(No Model.)

5 Sheets—Sheet 1.

L. B. McDONALD.

RECIPROCATOR.

No. 557,415. Patented Mar. 31, 1896.

Fig. 1

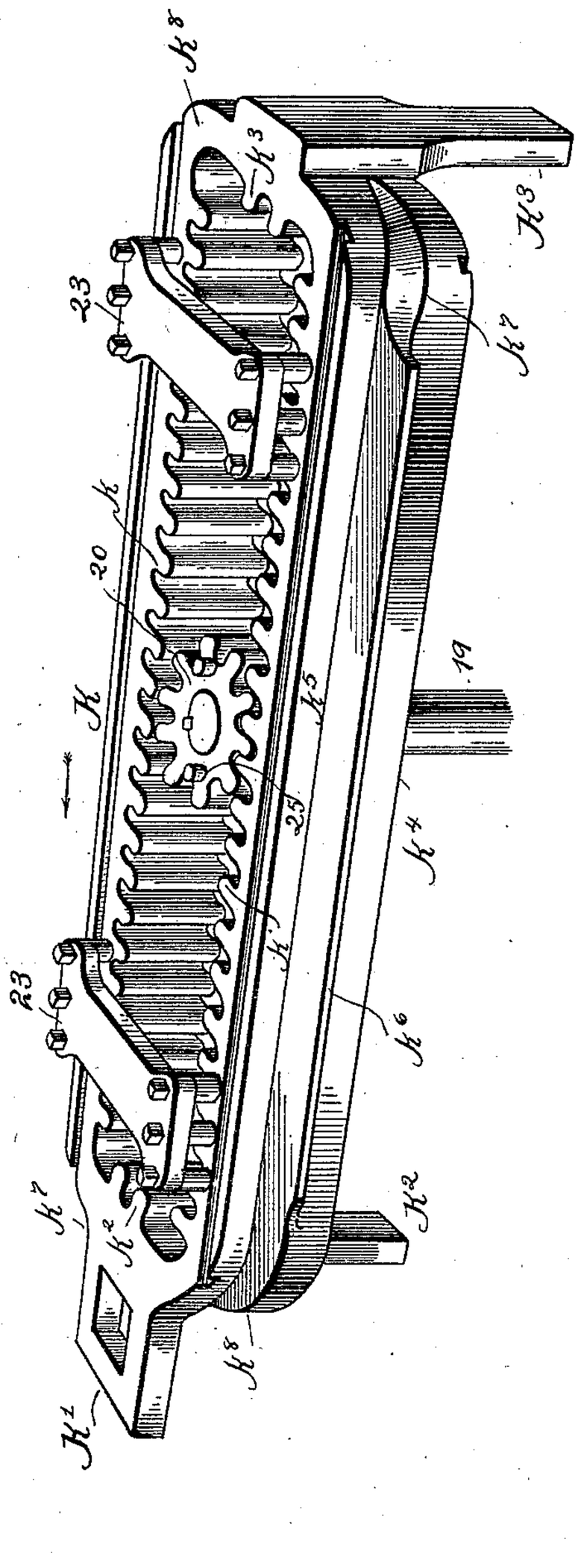
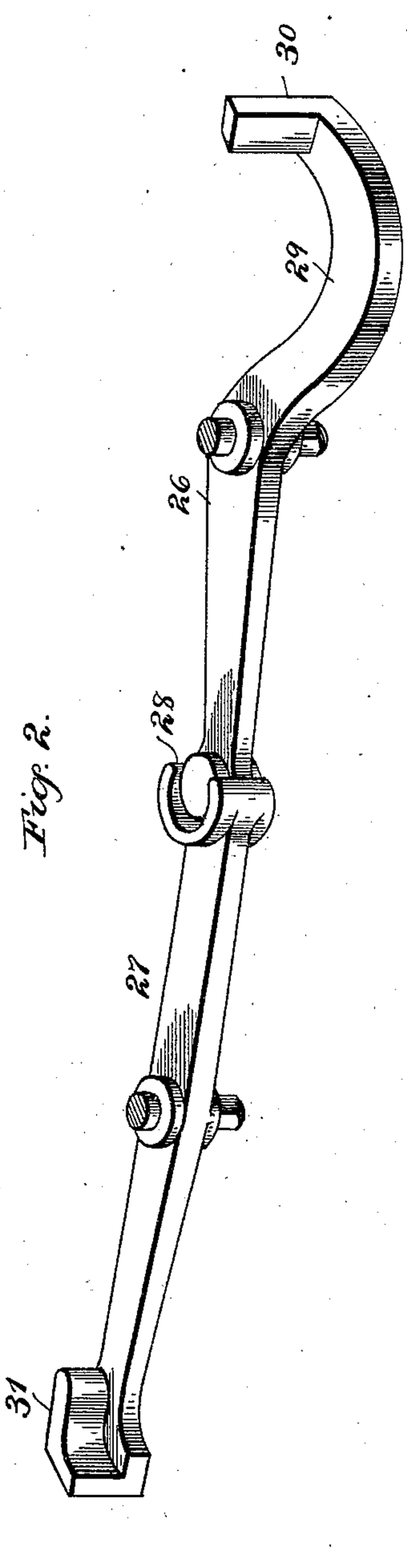


Fig. 2.



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(No Model.) 5 Sheets—Sheet 2.

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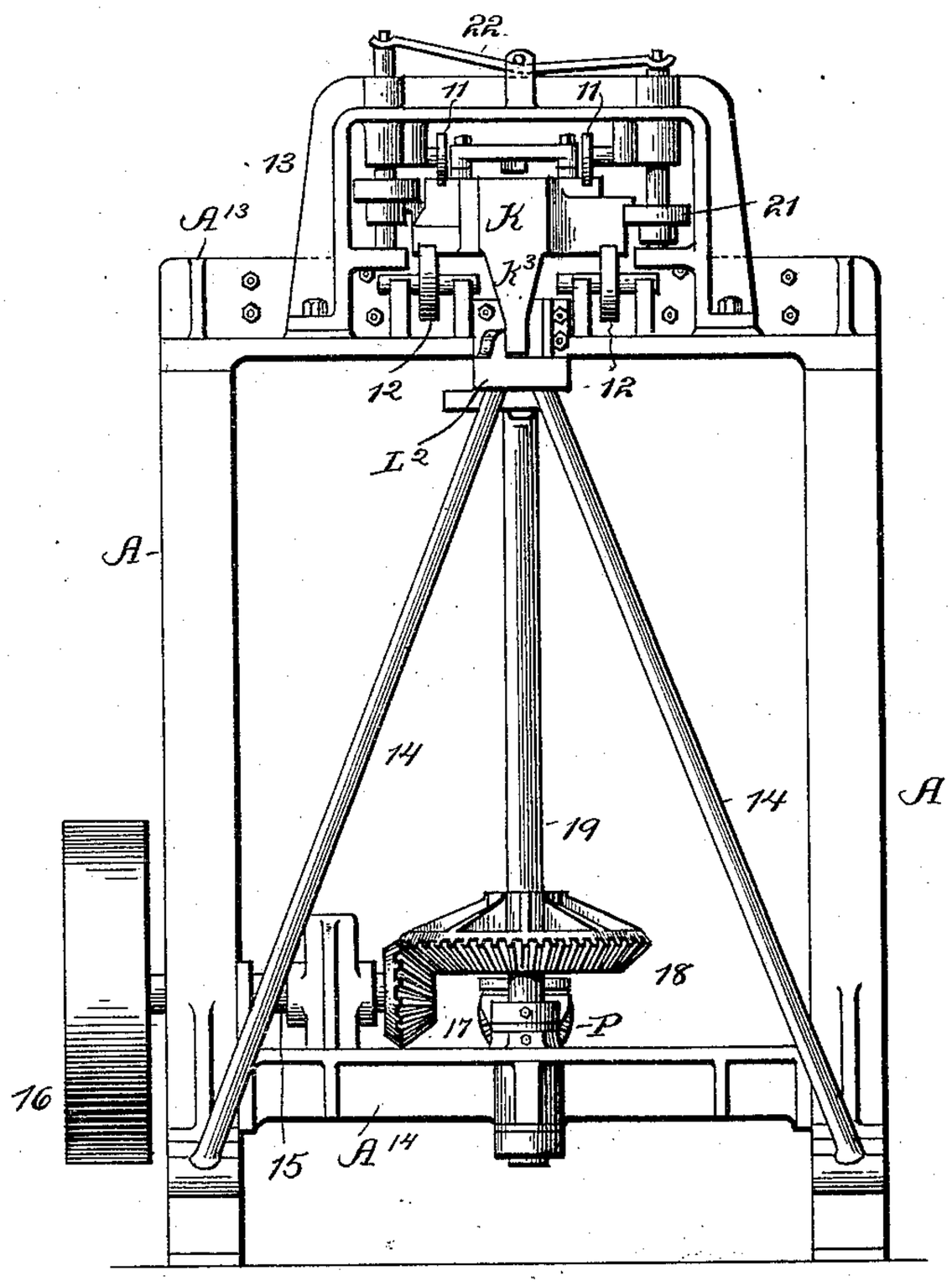
Fig. 3.



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(No Model.) 5 Sheets—Sheet 3.

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RECIPROCATOR.

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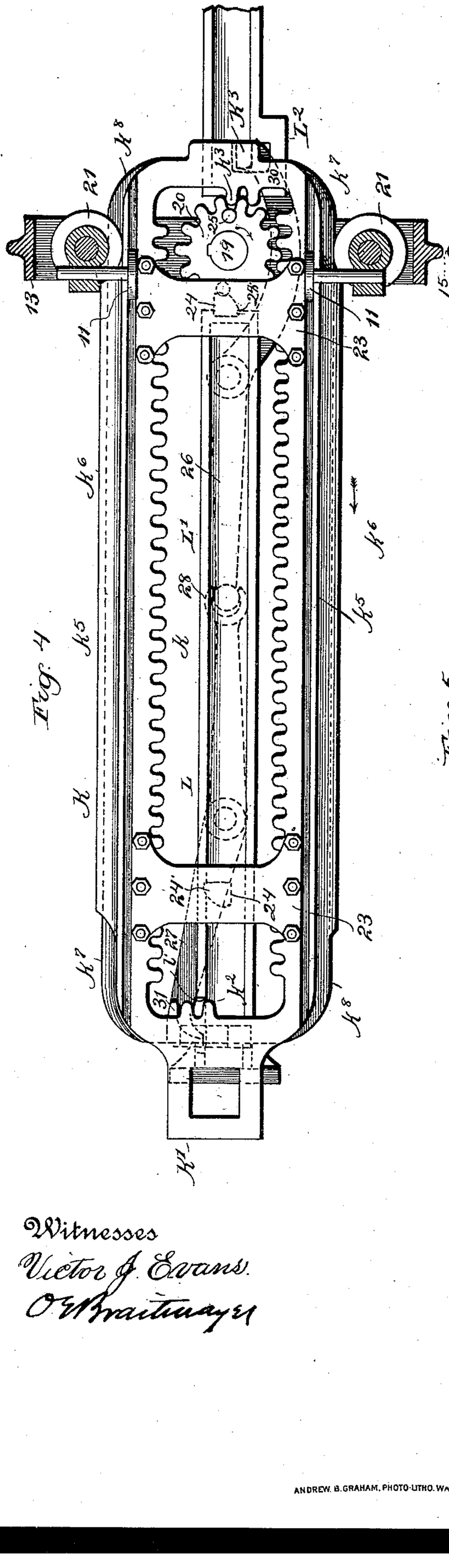

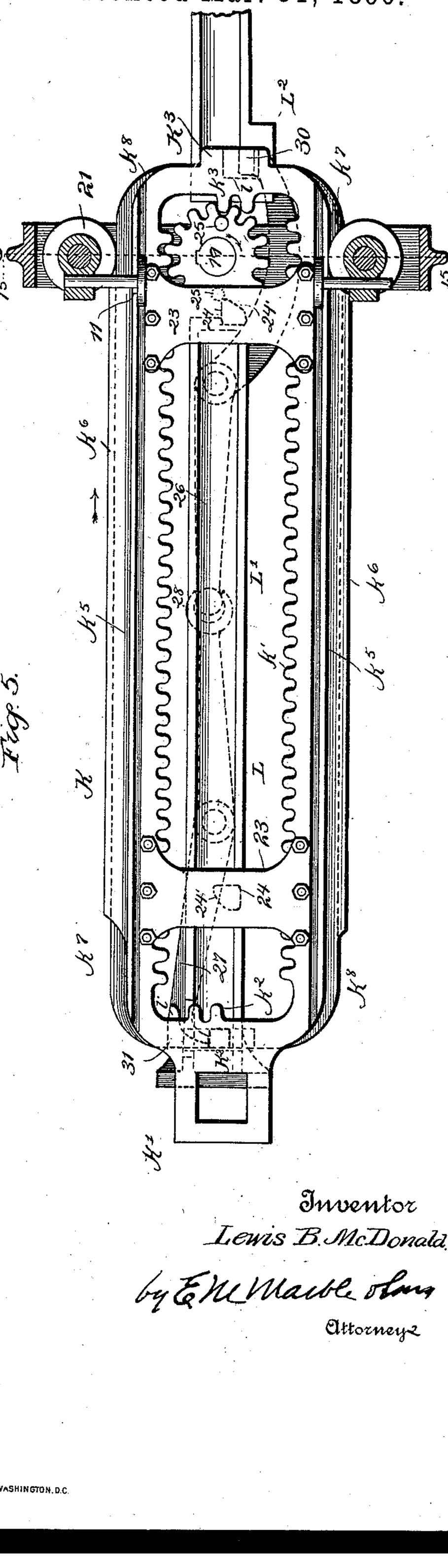

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(No Model.) 5 Sheets—Sheet 4.

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RECIPROCATOR.

No. 557,415. Patented Mar. 31, 1896.

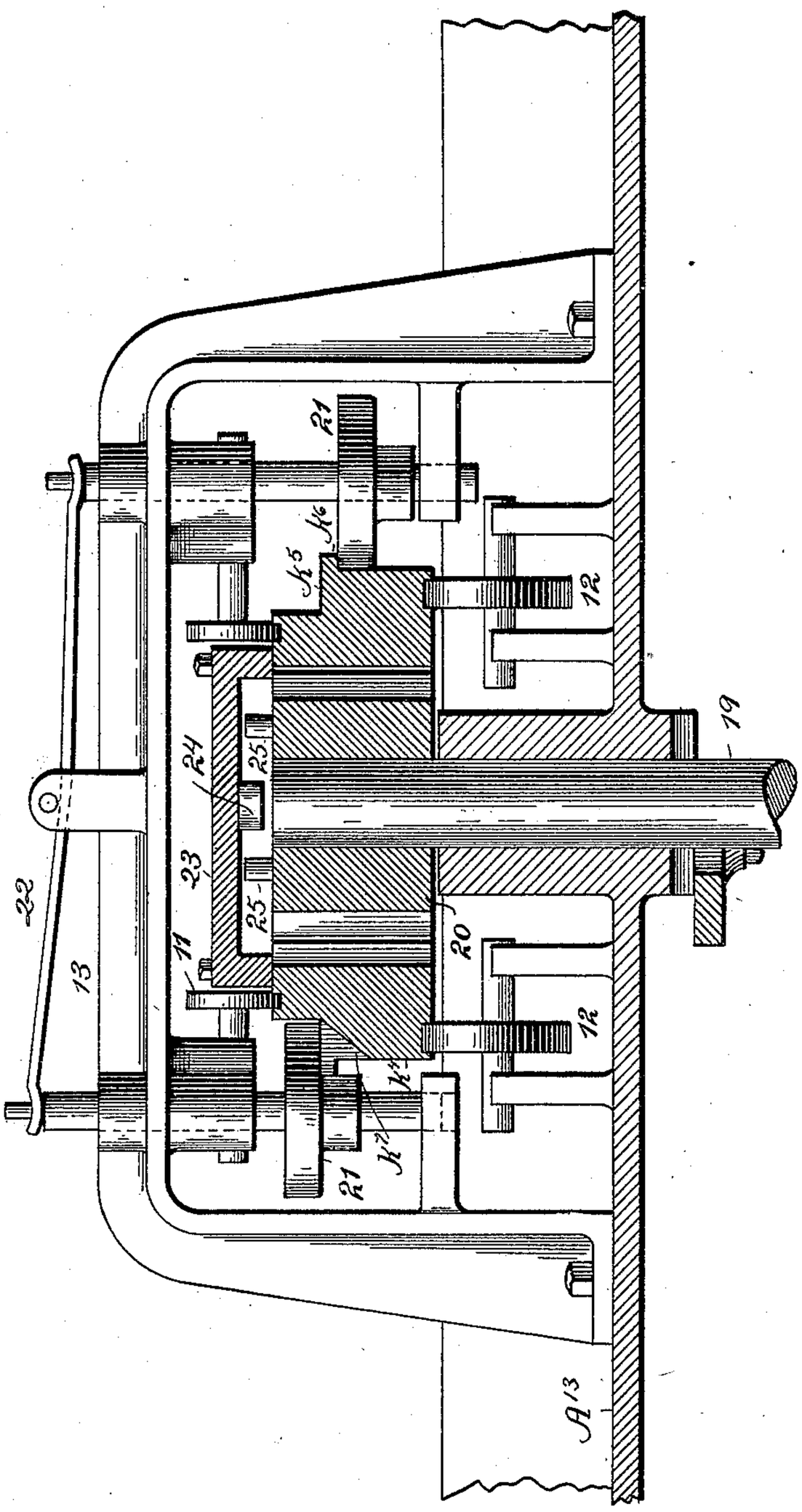

Fig. 6.

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(No Model.)

5 Sheets—Sheet 5.

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RECIPROCATOR.

No. 557,415.

Patented Mar. 31, 1896.

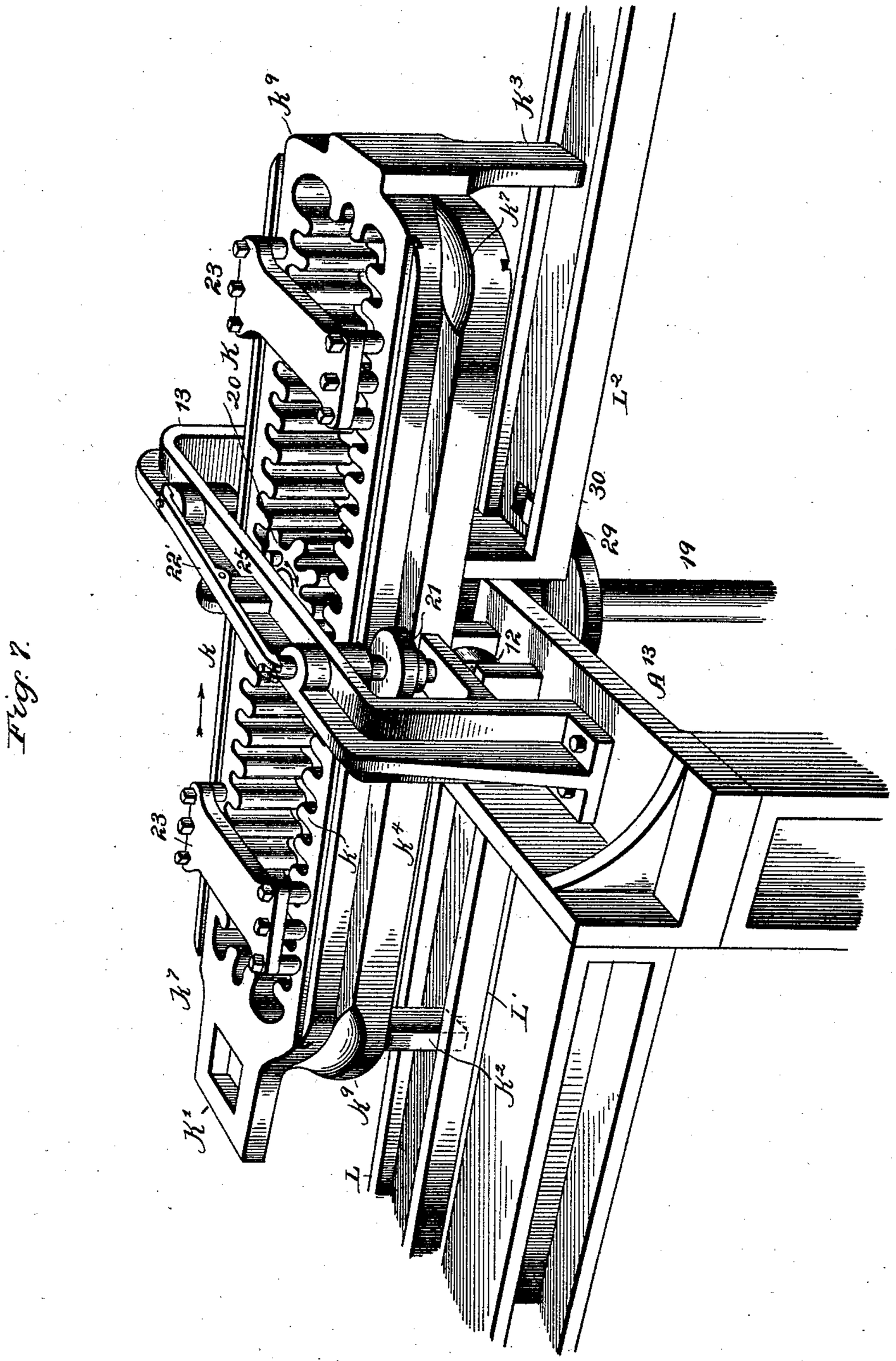

Fig. 7.

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UNITED STATES PATENT OFFICE.

LEWIS B. McDONALD, OF LITTLE ROCK, ARKANSAS, ASSIGNOR TO THE McDONALD COTTON COMPRESS COMPANY, OF ARKANSAS.

RECIPROCATOR.

SPECIFICATION forming part of Letters Patent No. 557,415, dated March 31, 1896.

Application filed January 27, 1896. Serial No. 577,025. (No model.)

To all whom it may concern:

Be it known that I, LEWIS B. McDONALD, a citizen of the United States, residing at Little Rock, in the county of Pulaski and State of Arkansas, have invented certain new and useful Improvements in Reciprocators; 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.

My invention relates to improvements in devices for transforming rotary into reciprocatory movement; and it consists in the improved reciprocator whose construction and arrangement of parts will be hereinafter fully described, and particularly pointed out in the claims.

The reciprocator which forms the subject of my present invention is specially designed for use in connection with the press for baling cotton and other fibrous materials which is described in my application for Letters Patent filed December 30, 1895, Serial No. 573,797, though it is applicable for use in connection with any device or mechanism in which a reciprocatory movement is desired.

The object of my invention is to provide a reciprocating mechanism, operated by a fixed power element having a uniform direction of rotation, whose movement shall at all times be positive, whose pull will at all times be direct, so that the power applied will be uniform and so that the strain upon the working parts will not vary, and in which the throw incident upon a reversal of the movement of the reciprocating mechanism will take place place quickly and without hesitation.

The first object of invention is dictated by the necessity of having the reciprocating movement of the operating-carriage uniform in speed and available power, while the second object of invention is necessary to attain if the power mechanism is to move easily and without any racking strain.

The third object of invention is indispensable to a reciprocating mechanism which is to operate in connection with a cotton-press, for, since the feed of the cotton to the press is continuous, any lengthened stoppage will lead to a blocking of the feed mechanism and an interruption of the operation of the press.

In accomplishing the object of my invention I make use of a form of internal rack, consisting of a frame having a central opening, provided with rack-bars on both sides of the opening lengthwise of the frame, and rack-teeth at both ends of the opening, and impart a reciprocating movement to the same by a fixed power-pinion, journaled in the machine-frame and operated by a positive connection with the power-shaft, so as to move in a uniform direction. The reciprocating movement of the frame is caused by the meshing of the teeth of the pinion with the rack-bars on either side of the opening of the same, while the throw of the frame at the end of its movement, so that the pinion will act upon both rack-bars to produce a movement intermitting in direction, is caused by the meshing of the teeth of the pinion with the rack-teeth formed in the ends of the opening. In order to secure a proper working of the parts, I have found it necessary to stagger the position of the rack-bars and rack-teeth relative to each other with the direction of the motion of the operative pinion. It is necessary, moreover, in such a construction to provide means for holding the operative side of the reciprocating frame in close contact with the power-pinion, as otherwise no positive action could be secured; to provide means for insuring a positive throw of the reciprocating frame at either end of its movement, and to provide means for maintaining the entire frame in the line of pull, thus avoiding the diagonal pull which might otherwise be found to exist with a reciprocating frame of the length necessary to give the operative carriage the necessary travel.

The means I use to hold the side of the reciprocator-frame to which power is being applied in close contact with the power-pinion consists of two disks—one on either side of the reciprocator and journaled so that they may be given a vertical movement. One of these disks is always in action, bearing against that side of the reciprocator to which power is being imparted and affording a guide to prevent lateral movement of the reciprocator away from the power-pinion, while the other is idle. To arrange for one of the disks moving idle while the other is in operation, when

the disks are journaled with their peripheries only as far apart as the distance between the bearing-surfaces formed on the sides of the reciprocator, I form the bearing-surfaces on the lower portion of the sides of the reciprocator, cut away slightly the upper portion of the same, and provide means for raising either operative disk at the end of its travel, so that as the throw occurs and the reciprocator is drawn toward the operative disk it will rise upon the upper or cut-away portion of the reciprocator and return idly upon the same, while the heretofore idle disk upon the opposite side of the reciprocator falls into operative position. In this manner the result obtained is that of always having one disk in operation to perform the office designated, while the other moves idle. In this same manner I also obtain a positive throw of the reciprocator at the end of its movements, for the guiding-disks will only rise and fall when the throw is complete, and they prevent any oscillation of the frame after their change of position and the application of power through the power-pinion to cause a return movement of the reciprocator. As the guiding-disks are not released from their operative position until the end of their movement, the reciprocator is at all times securely held in proper position for effective movement.

To prevent any failure of proper working of the parts due to wear, I make use of an auxiliary locking device which acts to prevent the throw of the reciprocator until the proper stage of its movement is reached.

The guide-rolls, as well as the top and bottom antifriction-rollers, (which move in grooves cut in the upper and under surface of the reciprocator and are journaled so that they may move laterally in their bearings to accommodate the lateral throw of the carriage,) are journaled at the point where power is applied to the reciprocator, as it is there that it is necessary to prevent any swerving of the reciprocator from its desired position. It is necessary, however, on account of the length of the reciprocator and on account of the necessity of shifting into the direct line of pull the forward end of the reciprocator when the throw occurs at the end of the forward travel of the same, not only to provide a track in which feet projecting downward from the end of the reciprocator may travel, but also to provide automatically-operating means for shifting the rear end of the frame. It is unnecessary to provide such shifting means when the power-pinion acts upon the end frame, which is connected to the body to be reciprocated, as in this case the end of the frame distant from such body, being free to move, will naturally aline itself to the line of pull. To meet these necessities, I form the track, which I provide for the feet projecting downwardly from the reciprocator, of channeled iron, so that the feet may slide against the sides of the track during their lengthwise travel, and make the inner width of the track equal to the width of the bottom portion of the feet and the throw of the reciprocator added, so that the throw of the reciprocator can take place. This throw takes place at the end of the reciprocating movement and at a time when no power is being exerted to move the operative carriage, so that the weight which has to be moved is merely that of the reciprocator, and as this is supported upon antifriction-rolls the expenditure of but little power is necessary. I further provide a system of levers whose ends project through openings cut in the track and which are operated automatically by the feet of the reciprocator to produce the desired throw of the same.

My invention is fully described in the drawings which accompany and form a part of this application, in which the same reference letters and numerals refer to the same or corresponding parts, and in which—

Figure 1 is a perspective view of my reciprocator, showing the operative pinion in gear. Fig. 2 is a detailed perspective view of the levers used in shifting the end of the reciprocator. Fig. 3 is an end view of my reciprocator in place upon the framework of a machine in connection with which it is to be used. Fig. 4 is a top plan view of my reciprocator and operating-pinion, showing the parts in the position they assume immediately before a throw of the reciprocator. Fig. 5 is a similar view showing the parts in the position they assume immediately after the throw of the reciprocator has taken place. Fig. 6 is an enlarged section of Fig. 5, taken on the line 15 15. Fig. 7 is a detailed perspective view of a modified form of my reciprocator, showing the same in place upon the framework of the machine in connection with which it is to be used.

Referring to the drawings, *a* represents the machine-frame.

K represents the reciprocator. The reciprocator is provided with a longitudinal opening, on the sides of which rack-bars *k* and *k'* are formed, and on the ends of which the rack-teeth k^2 and k^3, though, for a reason which will hereinafter appear, the rack-teeth k^2 and k^3 do not extend entirely across the opening in the reciprocator. The rack-bars and rack-teeth are staggered with relation to a line central of the opening in the reciprocator, in the direction of travel of the power-pinion, in order to facilitate the lateral throw of the reciprocator, which takes place at the ends of its movement, and to arrange for the teeth of the power-pinion always having rack-teeth to mesh with. The amount of staggering required of the rack-bars is equal to the movement of the pinion in the end rack-teeth during the throw of the reciprocator. With the width of throw which I use in my present movement the amount of staggering of the side bars is not quite half a tooth; but with different widths of throw the amount of staggering will vary, and I do not restrict myself

to any particular width of throw or staggered position of the rack-bars.

The reciprocator lies in the machine with its broad face downward, so as to permit of its being driven by a pinion mounted upon a vertical shaft. Its reciprocatory movement is relative to a fixed point—the point of the application of power—and takes place with the continued rotation of the power-pinion in a given direction.

The reciprocator is held at the point of the application of power between upper and lower antifriction-rollers 11 and 12, which are journaled in studs projecting from the roller-bracket 13 and are supported so as to be capable of lateral movement. The antifriction-rollers move in grooves cut in the upper and lower surfaces of the reciprocator and afford a positive support, rendering impossible any vertical movement of the reciprocator, though permitting lateral movement thereof. They also render the throw of the reciprocator comparatively frictionless and make the same easy and uniform. The reciprocator is provided with a draw-head k' to enable it to be connected with the body to be reciprocated.

In consequence of the length of the reciprocator and in order to enable the desired throw of the same to take place I have found it necessary to provide means for the guiding of the movement of the ends of the same. I thus take away from the supporting-rollers the lateral strain to which they would otherwise be subjected. I therefore form at the ends of the reciprocator downwardly-projecting feet K^2 and K^3, which move against the sides of the track L. This track is supported directly under the reciprocator and is made of channeled iron, so as to permit not only the travel therein of the feet K^2 and K^3, but also the lateral movement of said feet incidental to a throw of the reciprocator. In order to avoid undue friction, the bottom of the reciprocator is planed smooth. The track in my present construction is made in two pieces, one of which, L′, extends from the forward point of support to the cross-beam A^{13}, being bolted at these points, and the other of which, L^2, extends from the cross-beam A^{13} to the rear of the machine, being supported at its outer end by supporting-braces 14, which extend upward from the bottom cross-piece A^{14} of the machine-frame.

Power is applied to the reciprocator in the following manner: To the inner end of the power-shaft 15, which is journaled, as shown, in the machine-frame, is keyed the pinion 17. This pinion meshes with the pinion 18, mounted upon the vertical shaft 19. The vertical shaft 19, which has its bottom bearing in the cross-beam A^{14} of the machine-frame and its upper bearing in the cross-piece A^{13}, bears upon its upper end a pinion 20, which is arranged to mesh with the rack-teeth formed in the reciprocator and impart thereto the desired movement. The throw of the reciprocator is accomplished at the ends of its longitudinal movement by the engagement of the teeth of the power-pinion with the rack-teeth formed in the ends of the opening of the frame. These rack-teeth are slightly staggered with the direction of the movement of the pinion, so that the position of such teeth will correspond with that required to permit the transmission of effective rotative impulse by the power-pinion, and the rack-bar on the opposite side of the frame is also slightly staggered in the same direction for the same reason.

When the teeth are placed in the manner represented in the drawings, the throw can be effected with only two teeth placed in the ends of the opening in the frame, and the pitch-line of these teeth remains the same as that of the teeth of the rack-bars. If, however, more end teeth be used, as may be used without varying other than the mechanical details of the reciprocator, the pitch-line of the teeth will have to be altered in order to enable the proper throw to take place. While the lateral throw of the carriage is thus accomplished, it is necessary to provide means for holding the side of the reciprocator to which power is being applied against the power-pinion, so that no slipping of the intermeshing teeth can take place, and also to provide means for rendering the throw of the reciprocator positive and certain in its action. These objects I accomplish in the following manner:

On both sides of the reciprocator, with their peripheries separated by the width of the bearing portions of the same, I place guiding-disks 21, whose spindles are journaled in lugs projecting inwardly from the roller-bracket 13 and in openings formed in the top of the said bracket. The upper ends of the spindles project upward through such openings, but are normally forced downward by the action of the flat spring 22, which is mounted, as shown, upon the upper surface of the bracket. The guiding-disks are thus so supported as to be capable of vertical movement, although lateral movement is impossible. They are arranged so that one of the same always bears against the side of the reciprocator to which power is being applied, while the other rides idle upon the top of the reciprocator. The construction which renders this operation possible is as follows: The sides of the reciprocator are formed of two portions—a bearing portion k^4 and a recessed or cut-away portion k^5. The bearing portion is that toward the bottom of the sides of the reciprocator. A lip k^6 separates the two portions and prevents the guiding-disk, when bearing against the bearing portion k^4, from slipping upward out of engagement with the same. It is intended that the operating guiding-disk shall bear upon the bearing portion k^4 of the reciprocator, and that the idle guiding-disk shall move upon the cut-away portion thereof. It is necessary to provide means, operated automatically by the movement of

the reciprocator, for causing the guiding-disks to assume their respective positions. To this end, having in view the fact that the throw of the reciprocator takes place toward the guiding-disk which is in operation, I form on each of the sides of the reciprocator, at diagonal ends thereof, upwardly-curving portions k^7, which connect the bearing and the cut-away portions of the reciprocator. I also form on the alternate ends of the reciprocator vertically-depressed portions k^8. The upwardly-curving portions k^7 are formed at that end of the sides of the reciprocator toward which the movement of the same takes place, while the recessed or depressed portions k^8 occur at that end of the reciprocator at which the movement of the same begins.

If now the operation of the reciprocator be considered, it will be seen that as the end of the movement thereof is reached, and it begins its lateral throw by the engagement of the teeth of the power-pinion with the rack-teeth in the end of the opening therein, since the throw of the reciprocator is toward the side upon which power has just been applied, the guide-roller, which has just been operating against the bearing portion k^4, will be made to rise up upon the upwardly-curving portion k^7 in proportion as the throw takes place, and will at the end of the movement be in its upper or raised position, resting upon the recessed or cut-away portion k^5. During this movement the other guiding-disk will have been carried to the edge of the cut-away portion k^8, and will, as the throw is about complete, escape entirely from its support and be forced down by the flat spring 22, bearing against the end of its spindle, into operative position. A reversal of the positions of the guiding-disks has thus been effected. That disk which before was moving idly has dropped into operative position, and will now act to hold that side of the reciprocator to which power is being applied against the driving-pinion, avoiding any loss of power, and the guiding-disk which before was operative has become idle and will move back along the cut-away portion of the reciprocator.

The reason for recessing or depressing the portion k^8 is to cause the idle guide-disk to drop into position a little before the end of the throw has been accomplished. If such formation were not resorted to, the dropping of the disk into position would perhaps be uncertain, as it would have to occur in the moment of time between the end of the lateral throw of the reciprocator and the forward movement of the same caused by the continuous movement of the actuating power-pinion. If, however, the ends of the bar be cut away, as indicated, the operation takes place without any uncertainty.

The reciprocator is still perfectly guided, for the moment power is applied to the same and movement takes place the guiding-disk passes from the slightly-depressed portion of the bearing-surface and rides upon the bearing-surface in operative position.

In order to prevent the reciprocator throwing before the time at which the throw should occur by reason of wearing away of the upwardly-curving portion k^7, (an action which, if it should occur, would destroy the efficacy of the movement,) I support over the top of the reciprocator, at either end thereof, castings 23, upon whose under surface lugs 24 are formed. The inclined or cam face 24′ of these lugs occurs on that side thereof toward the upwardly-curving portion k^7. With these lugs engage the pins 25, formed on the power-pinion, the movement being such that the pins move up the curved portion of the cam-face of the lugs at the moment that the throw of the reciprocator commences, and finish their movement against such cam-face when the throw is complete. In this manner a guard is provided for preventing the throw of the reciprocator taking place too early, and consequently interrupting the operation of the device. It is necessary to use two pins 25, as shown, as the power-pinion is not at the same stage of revolution at both ends of the movement of the reciprocator with the length of reciprocator which is in use in my present construction, but differs by half a revolution. As the position of the cams 24 is fixed by the character of the function which they perform, and is the same at both ends of the reciprocator, the use of two pins 25 is indispensable.

In the modified form of reciprocator shown in Fig. 7 the lip k^6 is dispensed with, and instead of depressing vertically alternate corners of the reciprocator, as at k^8, such corners are formed with upwardly-curving portions k^9, similar in all respects to the upwardly-curving portions k^7. In this construction one of the guiding-disks rises in exact proportion to the fall of the other guiding-disk, and a rocking lever 22′ is used, as shown in Fig. 7, to control the movement of the same.

When the throw of the reciprocator takes place, at the end of its backward movement, it is unnecessary to use any additional means to aline the free end of the reciprocator, as it will itself come into proper alinement as soon as power is applied, the foot K^3 sliding over to the proper side of the track and bearing against the side thereof which corresponds to the side of the reciprocator to which power is being applied. When, however, the throw takes place at the end of its forward movement, it is necessary to provide means for positively throwing the free end of the reciprocator over a distance equal to the throw of the reciprocator in order to escape the diagonal pull which would otherwse result. This can be accomplished all the more easily, for at the moment when the throw takes place there is no pull between the draw-head of the reciprocator and the object to which it is attached, and all that has to be shifted is the dead-

weight of the reciprocator. As this is mounted upon antifriction-roller bearings, the power required is very slight.

I effect the throw of the far end of the reciprocator in the following manner: To the under side of the track L are pivoted levers 26 and 27, which are connected by a knuckle-joint 28. The arms of these levers are of equal length, and their connection is such that a movement of one causes a movement of the other equal in length and opposite in direction. The end of the lever 26 is curved, as shown at 29, and at the extreme end of the curved portion projects upward the pin 30. This pin works through an opening *l* formed in the bottom of track L. The free end of the other lever 27 is provided with a beveled faced head 31, which works in and out of the path of the foot K^2 of the reciprocator through an opening *l'* in the side of the same.

Considering again the operation of the reciprocator, and supposing the reciprocator to be moving backward or away from the body of the machine and the pin 30 to be in the middle of the track L, when the end of the movement is reached and the return of the reciprocator commences no change will take place in the position of the levers until the moment of the throw of the reciprocator at the end distant from the carriage. As this throw takes place the pin 30 will be forced out of the track L, and by the same movement the bevel-faced portion 31 will be pushed into the track, forcing the leg K^2 to the opposite side of the track L and into the direct line of pull. Should the bevel-faced edge 31 have been in the track L at the time indicated and the pin 30 out of the track, this difference in the operation would have taken place: As the foot K^2 reached the outer portion of its travel, it would have forced the bevel-faced portion 31 out of the track (for the foot K^2 would then be traveling on the side of the track proper to perform its action) and the pin 31 into the track. The same action as before would then have occurred when the throw took place.

I do not limit myself to the use of the reciprocating mechanism which I have thus described in connection with my improved cotton-press described in my application for Letters Patent, filed December 30, 1895, Serial No. 573,797, as it may be used in connection with any other mechanism in which the same movement is desired; but

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

1. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the ends of its movement, upwardly-curving sliding faces formed on the outer surface of the reciprocator at the ends thereof which move toward the power-pinion, and vertically-movable disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator, and adapted to bear against the side of the reciprocator to which power is being applied, substantially as described.

2. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the end of its movement, upwardly-curving sliding faces formed on the outer surface of the reciprocator at the ends thereof which move toward the power-pinion, cut-away portions on the opposite ends of the reciprocator, and disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator, and adapted to bear against the side of the reciprocator to which power is being applied, substantially as described.

3. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, the upper portion of the side of said reciprocator cut away, rack-bars on both sides of said opening, means for causing the throw of the reciprocator at the ends of its movement, bearing-surfaces formed on the lower portions of the sides of the reciprocator, upwardly-curving sliding faces formed on the bearing-surfaces at the ends thereof which move toward the power-pinion, cut-away portions on the opposite ends of the reciprocator, and disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator, and adapted to bear against the side of the same to which power is being applied, substantially as described.

4. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, the upper portions of the side of said reciprocator being cut away, rack-bars on both sides of said opening, means for causing the throw of the reciprocator at the ends of its movement, bearing-surfaces formed on the lower portions of the sides of the reciprocator, upwardly-curving sliding faces formed on the bearing-surfaces at the ends thereof which move toward the power-pinion, cut-away portions on the opposite ends of the reciprocator, disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator, and adapted to bear against the side of the same to which power is being applied, and means for insuring the rise and fall of said disks, substantially as described.

5. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the ends of its movement, upwardly-curving sliding faces formed on the outer sur-

face of the reciprocator at the corners thereof, and vertically-movable disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator, and adapted to bear against the side of the reciprocator to which power is being applied, substantially as described.

6. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, the upper portions of the sides of said reciprocator being cut away, rack-bars on both sides of said opening, means for causing the throw of the reciprocator at the ends of its movement, bearing-faces formed on the lower portions of the sides of the reciprocator, upwardly-curving sliding faces formed on the bearing-surfaces at the corners of the reciprocator, disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator, and adapted to bear against the sides of the same, and a lever connecting said disks and adapted to insure the rise and fall of the same, substantially as described.

7. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, the upper portion of the sides of said opening being cut away, rack-bars on both sides of said opening, rack-teeth on portions of the ends of said opening, said rack-bars and rack-teeth being staggered with the direction of rotation of the power-pinion, bearing-surfaces formed on the lower portion of the sides of the reciprocator, upwardly-curving sliding faces formed on the bearing-surfaces at the ends thereof which move toward the power-pinion, cut-away portions on the opposite ends of the reciprocator, and disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator and adapted to bear against the sides of the same to which power is being applied, substantially as described.

8. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, the upper portion of the sides of said reciprocator being cut away, rack-bars on both sides of said opening, rack-teeth on portions of the ends of said opening, said rack-bars and rack-teeth being staggered with the direction of rotation of the power-pinion, bearing-surfaces formed on the lower portions of the sides of the reciprocator, ledges at the top of said bearing-faces, upwardly-curving sliding faces formed on the bearing-surfaces on the ends thereof which move toward the power-pinion, cut-away portions on the opposite ends of the reciprocator, and disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator and adapted to bear against the side of the same to which power is being applied, substantially as described.

9. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at both ends of its movement, grooves cut in the upper and lower surfaces of said reciprocator, laterally-movable disks engaging with said grooves, and means for keeping the side of the reciprocator to which power is being applied in contact with the power-pinion, substantially as described.

10. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the ends of its movement, upwardly-curved sliding faces formed on the outer surface of the reciprocator at the ends thereof which move toward the power-pinion, vertically-movable disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator and adapted to bear against the side of the reciprocator to which power is being applied, and means for shifting into the line of pull the end of the reciprocator to which power is being transmitted when the throw of the same occurs at the opposite end thereof, substantially as described.

11. The combination with a fixed power-pinion, of a reciprocator having projecting feet formed on both ends of the same, and having an opening therein of a width greater than the diameter of the pinion, a track in which said feet move, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the ends of its movement, means for keeping the side of the reciprocator to which power is being applied in contact with the power-pinion, and means for shifting into the line of pull the end of the reciprocator to which power is being transmitted when the throw of the same occurs at the opposite end thereof, substantially as described.

12. The combination with a fixed power-pinion, of a reciprocator having projecting feet formed on both ends of the same, and having an opening therein of a width greater than the diameter of the pinion, a track in which said feet move, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the ends of its movement, means for keeping the side of the reciprocator to which power is being applied in contact with the power-pinion, and levers attached to said track, for shifting into the line of pull the end of the reciprocator to which power is being transmitted when the throw of the same occurs at the opposite end thereof, substantially as described.

13. The combination with a fixed power-pinion, of a reciprocator having projecting feet formed on both ends of the same and having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, a track in which

said feet move, levers pivotally attached to said track, the ends of said levers projecting into the line of travel of said feet and being adapted to be actuated by the same so as to move in opposite directions, means for keeping the side of the reciprocator to which power is being applied in contact with the power-pinion, and means for causing a throw of the reciprocator at the ends of its movement, thereby actuating the pivotally-attached levers to shift the end of the reciprocator from which power is being taken into the line of pull, substantially as described.

14. The combination with a fixed power-pinion, of a reciprocator having projecting feet formed on both ends thereof, and having an opening therein of a width greater than the diameter of the power-pinion, rack-bars on both sides of said opening, and rack-teeth on portions of the ends of the same the upper portion of the sides of said reciprocator being cut away, bearing-surfaces formed on the lower portions of the sides of the same, upwardly-curving sliding faces formed on the bearing-surfaces at the ends thereof which move toward the power-pinion, cut-away portions on the opposite ends of the reciprocator, disks stationed in line with the power-pinion with their peripheries separated by the width of the reciprocator and adapted to bear against the side of the same to which power is being applied, a track in which said projecting feet travel, and levers pivotally attached to said track, the ends of said levers projecting into the line of travel of said feet and being adapted to be actuated thereby so as to move in opposite directions, substantially as described.

15. The combination with a fixed power-pinion, of a reciprocator having an opening therein of a width greater than the diameter of the pinion, rack-bars on both sides of said opening, means for causing a throw of the reciprocator at the ends of its movement, means for keeping the side of the reciprocator to which power is being applied in contact with the power-pinion, pins projecting upward from the power-pinion, and cams 24 adapted to be engaged by said pins at the end of the movement of the reciprocator, whereby throw of the reciprocator until the end of its movement is reached is prevented, substantially as described.

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

LEWIS B. McDONALD.

Witnesses:
JOHN B. JONES,
A. S. GOOCH.