeth for meshing with the pinion O^3. A pawl-carrying plate, Q^2, is keyed fast to the rake-shaft, and fits snugly, but without creating friction, against the gear Q'. The pawl Q^3 is pivoted at its heel to the plate Q^2, and is provided with the lateral lug q', extending inwardly or toward the shaft Q, and this lug is borne upon by a spring, q^2, bent or curved so as to form the shoulder or angle q^3. When that portion of the spring outside of the shoulder bears upon the pawl-lug, the pawl-nose is engaged with the ratchet-teeth, as shown, and is allowed to "click" or slip along the teeth as the machine backs by the yield of the free end of the spring. A pin, Q^4, projecting laterally from the pawl-nose through the slot q^4 in the disk or ratchet-carrier Q^2, enables an attendant to swing the pawl-nose inward by rocking the pawl on its pivot against the force of the spring, and when the lug q' is presented to the spring inside of its shoulder, or nearer its support than said shoulder, the spring holds the pawl in its inoperative position, and the machine may be moved forward without rotating the rake-shaft, as the tumbling-shaft continues to revolve with the axle and actuate the pinion O^3 and gear Q'. The pawl is sustained against thrusts and its pivot relieved of strain by the projection q^5 on the pawl-plate at the heel of the pawl. This projection constitutes an abutment, against the curved surface of which the correspondingly-curved heel of the pawl bears. The clutch, *per se*, is not herein claimed, being elsewhere claimed by me.

A rake-controlling cam, R, is adjustably and detachably secured above the rake-stand and in fixed relation to the rake-shaft, as presently to be described, and above the cam is secured a rotating rake-carrier or rake-shaft head, S. This carrier is secured in place by a key or otherwise, so as to turn with the rake-shaft Q, and has pivoted to it a series of short rake-carrying arms, S′, five such arms for a similar number of rakes being in this instance employed. The rotary rake-carrier S is formed, as plainly shown in Figs. 15, 16, and 17, with five doubly-lugged radiating ears or webs, S^2. One, s, of the pair of lugs $s\ s'$ of each ear S^2 is beveled or gradually reduced in thickness on its inner surface from its inner end outward, being thinnest at its outer end. The other lug, s', is of uniform thickness or parallel-sided throughout. These lugs are tangential to the rake-carrier, and connected by the radial ears or webs S^2 throughout their length, and thus are given ample strength. By beveling the inner surface of every alternate lug of the series—one lug of each pair—as shown, the holes in the lugs for pivots S^3 may readily be bored by starting the drill about parallel with the beveled side of one lug of a pair and boring first through the opposite lug of this pair, and then through the beveled lug of an adjacent pair of lugs. The pivot-pins S^3 are inserted parallel with the beveled face of a lug and through the remaining lug of the pair, and then through an adjacent beveled lug. When the pivots are in place the adjacent ends of two of them are dogged by a bolt, s^3, passing through the web. In this way it will be seen that it is only necessary to use securing-bolts in number corresponding with the number of pivots for the short rake-carrying arms. It will also be seen that by the peculiar relation to other parts and formation of the lugs $s\ s'$ the rake-shaft head S may be cast in one piece of smaller diameter and less weight than it would be possible to make it were the lugs all made parallel-sided or of uniform thickness throughout, and the adjacent lugs or pairs of lugs for different pivots consequently placed much farther apart than are the lugs $s\ s'$.

Each of the short rake-carrying arms S′ (see Figs. 15 and 18) is formed in a single piece, and so as to constitute a socket for an arm, S^4, to which a rake-head is attached, as usual, and has a downwardly-projecting slightly-inclined tubular stud or roller-carrying arm, S^5, and the usual pivot-bearing or heel perforation. This one-piece roller-arm is shouldered near its end, and a roller, s^4, fitted upon the reduced round and tubular portion s^5 of the arm, and secured by placing a washer upon the end of the arm outside of the roller, and heading or riveting the projecting end of the arm against or toward the washer to prevent its displacement. In event of displacement of the washer, it or another one can be secured to the end of the roller-arm, to hold the old roller or a new one in place, by the use of a rivet such as shown in Fig. 19, this rivet being headed or struck up at its end after being inserted in place in the bore of the roller-arm from above and held by inserting a tool behind it, with its head bearing against the shoulder at the juncture of the larger or rivet-head-accommodating portion s^6 of the bore with the smaller or rivet-occupied lower portion, s^7, of the bore. It should be noticed that the shoulder S^6 of the roller-arm is curved or rounded, so as to gradually reduce the arm to the desired size at its lower end, instead of abruptly reducing the arm by an angular or square shoulder. The maximum strength is in this way secured for the roller-support and liability of breakage by strain avoided or greatly reduced.

The fixed portion of the track of the cam-plate or casting R is of usual and suitable construction, to give to the rakes the proper rising and falling movements as rotated about their axis, the cam-track traveling-rollers of the short rake-carrying arms bearing upon the cam-track, as is well understood.

The cam-plate is provided with two gates, R′ R^2, as farther on fully described, and has formed with it at the side of its hub R^3, and radiating therefrom, a slotted step-supported portion or bridge-piece, R^4, extending from the

cam-hub to the cam-track. By extending this step-supported portion R^4 from the hub to the track of the cam-casting, so as to constitute a spoke-like connection or bridge between the hub and track, instead of making it merely a radial arm of the hub terminating short of the track, the desired strength is attained. On its under side, and next the cam-hub, the radial portion R^4 is flat and flush with or in the same level as the lower end of the hub. The slot *r* is slightly curved, for a purpose presently to be made apparent.

A pipe-box or tubular bracket, T, serves to detachably support the cam R and the rake-shaft upon the rake-stand O, and also provides for adjustably securing the cam so that it may be fastened in the proper position relatively to the rotating rake-carrier or head of the rake-shaft. This pipe-box T is shown as formed with a shoulder, *t*, about midway its length, reducing the diameter of its upper portion, about which the cam-hub fits, so as to bear upon the shoulder, and with a step or side arm, T′, the upper surface of which is flush with or in the level of the shoulder *t*. A flange, T^2, serves to securely bolt the pipe-box in place upon the rake-stand O. The rake-shaft passes down through the pipe-box, and has the before-described gear and ratchet mechanism mounted upon its lower end in such manner as to prevent accidental upward movement of the shaft. Downward movement of the rake-shaft is prevented by a cross-pin above the rotating rake-carrier, which bears on the upper end of the pipe-box.

The step projection or side arm, T′, of the pipe-box bracket is provided with notches or ratchet-like serrations on its under surface, at its outer end, and the step-supported arm or bridge-piece R^4 of the cam-casting bears on this step-arm, and is secured to hold the cam by means of the slotted serrated and end-lugged clip or washer T^3 and bolt *t′*, as plainly shown in the drawings. The lugs at the ends of the clip-washer are arranged at a distance apart just equal to the width of the bridge-piece R^4 at the point where the lugs embrace it. The operation of these adjusting devices will readily be understood, as obviously when bolt *t′* is loosened the cam-casting may be turned slightly, but to the extent needed about its pipe-box support, and secured by tightening the bolt by its nut, and so drawing down the head of the bolt on the bridge-piece and clamping this piece, the step, and the washer firmly together.

An upright stay-rod, T^4, is secured at its lower end to the pinion-box casting O′ of the rake-stand and at its upper end to the cam-casting by the downwardly-projecting flange t^2 thereof, and thus the parts are firmly braced and connected and possibility of accidental disengagement of the tumbling-shaft pinion and rake-shaft gear is prevented.

It should be noticed that the casting O′ not only serves to brace the rake-stand and as a bearing for the shaft of the pinion actuated by the tumbling-shaft, but that as it is removably secured by bolts to the rake-stand, a ready separation of the parts in event of breakage is provided for to enable repairs to be made without loss of all of the parts. The stay-rod T^4, being detachably secured by its threaded ends and nuts to the rake-cam R and the removable bridge-casting of the rake-stand, admits of the independent removal of the parts with which the opposite ends of the stay-rod connect, with obvious advantage.

At the inner or heel end of each of the rake-head-supporting arms S^4 there is adjustably secured a striker plate or clip, U, (see Fig. 8,) by means of the bolts which pass through the arm S^4, and through the hole t^3 and slot t^4 of the short rake-carrying arm S′. By means of the slots *u u* in the clips, through which pass the bolts for adjustably securing the rake-head-supporting arms, these clips may be adjusted up or down. Each clip has a downwardly-projecting lug or flange, *u′*, upon it, for a purpose presently to be explained.

The lower or leading cam-gate, R′, which is first reached by the rollers s^4 of the rake-arms, is pivoted in place by a stud, *r′*, which passes through the cam-casting and projects beneath it.

A tubular stud or pipe bearing, r^2, on the under side of the cam-casting incloses the cam-switch stud or pivot for a portion of its length. Beneath this stud-bearing the switch-pivot has a toothed disk, r^3, attached fast to it. A spring, r^4, coiled about the tubular stud r^2, acts at one end on the disk r^3 by engagement with its ratchet-like or curved teeth. The opposite end of the spring presses against or engages one of the series of ratchet-like or curved teeth *v* on a vibrating trip or switch dogging and releasing arm, V, secured at its heel by a pivot, *v′*, on the under side of the cam, and acting at its shouldered outer end or nose against a downwardly-projecting stud or shank, v^2, of a heel projection, r^5, of the switch-gate R′. This shank passes down through a slot, r^6, in the cam-casting.

It will be seen that the spring r^4 acts with a tendency to rotate the disk r^3 in a direction such as to move the switch into the position in which it is shown in dotted lines in Fig. 22, (which may be termed the "open position," as when the switch is so adjusted a rake is caused to sweep off a gavel,) and also acts with a tendency to keep the trip and dog V in its dogging position, as shown in Fig. 20, thus normally holding the switch locked against movement of the spring. The tension, and consequently the force with which this spring acts, may readily be regulated as desired by adjusting its ends so as to engage respectively with the proper teeth of the disk r^3 and the vibrating trip V.

A projecting arm or lateral branch, V′, of the trip is provided with an eye, in which is hooked a link or rod, V^2, by connections with

which the switch-tripping mechanism may be actuated by the driver of the machine while in his seat. A pull on this rod, such as to vibrate the nose of the trip toward the switch-pivot so as to release the shank v^2 of switch-heel projection, will obviously result in the opening of the switch, while by releasing the strain on the rod, so as to allow the trip to be rocked by its spring into or about into the position in which it is shown in Fig. 20, the switch will be automatically restored to its locked position by the action of one of the rollers, s^4, against its heel projection r^5, thus vibrating the switch-shank v^2 against the trip and forcing it out of the way until the shank reaches the shoulder end of the trip and assumes its dogged position. The mechanism in this instance shown for connecting the switch-tripping mechanism with the link-rod k^3, controlled by the treadle and the rock-shaft K′ and its spring, is as follows: A bell-crank lever or trip-actuating trigger, V^3, is pivoted at v^3 to a vertically-adjustable support, presently to be described, and is connected by its short downwardly-projecting arm with one end of the link V^2, which at its opposite end is jointed to the side arm of the tripper V. The longer and nearly horizontally-projecting arm of the trigger V^3 is acted upon by the lugs of the rake-arm clips or striker-plates, U, as further on will be made apparent. The adjustable support of the vertically-rocking trigger consists of a pivoted two-part or jointed thrust-rod, W W′, which, at its upper end, is slotted and loosely fitted to a stud, v^4, projecting horizontally from the cam-casting R. The stud-and-slot connection between the upper end of the trigger-supporting thrust-rod and the cam is such as not to bind the parts or improperly limit the movements of this rod, the sections W W′ of which are united by a rule-joint, w, which, as is well understood, prevents flexure of the rod by endwise pressure after it has been straightened out. The lower and shorter section, W′, of this rod is jointed by a pivot, w', and lug w^2 to the front arm of the rake-stand near its lower end. A link, Y, connects the section W′ of the trigger-actuating rod to a crank, y, at one end of a short rock-shaft, mounted in a bearing in the rear arm of the rake-stand and near its lower end. A crank, y', on the opposite end of this rock-shaft is adjustably connected with the rear end of the link k^3.

It will be seen that when the treadle K is operated to rock the shaft K′ against the pressure of its spring the pull on the link k^3 will, by means of the doubly-cranked shaft y y' and link Y, straighten the rule-jointed thrust-rod and elevate the trigger, which as so moved upward adjusts itself by slightly rocking on its pivot, so as not to bind or improperly actuate its connections.

In operation, with the parts adjusted as shown in Fig. 8, the driver, when he desires to discharge a gavel from the platform Z, depresses the treadle to turn the rock-shaft K′ against the action of its spring, and so pull on the rod k^3 and straighten the thrust-rod W W′ to elevate the trigger V^3, so that the striker-lug u' of the rake-carrying arm which is first presented to the trigger will, by bearing upon it, rock it and actuate the tripper of the switch R′ to undog the switch-shank and allow the switch-spring to act upon the toothed disk of the switch-pivot and swing the switch open, as indicated by dotted lines in Fig. 22. The roller s^4 of the rake-arm is thus caused to travel inside the switch R′, and the rake-head is lowered to sweep the platform. After the roller passes the switch proper it strikes its heel-arm r^5, and so positively resets the switch or returns it to its normal position in which it is dogged, as already fully explained. When the switch is in its normal position, as shown in full lines in Fig. 22, the rake-heads act as reels or beaters only, being elevated above the platform in passing over it, the rollers s^4 passing outside of the switch R′, as well as outside of the freely-pivoted cam-gate R^2. The roller of an arm, after passing inside of the gate R′ and resetting it by acting on its heel projection, passes out at the gate R^2 by opening it, as represented in dotted lines, for an obvious and well-known purpose.

It will be seen that the thrust-rod W W′, no matter at what time it may be elevated to locate the trigger at its operative altitude, cannot present this trigger to the action of a striker at a time when, were the cam-gate opened, it would be liable to be struck by a roller.

Instead of setting the tripper-actuating mechanism, as above explained, for operation by the driver, so as to control the action of the rakes, it may be so set as to cause the rakes, or any one or more of them, to rake automatically. To so set the parts it is only necessary to adjust one or any desired number of the striker-plates U so that their lugs u' will be in position to actuate the trigger when presented to it and to change the attachment of the link Y from the hole x above the pivot w' of the thrust-rod to the hole x' beneath said pivot. The thrust-rod W W′ will thus be held straight to elevate the trigger, the spring on the rock-shaft K′ holding the parts in proper position. Every rake, the striker-plate of which is properly adjusted, will be worked automatically to sweep the platform unless the driver should actuate the treadle to rock the rock-shaft against the action of its spring, and so by a thrust on the link Y flex the thrust-rod and lower the trigger out of the way of a striker-plate. It will thus be seen that the operation of the thrust-link Y on the trigger is reversed by jointing it to the thrust-rod beneath, instead of above, its pivotal support.

The rake-shaft is inclined to the rear (see dotted line X, Fig. 8) for the purpose of causing the rake-heads to travel faster while acting as beaters to reel the grain in to the cut-

ters than when acting as rakes to sweep the grain from the platform. A quick action in reeling is very desirable, so as to properly present the grain to the cutters and press it back upon the platform, and a comparatively slow action while discharging a gavel is required to guard against kicking the gavel or so quickly and violently acting on it as to scatter it as discharged. That this variable speed is given the rake-heads will be obvious from inspection of Fig. 8, by which it will be understood that the outer end of the rake-head X′ (shown in the position assumed by it when commencing its reeling action) is at its greatest distance from the axis of revolution of the rake-shaft and farther from said axis than is the outer end of the rake-head X^2, which is represented as in the position assumed by it at the time of discharging a bundle, at which time it is closer to the axis than at any other. As X′ has a larger path to travel in a given time while at and near that part of its circuit in which it is represented than has X^2 while at and near that part of its circuit in which it is represented, it is plain that X^2 travels slower than X′.

An additional advantage arising from inclining the rake-shaft backward, or nearly so, is that a rake-head, as it discharges a gavel, is lifted more nearly directly away from the gavel than it would be were the rake-shaft not so inclined. The upward movement of the rake-head away from the gavel is the result of the travel of the rake at this time toward its axis. Thus the too energetic action of the rake, resulting in violently kicking off the gavel from the platform and sometimes again kicking it before it reaches the ground, is avoided.

I claim as of my invention—

1. The combination of the tumbling-shaft, the bevel-pinion connected therewith, the rake-stand, the bridge-casting detachably secured thereto, and the pipe-box bearing of the bridge-casting in which the pinion-shaft is mounted, substantially as and for the purpose hereinbefore set forth.

2. The rotating rake-carrier provided with the doubly-lugged radiating ears or webs, one lug of each ear being beveled on its inner surface, substantially as and for the purpose hereinbefore set forth.

3. The combination of the rotating rake-carrier provided with the series of radiating ears or webs, each having the pair of lugs, one of which is beveled on its inner side, the pivot-pins, and the securing-bolts, substantially as and for the purpose hereinbefore set forth.

4. The one-piece tubular roller-carrying arm of the short rake-carrying arm, the upper portion, s^6, of the bore of which is larger than the lower portion, s^7, thereof, as and for the purpose described.

5. The combination, substantially as hereinbefore set forth, of the tumbling-shaft, the pinion connected therewith, the rake-stand, the bridge-casting detachably secured to the rake-stand, and having the pipe-box bearing for the pinion-shaft, the rake-shaft, the rake-cam, and the stay-rod detachably connected at its opposite ends with the cam and the bridge-casting, for the purpose described.

6. The pipe-box T, shouldered to reduce the diameter of its upper end about which the cam fits, and having the perforated step projection provided at its outer end and under surface with serrations, substantially as and for the purpose hereinbefore set forth.

7. The combination of the cam-casting provided with the slotted step-supported arm or bridge-piece, the pipe-box secured to the rake-stand and having the perforated and serrated step-arm, the slotted serrated and end-lugged clip-washer, and the securing-bolt, substantially as and for the purpose hereinbefore set forth.

8. The combination of the rake-stand, the pipe-box supported thereon, the cam-casting mounted on the pipe-box, and the stay-rod, substantially as described.

9. The combination of the cam-casting, the leading cam-gate, its pivot, the pipe-bearing on the under side of the cam-casting through which said pivot passes, the toothed disk on the lower end of the switch-pivot, and the spring coiled about the pipe-bearing of the switch-pivot and acting upon the toothed disk with a tendency to open the switch, substantially as and for the purpose hereinbefore set forth.

10. The combination of the cam-casting, the leading cam-gate, its pivot supported in the cam-casting and projecting beneath it, the heel projection of the switch, its stud or shank passing downwardly through a slot in the cam-casting, the vibrating trip acting upon the switch-shank to dog and release the switch, the spring acting upon the switch-pivot with a tendency to open the switch and upon the trip with a tendency to hold it in dogging contact with the switch-shank, and means by which to actuate the trip to release the switch, substantially as hereinbefore set forth.

11. The combination of the spring-actuated switch dogging and releasing trip, the trip-actuating trigger, the link connecting it with the trip, the vertically-adjustable support upon which the trigger is mounted, and mechanism controlled by the driver for moving said trigger upward to cause it to be actuated by the contact of one of the striker-plates of the rake-arms, or downward to allow the striker-plates to pass above and clear of it, substantially as and for the purpose hereinbefore set forth.

12. The combination of the trip-actuating trigger, the rule-jointed thrust-rod upon which the trigger is mounted, and mechanism connecting said thrust-rod with the treadle-actuated and spring-controlled rock-shaft, substantially as and for the purpose hereinbefore set forth.

13. The combination of the sectional rule-jointed thrust-rod upon which the trip-actuat-

ing trigger is pivoted, the pivotal support for the lower and shorter section of the thrust-rod, the doubly-cranked shaft, with one crank of which the lower section of the thrust-rod is connected (either above or below its pivot) by a thrust-link, and the link connecting the opposite crank of said shaft with the spring-actuated and treadle-controlled rock-shaft, substantially as and for the purpose hereinbefore set forth.

14. The combination of the rule-jointed thrust-rod, slotted at its upper end, the cam-casting, the pin thereon embraced by the slot of the thrust-rod, the trigger pivotally supported on the upper end of the thrust-rod and actuated by the properly-adjusted striker-plates of the rake-arms when the thrust-rod is straightened, the cam-switch trip, and the cam-switch, moved in one direction by a spring when the trip is actuated by the trigger and in the other direction by the action of the rollers of the rake-carrying arms, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name.

JOHN S. DAVIS.

Witnesses:
GEORGE W. HUMPHREY,
WILLIE HUMPHREY.