No. 677,538. Patented July 2, 1901.

R. DALTON.

EXCAVATING APPARATUS.

(Application filed Jan. 17, 1900.)

(No Model.) 6 Sheets—Sheet 1.

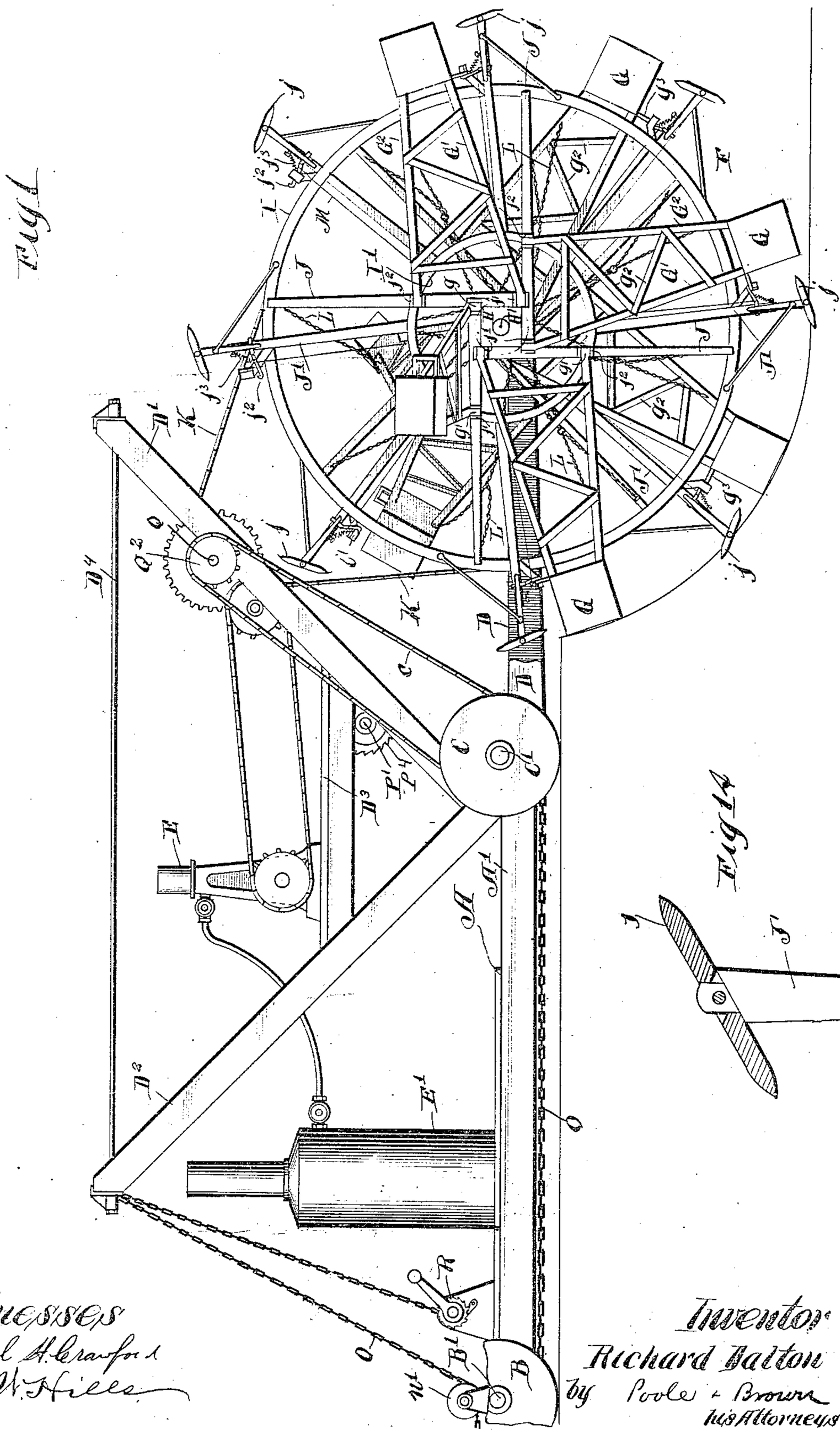

Fig. 1.

Fig. 1A.

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(No Model.) 6 Sheets—Sheet 2.

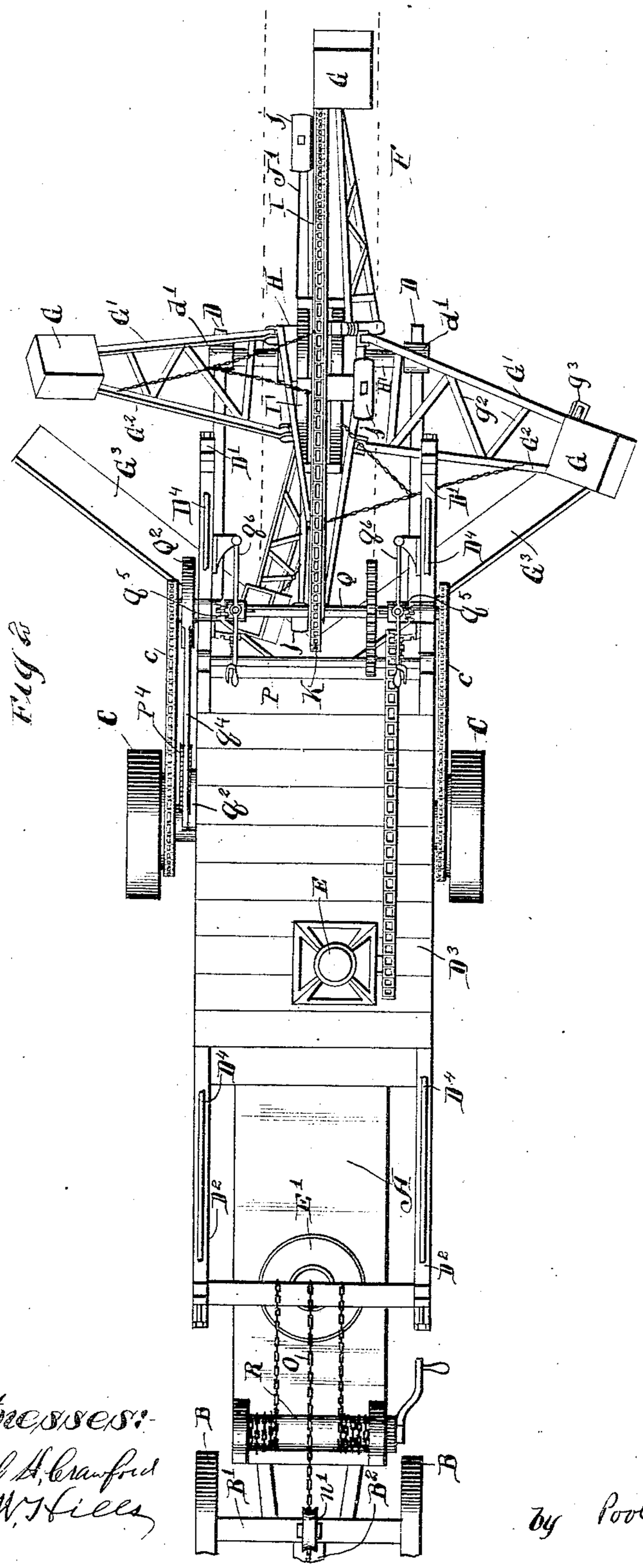

Fig 2.

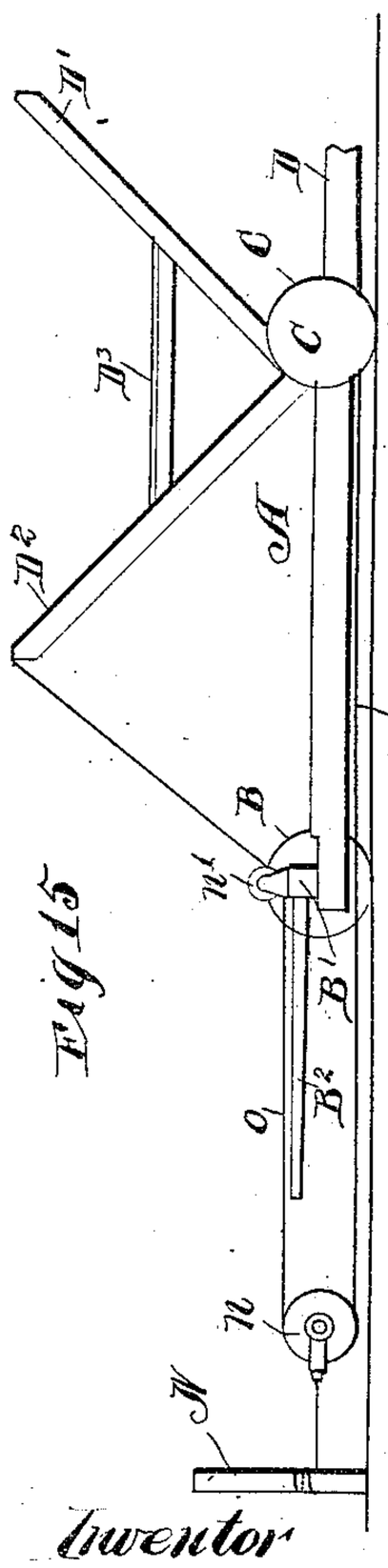

Fig 15.

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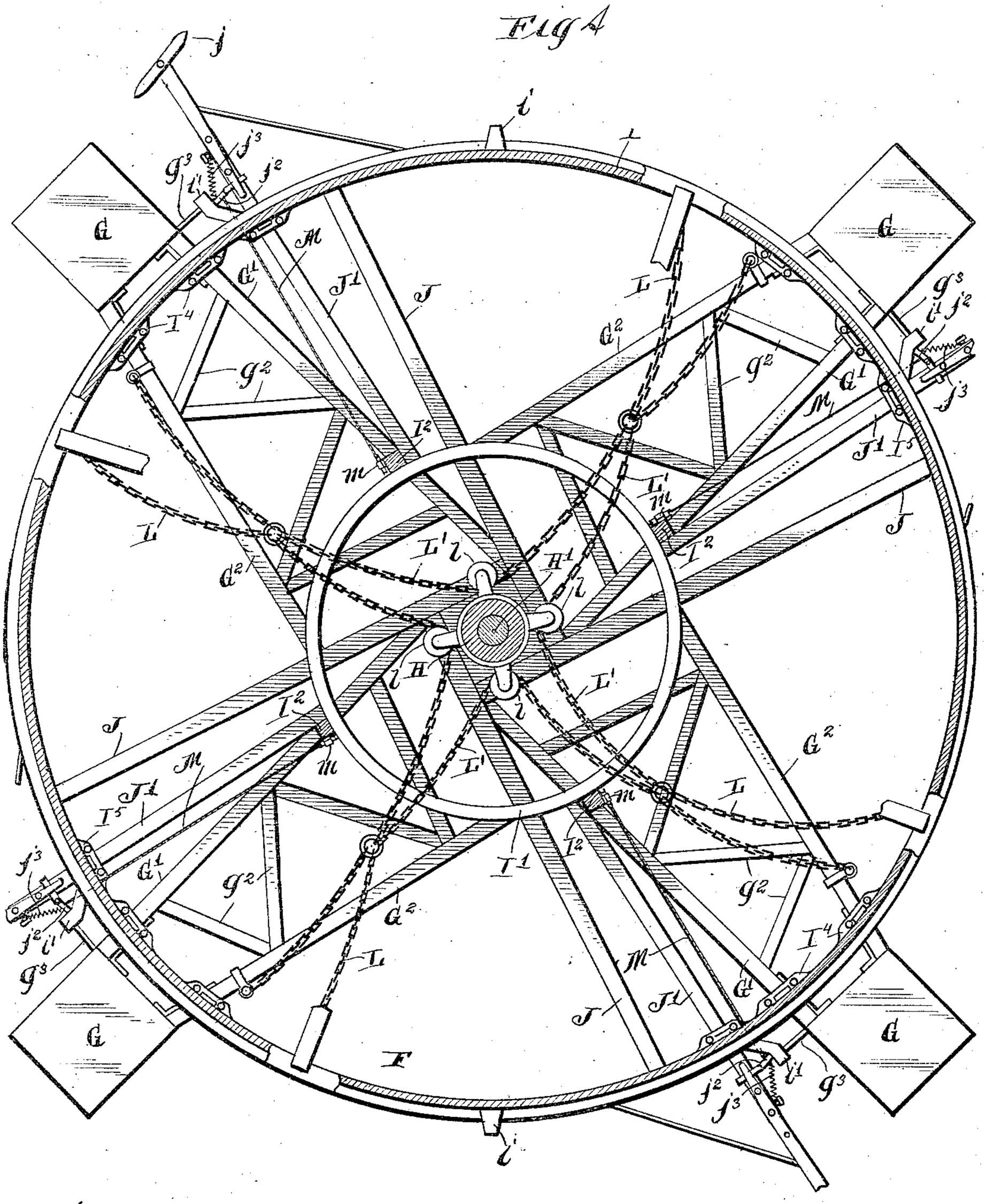
(No Model.) 6 Sheets—Sheet 4.

FIG 4



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(Application filed Jan. 17, 1900.)

(No Model.) 6 Sheets—Sheet 5.

Fig 5.

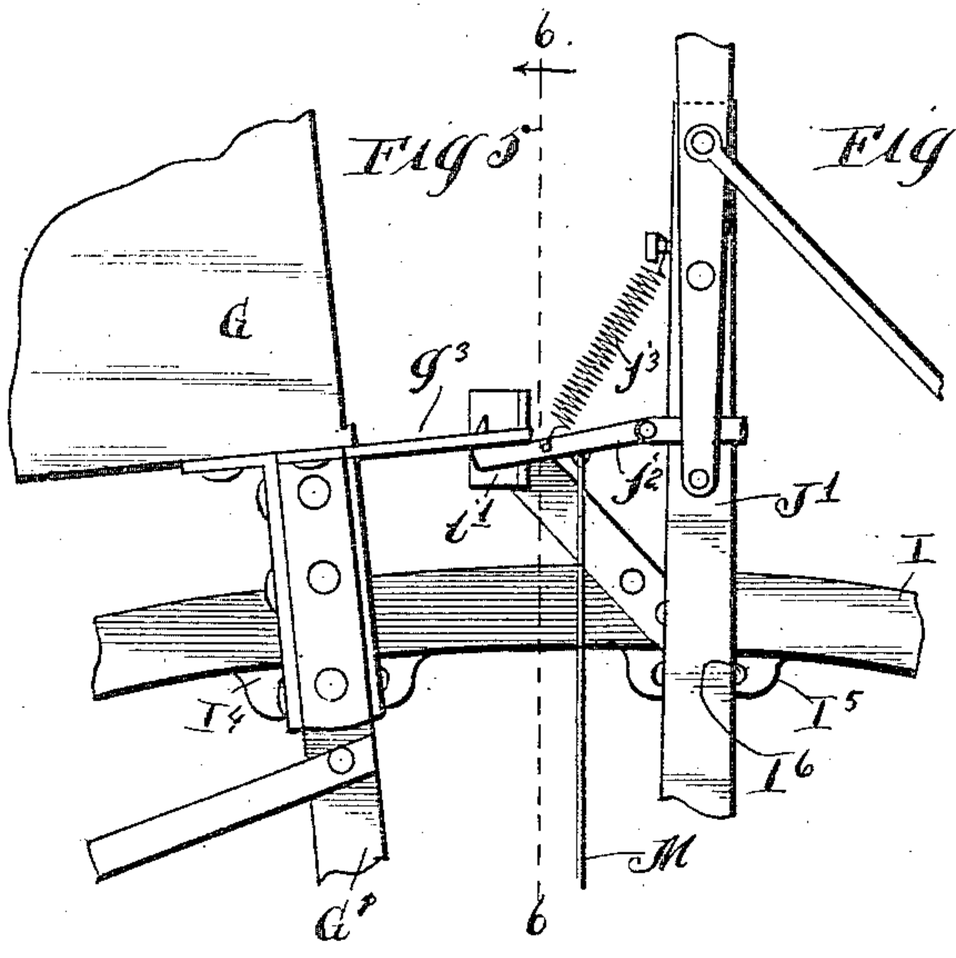


Fig 6.

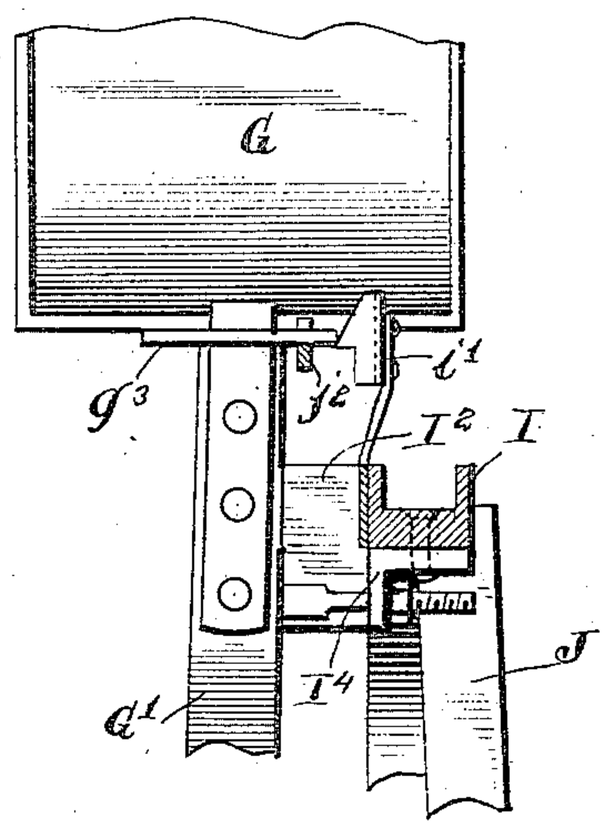


Fig 7.

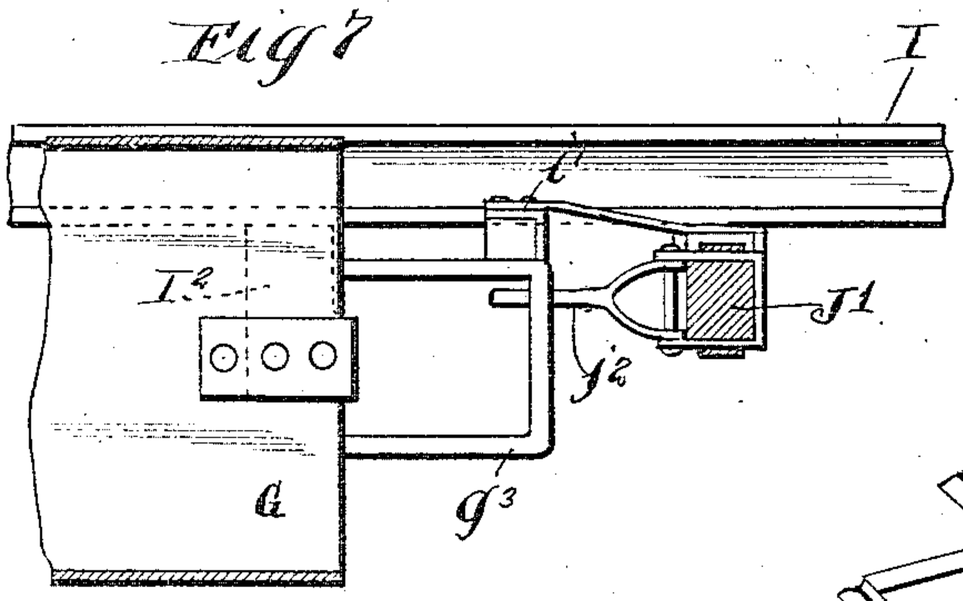


Fig 8.

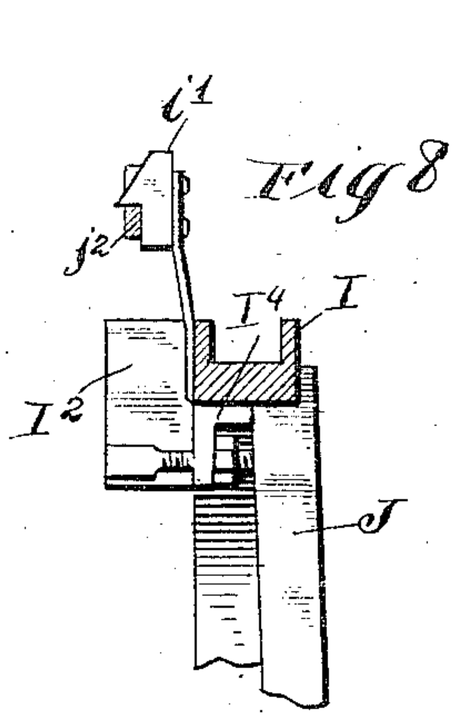


Fig 9.

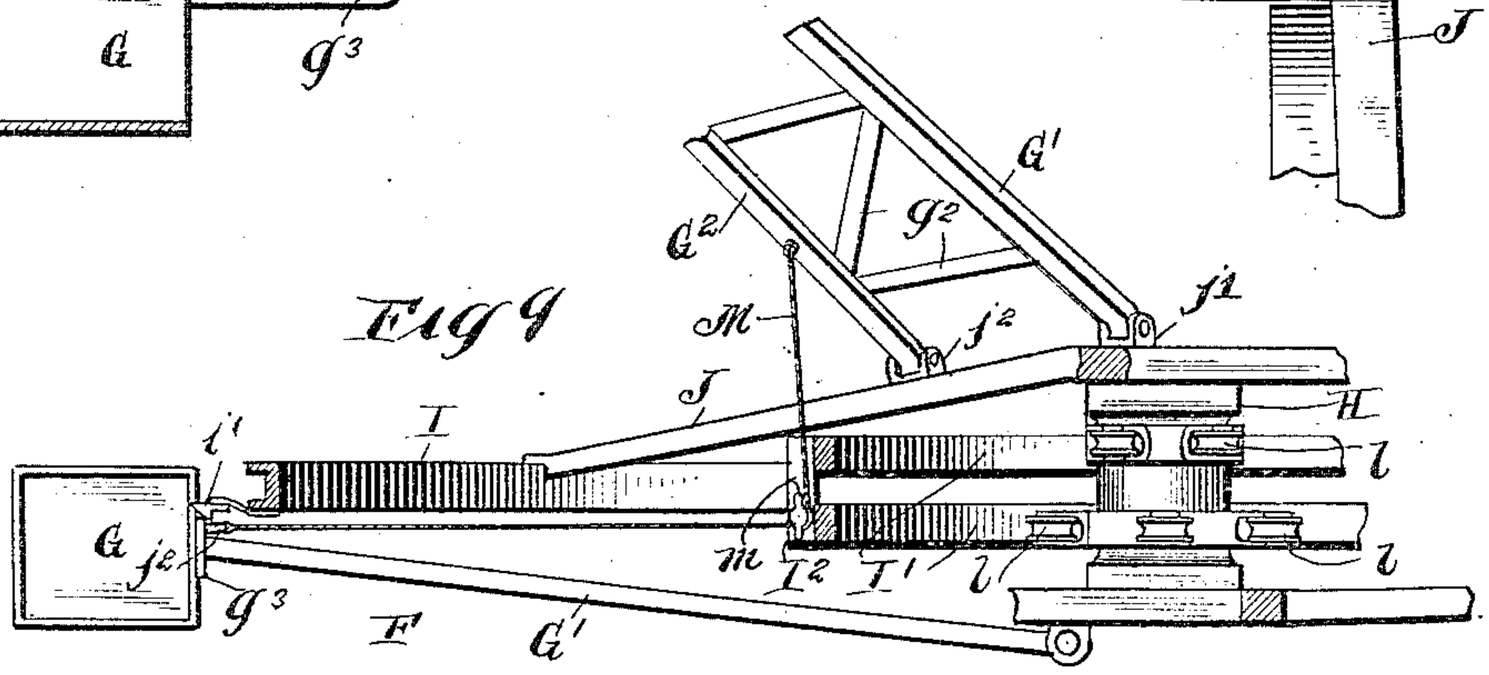
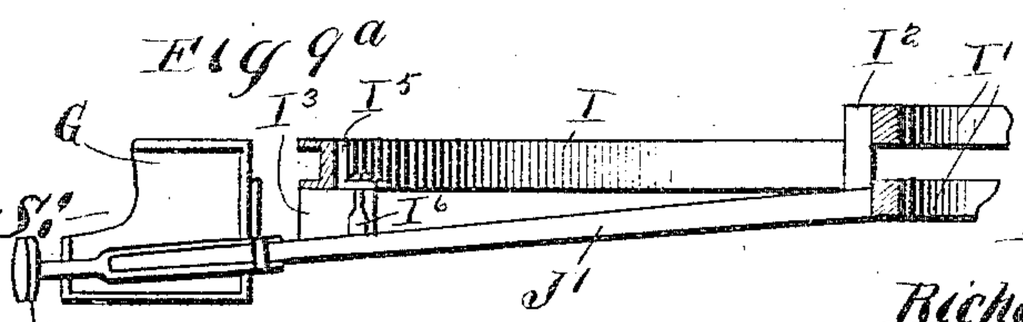


Fig 9a.



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EXCAVATING APPARATUS.

(Application filed Jan. 17, 1900.)

(No Model.) 6 Sheets—Sheet 6.

Fig 10

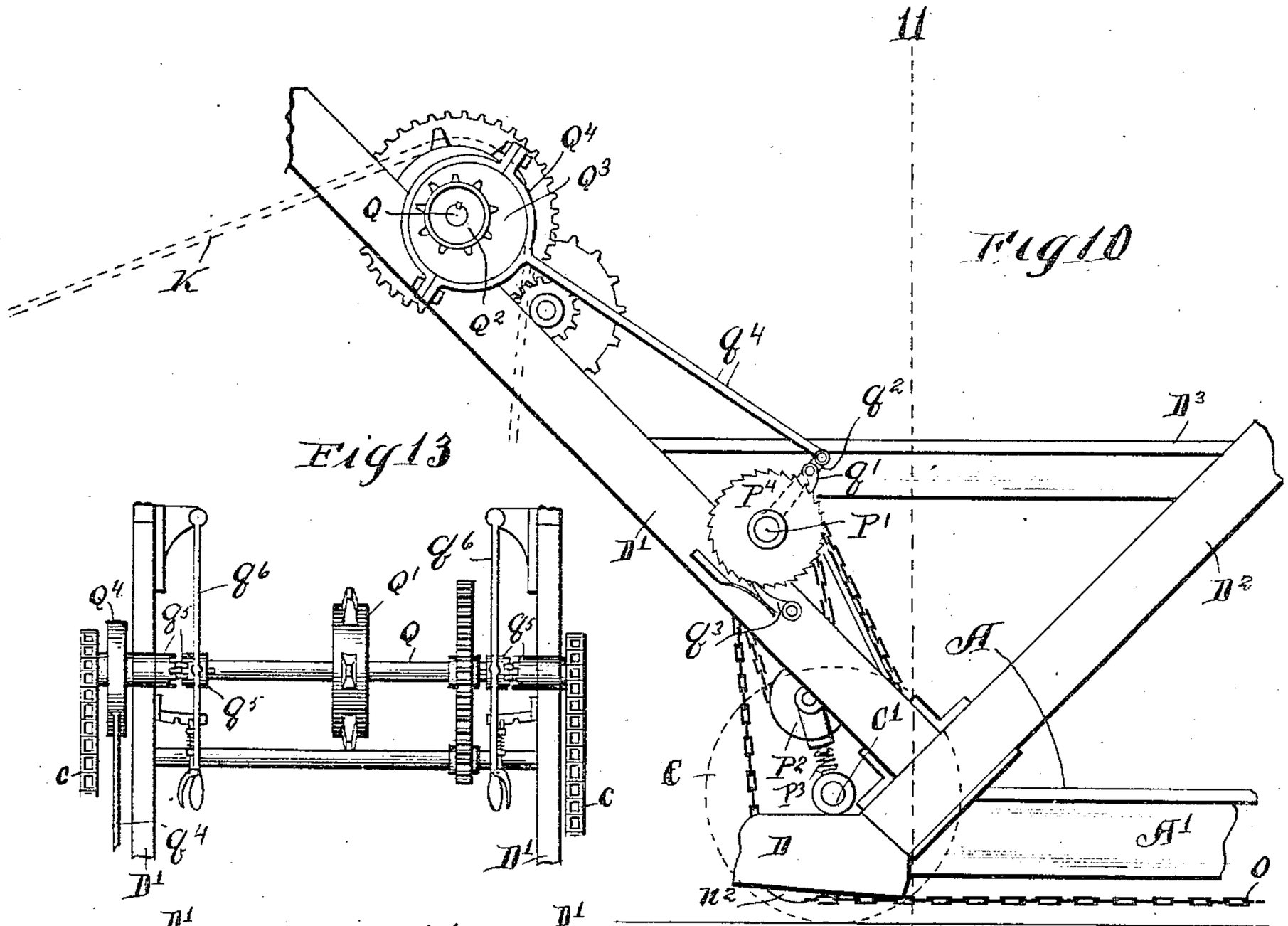


Fig 13

Fig 11

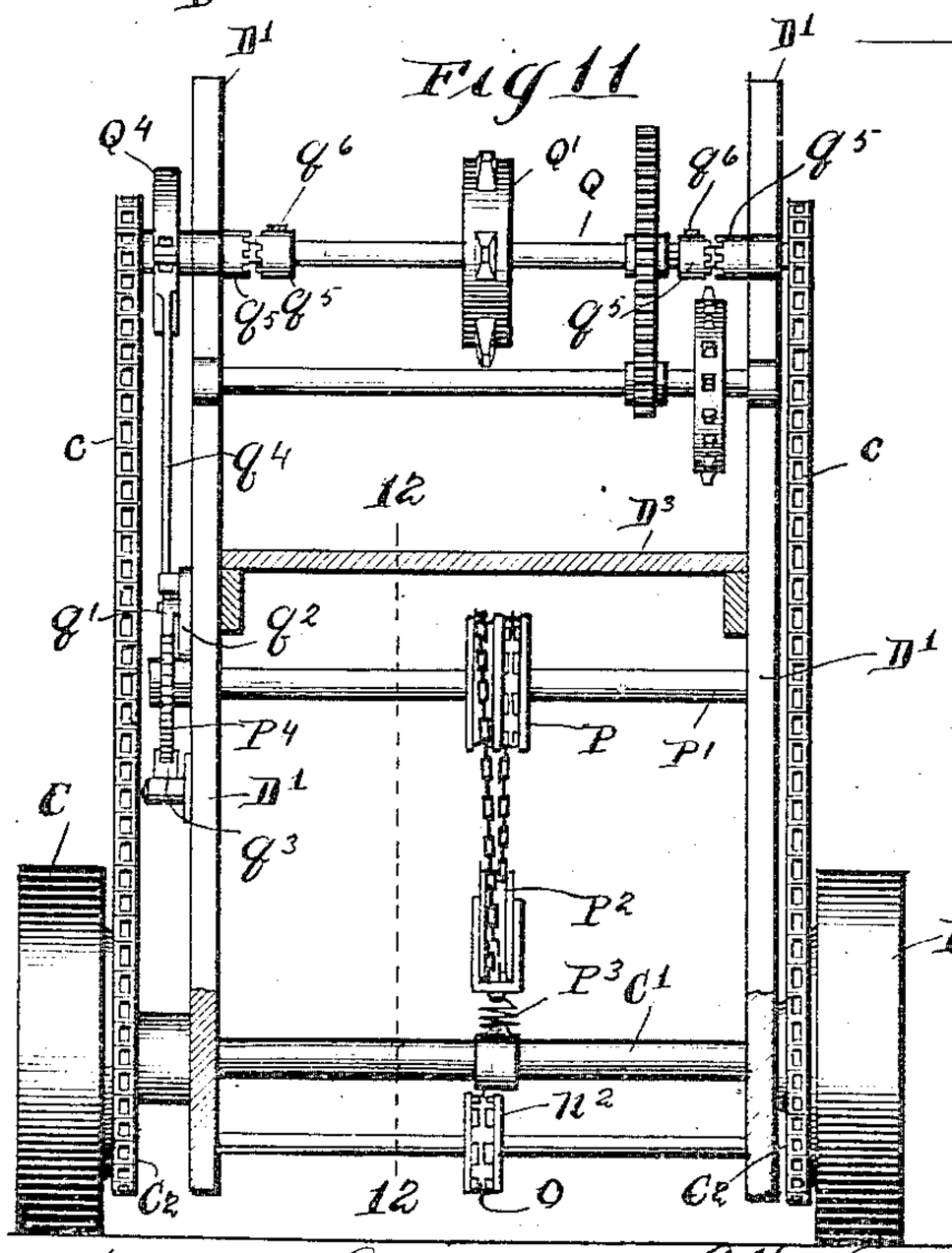
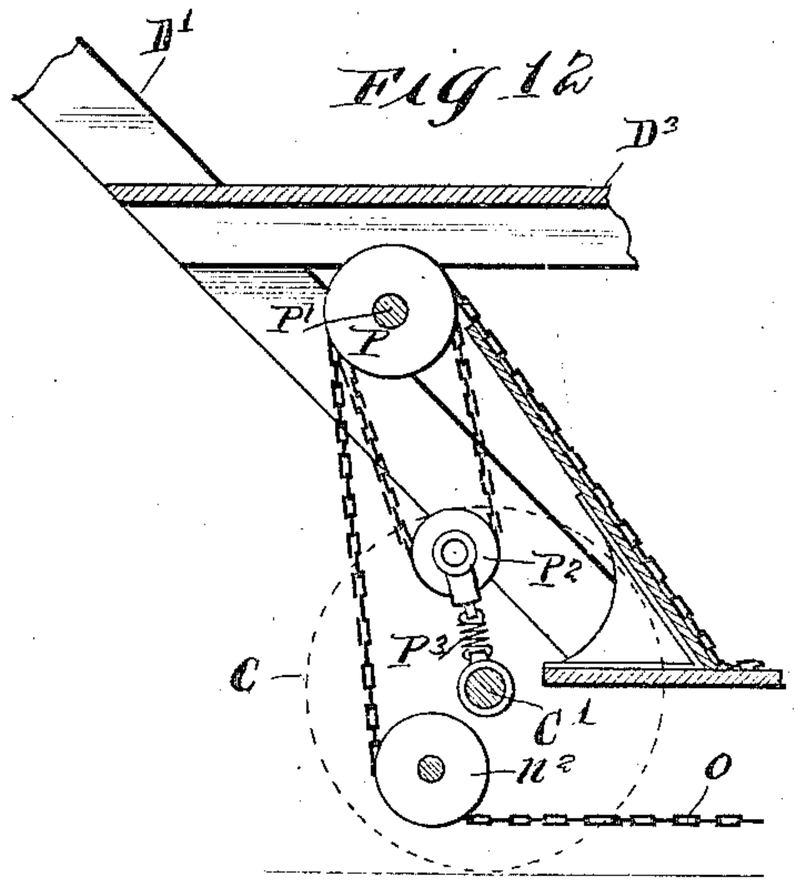


Fig 12



Witnesses: Earl A. Crawford C. M. Hills.

Inventor:
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UNITED STATES PATENT OFFICE.

RICHARD DALTON, OF WILMETTE, ILLINOIS.

EXCAVATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 677,538, dated July 2, 1901.

Application filed January 17, 1900. Serial No. 1,720. (No model.)

To all whom it may concern:

Be it known that I, RICHARD DALTON, of Wilmette, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Excavating Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an excavating apparatus for ditching and like purposes of that kind embracing a rotative wheel frame or hub provided with scoop-bearing arms which are pivoted to the said wheel frame or hub and are movable laterally with respect thereto, so that the material taken up by the scoops while the latter are retracted may be deposited at the side of the line of excavation when the scoops are extended or moved outwardly by the lateral swinging of the scoop-bearing arms on their pivots.

An excavating apparatus embodying my present invention operates on the same general principal as that set forth in my prior Letters Patent, No. 520,916, granted June 5, 1894, but differs therefrom in several respects, as will hereinafter appear.

My invention consists in the matters hereinafter more fully described, and pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a view in side elevation of an apparatus embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is an enlarged side elevation of the scoop-carrying wheel of the apparatus. Fig. 4 is a vertical longitudinal section of the same. Fig. 5 is a fragmentary sectional view of the wheel, illustrating the scoop-locking device. Fig. 6 is a section taken on line 6 6 of Fig. 5. Fig. 7 is a detail plan view of a scoop and locking-device whereby the same is secured to the wheel-rim. Fig. 8 is a fragmentary section of the rim, showing the latch mechanism and adjusting-block. Fig. 9 is a view similar to Fig. 7, but showing the scoop released from engagement with the rim. Fig. 9ª is a view similar to Fig. 9, showing distance-blocks inserted between the plow-arm and wheel rim. Fig. 10 is a fragmentary side elevation of the wheel-carrying frame, illustrating the winch mechanism. Fig. 11 is a section on line 11 11 of Fig. 10. Fig. 12 is a section on line 12 12 of Fig. 11. Fig. 13 is a detail of the operating mechanism. Fig. 14 is a longitudinal vertical section of a plow and plow-arm. Fig. 15 is a diagrammatic view illustrating the means for propelling the machine and adjusting the wheel to different depths of cut.

As shown in the said drawings, A indicates a carrying frame or platform, which is adapted to be moved or shifted along the path of the proposed excavation and is preferably provided with supporting-wheels B B at its front end and C C at its rear end, of which the wheels B B at its front end are mounted on an axle B′, having central pivotal connections with the frame and provided with a tongue B^2. The rear wheels C C are mounted on an axle C′. Pivotally connected with the rear end of said carrying-frame is an adjustable supporting-frame consisting of two rearwardly-extending arms D D and rearwardly and forwardly inclined beams D′ and D^2, said beams being rigidly secured together at a point near the end of the carrying-frame and forming a frame which is pivotally connected with the said carrying-frame, so that the rear end of the arm may be raised and lowered. Conveniently the pivotal connections on the two frames referred to are formed by the axle C′, which is rigidly attached to the longitudinal side members A′ A′ of the frame A and to which the forward end of the arms D D, which extend outside of the frame members A′ A′, are pivotally connected. The frame-pieces D^2 D^2, as shown, are attached at their lower ends to the arms D D, and the frame-pieces D′ D′ abut against and are secured to the pieces. The outer ends of the said frame-pieces D′, as shown, are connected with the outer ends of the frame-pieces D^2 by tie-rods D^4 D^4. A platform D^3 is attached to the frame-pieces D′ D^2. Said platform supports a steam-engine or other motor E. If a steam-engine be used, a boiler E′ will be carried on the platform A.

Mounted on the rear end of the arms D D is a rotative excavating frame or wheel F, carrying a plurality of scoops G. Said wheel is driven from the motor on the carrying-

frame by means of driving connections mounted on said frame. As herein shown, said rotative frame or wheel embraces a hub H, rim I, spokes J, and a circular stay I′, secured on said spokes on each side of the wheel, between the hub and the rim. The said hub is mounted upon an axle H′, supported at the ends thereof in bearing-boxes d' d' upon the rear ends of the arms D D. The wheel-rim is provided with a peripheral groove, in which rests a sprocket-chain K, by means of which motion is transmitted from the motor to said wheel. To prevent said sprocket-chain slipping on the wheel F, a sprocket-tooth i to engage said chain is provided on each side thereof.

Obviously inasmuch as the frame members D D′ D^2 comprise parts of a rigid frame which is pivoted upon the rear axle C′ the said frame may be pivotally swung as a whole upon the frame A for elevating or lowering the excavating-wheel without affecting the operative connection of the same with the motor carried upon the platform D^3. Plow-bearing arms J′, herein shown as eight in number and arranged alternately on opposite sides of the wheel, are rigidly secured to said stay I′ and rim I and extend radially beyond the rim I to a point slightly beyond the outer or cutting edges of the scoops. Upon the outer ends of the said spokes J′ are cutting blades or plows j j, set at such an angle with the said spokes as to insure efficient cutting action in the path of the advancement of the scoops. The said cutting-plows may be of any desired shape or form. As herein shown, however, they are made wider or broadened at their cutting ends or edges and are designed to be self-sharpening. This result is attained by providing a tenon on the outer end of said arm and a mortise through the central part of the plow, the plow being secured to the arm by means of a removable pin which passes through said plow and tenon, as illustrated in Fig. 14. The friction of said plow against the material through which the trench is being cut wears away the outer surface of the end of the plow. When this process has continued to such extent as to reduce the cutting power of the plow, the same is inverted upon the arm, thereby presenting a new cutting edge. As clearly illustrated in Fig. 2, the said plows are offset from each other on either side of the rim of the wheel and are arranged at varying distances laterally from the plane of the wheel in such manner that some of the plows cut on opposite sides of the excavation, trench, or ditch, while others cut at intermediate points.

The scoops, as herein shown, are metallic vessels or buckets having bottom, inner, outer, and side walls. The advance edges of the outer walls are sharpened and act as cutting edges in the advance of the scoops. Said scoops operate both to cut their way through the material to be excavated and also to scoop up material previously loosened or detached by the plows. The said buckets, as shown, are eight in number and are arranged alternately on either side of said wheel-rim and outside the periphery thereof in such manner that when in operative position the said scoops will stand in overlapped relation to each other circumferentially of the wheel or may be placed in alinement with each other circumferentially. The width of the excavation, ditch, or trench will obviously be dependent upon the lateral distance apart of the outer side faces of the scoops, and in order to enable such excavation, ditch, or trench to be varied in width I attach to the sides of the wheel-rim or elsewhere on the wheel blocks I^2, in position for contact with the scoop-supporting arms when the latter are retracted, said blocks serving to determine the lateral position of the scoops with respect to the wheel-rim and each other. If the blocks be entirely removed, the scoop-arms will rest close to the wheel-rim, and the scoops will then be in alinement with each other circumferentially of the wheel, and the trench will be no wider than the width of the scoops, and by placing thicker or thinner blocks on the wheel the scoops will be spread apart to a greater or less extent and the width of the trench correspondingly varied. Said blocks thus attached to the wheel constitute, in effect, adjustable stops for limiting the inward movement of the scoops, and adjustable stops of other construction may obviously be used with the same result. When the limiting-stops for the scoops are set to cut a wider or narrower trench, it is obviously necessary to correspondingly change the lateral position of those of the plows which are located at the greatest distance from the plane of the wheel and which therefore cut at the sides of the trench. Provision for such adjustment is made by inserting distance pieces or blocks I^3 between some of the plow-arms and the wheel-rim and by making such distance pieces or blocks removable, so that in the case of the plows which are at the widest distance apart blocks may be inserted of sufficient thickness to hold the plow-arms in proper position.

As shown in the drawings, the blocks I^2, which determine the position of the scoops, are secured by bolts to angle-pieces I^4, secured to the inner surface of the wheel-rim, while in the case of the plow-arms similar angle-pieces I^5 are secured to the inner faces of the wheel-rim, and the plow-arms are secured to the rim by clips I^6, which extend around the arms and pass at their ends through holes in said angle-pieces, the distance blocks or pieces I^3 being inserted and clamped between the arms and said rim within said clips.

The buckets are movably secured upon the wheel, as follows: Each of the four spokes on each side of the said wheel is provided near its inner end with a lug j', forming one of the members of a hinge, and a similar member j^2

is secured on each of the said spokes at a considerable distance outwardly from the wheel-hub. Rigidly secured to the said scoops or buckets are bars G′ G², of which the bar G′ is secured to the front end of the bucket and the bar G² is secured to the rear end thereof. The bars G′ and G² together constitute the scoop-supporting arms. The inner ends of said bars G′ G², respectively, are provided with members of a hinge-joint complemental to the hinge-joint members j' j^2 and are indicated, respectively, by g g'. The bars are connected by oblique braces g^2, rigidly secured to each bar, whereby the same are held rigidly in proper relation to each other and the arms are made suitably stiff. The bar G′, which extends from the front end of the scoop or bucket to the inner end of the spoke, is sufficiently longer than the bar G² to insure the scoop or bucket being held in the most advantageous position while the same is being filled and emptied. Inasmuch as the said bars are hinged to the spoke at different radial distances from the center of the wheel, it follows that as the wheel rotates in the direction of the cut of the scoop said scoops at at the front part of the wheel have a tendency to swing laterally therefrom when the supporting-arms thereof reach a horizontal position, as illustrated in Figs. 1 and 2. Obviously the continued rotation of the wheel with the said scoop in its extended position causes the said scoop to be inverted, with the effect of dumping its contents therefrom at the side of the ditch. When the spoke passes its vertical position, the pivotal supports of the scoop are in such positions that the said scoop swings backwardly to its retracted position against the rim of the wheel, the scoop-arms in this respect operating in the same manner as those shown in my said prior patent hereinbefore referred to. The operation of the said scoops or buckets may be effected through gravity alone; but for the purpose of insuring the prompt return of the empty bucket to its position against the rim under all circumstances I have provided means whereby the outward movement of a full bucket tends to retract the empty one. These parts are clearly illustrated in Figs. 3 and 4. The devices for this purpose herein shown are made as follows: Each scoop is provided with a chain L, which is secured at one end to the outer end of one of the spokes supporting the rim of the wheel and at the other end is secured to the outer end of the arm G² of the scoop. The said chains are of sufficient length to permit the said buckets to swing outwardly to the full limit of their movement. In the bight of each of said chains, as shown, one of the links is made larger or a ring is inserted in lieu of the link, and each of said large links or rings is connected with the ring of the next succeeding chain L on the same side of the wheel by means of chains L′ L′, the bights of which are passed around the pulleys l, located at or near the center of the wheel. The length of said chains is such that when the scoops are in position against the rim, as illustrated in Figs. 3 and 4, the said chains assume the positions therein illustrated. When, however, the loaded buckets swing outwardly, as illustrated in Fig. 1, the weight thereof being much greater than that of the empty bucket, which has previously swung outward on the same side of the wheel, the strain upon the chain L is communicated to the similar chain of the said empty bucket by means of the connecting-chain L′, whereby the empty bucket is drawn back against the wheel-rim or into its normal or cutting position.

As a further improvement I have provided guides or supports G³ G³ for the loaded scoops or buckets, extending obliquely outward and rearward on each side of the excavating-wheel, as clearly illustrated in Fig. 2. The said guides are rigidly secured to the framework of the machine and incline slightly upward toward the dumping position of the scoops at each side of the wheel. As the loaded scoop or bucket swings outwardly the same is supported by the said guide. Said guides serve to make the movement of the scoops more smooth and regular, as they prevent the same from swinging too quickly and forcibly downward and outward under the weight of the loads therein when the pivotal axes of the scoop-arms reach the position at which gravity acts on the scoops to throw them outward, it being obvious that in the absence of such guides the loaded scoops might fall or swing with such force as to produce an undesirable shock or jar when stopped by the chains which limit their movement.

Inasmuch as the scoop-supporting arms are pivotally connected with the wheel near the center thereof, said arms would need to be made very heavy and strong to withstand the strain of the scoops in cutting if the stiffness of the arms alone be relied upon to take such strain, and I have provided means for locking said scoops or arms to the outer part of the wheel or the wheel-rim in such manner as to prevent backward strain on the arms or backward movement of the scoops relatively to the wheel-rim in the direction of the plane of the wheel during the operation of cutting. Locking means for this purpose are shown in the drawings and illustrated in Figs. 3 and 4 and in detail in Figs. 5, 6, 7, 8, and 9, as follows: As clearly illustrated in the said figures, the front side of the scoop or bucket is provided with a bail g^3, rigidly secured thereon and projecting forwardly therefrom, near the bottom thereof. A spring-latch j^2 is hinged to the plow-bearing arm J′ and is provided with an upturned end adapted to engage the said bail g^3 of the adjacent scoop. A spring-catch i' is rigidly secured on the rim, with its end projecting upwardly and adapted to hook over and engage the said latch j^2 and hold the same in a retracted position. The upper

end of the said spring-catch i' is sloped or inclined outwardly from the said bail and is adapted to be knocked out of engagement with the latch j^2 by the said bail when the scoop swings back into position against the rim after dumping. A spring j^3, herein shown as a spiral n[illegible]ng-spring, is secured to the said latch j^2 and to the said plow-bearing arm J′ and acts to draw the outer hooked end of the said spring-latch upwardly into locking engagement with the bail g^3 when the bail (as the said scoop or bucket swings back to position against the rim) strikes against the inclined surfaces of the spring-catch i' and knocks the same laterally out of engagement with the latch. The latch thus arranged obviously serves to hold the scoop firmly interlocked with the outer or peripheral part of the wheel while the scoop is cutting, thereby relieving the scoop-arm and its pivots largely from strain at this time. As clearly illustrated in Figs. 4, 5, and 9, means are also provided for releasing the said locking device from the scoop at a point in the rotation of the wheel where the said scoop swings outwardly to its dumping position. Said releasing means are constructed as follows: A chain M is secured to each of said spring-latches, near the middle thereof, and extends radially inward toward the axle and passes around a pulley m, secured on the stay-band I′. The outer end of said chain is made fast to the arm G^2 of the scoop next in advance of the one about to be released, as clearly illustrated in Figs. 4 and 9. As heretofore described, the said scoop next in advance will swing outwardly on the opposite side of the wheel from the scoop to be released. The outward movement thereof will bring a strain upon the chain M, which will retract the latch j^2 sufficiently for it to be engaged by the detent i'. The bail of the scoop or bucket will now be released from the locking engagement of the said latch, as shown in Fig. 9, and the said scoop will be free to swing outwardly to its dumping position. When said latch is disengaged from the bail, it is engaged by the said catch i', which holds the same in its retracted position until the said scoop or bucket swings back to position against the rim, as before described, when the bail engaging the said catch causes the release of the said latch, whereupon it hooks into the bail and securely locks the scoop to the rim, as before described.

Obviously any propulsive or tractive means may be used in the operation of my invention; but preferably the means illustrated in Figs. 1, 2, 10, 11, 12, 13, and 15 are used. For the purpose of advancing the machine during the operation of excavating an anchor or stake N is rigidly secured some distance in advance of the apparatus and in the line in which it is desired to advance, and a pulley n is secured thereto, a similar pulley n' being secured on the front end of the frame A. A cable O, preferably a chain cable, passes through said pulleys, and one end thereof is secured at the outer end of the frame member D^2. The other end of said cable extends beneath the frame A of said machine and around a pulley n^2 at the rear thereof and is led upwardly to a winch. The said winch consists of a pulley P, supported on a shaft P′, journaled on the frame members D′ D′. As shown, the said pulley P is provided with grooves in its periphery, and sprocket-teeth to engage the chain are located in said grooves. A tension device is provided for said winch comprising a pulley P^2, similar to and in the same plane with the pulley P and yieldingly connected with the frame A by means of a strong spiral spring $P^{3\prime\prime}$, as illustrated in Figs. 10, 11, and 12. The said inner end of the cable is passed around both of the said pulleys, as illustrated in the said figures. By this means any desired strain may be sustained without the said chain slipping, inasmuch as the said teeth on the periphery of each pulley engage the links of the chain. Furthermore, any desired amount of frictional engagement with said pulleys may be secured by passing said chain a greater or less number of times around said pulleys, for obviously any number of grooves may be provided in the peripheries thereof. Obviously strain produced upon the said cable O by means of the said winch acts to advance the said machine along the path of the desired cut and also secures another desirable purpose—that is to say, the strain communicated to the front end of the frame member D^2 by means of the pulley n and n' tends to lift upwardly on the excavating-wheel, so that a part of the weight of the same when cutting is sustained by the draft upon the said cable. This is a matter of great importance, for in the event of a scoop coming in contact with any obstruction—as, for instance, a stone in the line of the cut—the forward movement of the apparatus is checked somewhat, whereupon the greater portion of the strain produced by the winch is brought upon the frame in a manner to lift the wheel and allow the scoop to pass over such obstruction, whereupon the next succeeding scoop of the obstruction, if not too large, will remove it.

The winch heretofore described may be operated by any desired means; but it is preferable to operate the same from the motor which drives the excavating-wheel. For this purpose I have provided operative connection between the same and said winch, as follows: A shaft Q, which carries the driving-wheel Q′, whereby the excavating-wheel is operated, is provided on its outer end adjacent to the frame member D′ with an eccentric Q^3. An eccentric yoke Q^4 of familiar construction surrounds said eccentric. The outer end of the shaft P′ is provided with a ratchet-wheel P^3 and an oscillating arm q^4 is pivoted on said shaft and extends outwardly beyond the periphery of said ratchet and carries a pawl q', adapted to engage said

ratchet-wheel. An eccentric-rod connects said eccentric yoke with the outer end of said arm. A spring-pressed pawl q^3 is pivoted on the frame member D^2 in position to engage the said ratchet-wheel on the side opposite the said pawl q'. When the shaft Q is rotated by the motor, the said crank-pin communicates reciprocal motion to the connecting-rod q^4, whereby the said ratchet and ratchet-wheel act to rotate the winch, the pawl q^3 effectively holding the winch from rotation in the wrong direction.

Obviously other pulleys may be interposed or the form of the winch may be modified without materially departing from the principle of this feature of my invention, which is to drive the said winch from the same motor that operates the excavating-wheel and by the operation of the said winch secure the advance movement of the machine and at the same time provide for lifting the wheel to the extent necessary for the passage of the scoop over stones or obstructions which are so firmly embedded or so large as to make liable the breakage of the scoops.

While in the drawings the said apparatus is shown set up in operative position for the work of excavating, obviously, inasmuch as the wheel-bearing frame is pivoted upon the frame A, as before described, the outer end of the frame member D' may be drawn downwardly to any desired extent or to a position in which the same rests upon the frame members A, in which event the excavating-wheel is lifted entirely out of its excavation. The machine may, under its own power or otherwise, be conveyed to any desired location when so adjusted. For the purpose of raising the excavating-wheel out of the excavation when the motor is not in operation a supplemental winch R of familiar form is provided. The said winch R is secured upon the frame A, and ropes or chains are attached at the ends of a cross-piece on the frame members D^2 and applied in the usual manner to the winch, as illustrated in Fig. 1. By means also of this winch any desired regulation as to depth of the excavation made by said wheel may be secured.

Figs. 11 and 13 illustrate means for propelling the machine when the same is not engaged in excavating. As shown, the shaft Q is provided at its ends with sprocket-wheels Q^2 Q^2. Complemental sprocket-wheels C^2 C^2 are provided on the inner side of the traction-wheels C C and in alinement with the said sprocket-wheels Q^2 Q^2, and sprocket-chains *c c* are trained around said sprocket-wheels. Clutches q^5 q^5, each composed of a fixed and a longitudinally-movable member, are provided on said shaft Q adjacent to the frame members. Hand-levers q^6 of a familiar form are pivoted on the frame and to the movable member of the clutch, whereby the said movable member of the clutch may be moved into and out of engagement with the complemental fixed member on the same end of the shaft. When it is desired to propel the machine by means of said mechanism, the excavating-wheel is elevated sufficiently high to avoid contact with the earth. The same is disconnected from the motor and by means of the operating-levers q^6 q^6 the said clutches are thrown into operating engagement, whereupon the rotary motion communicated by the motor to the shaft Q is communicated to the driving-wheels C by means of a sprocket before described. Inasmuch as there are two of the said clutches, either may be used separately or both may be thrown into operation at the same time. When the excavator is propelled in the manner described, it will ordinarily be steered by means of a tongue B^2; but obviously the steering may be accomplished by means of the operating-levers q^6 q^6, direction being determined by the throwing of one or the other of said clutches into operative engagement, whereby one of the chains *c* upon one side of the machine will cause rotation of the traction-wheel C, while the other chain *c* on the opposite side of the machine is at rest.

The employment of a series of plows—one in advance of each scoop—has the advantage of lessening the work to be done by and the consequent strain on the scoops, the said plows when so arranged acting to loosen the material in advance of the scoops and deposit such loosened material in the scoops, the loosened material obviously filling by gravity into the scoops as it is detached from the heart of the excavation by said plows. Moreover, the material being loosened by the plows and falling loosely into the scoops will be discharged therefrom more readily and freely than would be the case if the material was taken up by the scoops without being previously loosened.

Many of the details of construction illustrated and above described are not essential to the carrying out of the broad features of my invention when separately considered. The scope of the invention will be set forth in the appended claims, and it is to be understood that the omission of an element or the omission of a particular feature of any of the elements mentioned in any given claim is intended to be a formal declaration of the applicant that the omitted elements or features are not essential to the invention therein set forth.

I claim as my invention—

1. An excavating apparatus embracing a rotative wheel scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect to the wheel, said arms being arranged alternately at opposite sides of the wheel and the scoops on opposite sides of the wheel being adapted to stand in overlapped relation with each other circumferentially when in their retracted positions.

2. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lat-

eral movement with respect to the wheel, said arms being arranged alternately at opposite sides of the wheel and plows attached to the wheel at both sides thereof, and means for adjusting said arms laterally to afford a desired width of cut.

3. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect to the wheel, said arms being arranged alternately at opposite sides of the wheel and reversible double-ended plows attached to the wheel at both sides thereof.

4. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect to the plane of the wheel, said arms being pivoted to the wheel so as to swing about axes oblique to the plane of rotation of the wheel, so that the said arms tend to move both outwardly and inwardly by the action of gravity, and means supplementing the action of gravity in the return of the arms from their extended to their retracted positions acting on said arms to insure their return before the scoops on the same reach the ground in their downward movement.

5. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect thereto, and connections between the said arms whereby outward movement of each arm will produce inward movement of another arm.

6. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect thereto, connecting-chains between the said arms and guide-pulleys for the same, whereby outward movement of each arm produces inward movement of another arm.

7. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with said wheel and capable of lateral movement relatively to the plane of the wheel, chains connecting each arm with the wheel and acting to limit the outward movement of the arm, arm-actuating chains connecting the limiting-chains with each other, and guide-pulleys for said arm-actuating chains.

8. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted to the wheel and having lateral movement relatively thereto, and locking means securing the scoops to the periphery of the wheel and acting to hold the scoops from movement in the direction of the plane of the wheel.

9. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted to said wheel and having lateral movement relatively thereto, locking devices for holding the scoops from movement with respect to the wheel in the direction of its plane of rotation and means for automatically releasing said locking devices to permit the lateral movement of the scoops.

10. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted to said wheel and having lateral movement relatively thereto, spring-actuated latches on the wheel adapted to engage the scoops, catches acting on the latches to hold the same temporarily out of position for engagement with the scoops, and means operated by each of the said arms acting to release the catch associated with one of the other arms.

11. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted to the wheel and movable with respect thereto, said arms being located alternately on opposite sides of said wheel, spring-actuated latches on the wheel engaging the scoops to hold the same from backward movement with respect to the plane of the wheel, and chains connecting each arm with the latch belonging to an arm at the opposite side of the wheel.

12. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted to the wheel and movable laterally with respect thereto, said arms being pivotally connected with the wheel so as to swing about axes oblique to the plane of rotation of the wheel, whereby said arms tend to move both outwardly and inwardly by the action of gravity, and oblique guides at the sides of the wheel located in position to support and guide the scoops in the outward lateral movement of the same under the action of gravity.

13. An excavating apparatus embracing a rotative wheel, provided with a circular rim, scoop-bearing arms pivoted to the wheel and movable laterally with respect thereto, and driving means for the wheel embracing a driving-pulley and a driving-belt trained around said driving-pulley and the rim of the said wheel.

14. An excavating apparatus embracing a rotative wheel provided with a circular rim, scoop-bearing arms pivoted to the wheel and movable at their outer ends laterally with respect thereto, means for locking the scoops to the outer part of the wheel when said scoops are in their retracted position and means for driving the wheel embracing a driving-pulley and a driving-belt trained around said pulley and said wheel-rim.

15. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted thereto and movable laterally with respect to said wheel, a movable supporting-frame, a wheel-carrying frame pivoted to the supporting-frame, a motor and driving-gear for the wheel mounted on said wheel-carrying frame, and adjusting means for changing the angle of the carrying-frame with respect to the supporting-frame.

16. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted thereto and movable laterally of the wheel, a movable supporting-frame, a wheel-carrying

frame pivoted to the supporting-frame, a motor and driving-gear for the wheel, mounted on said wheel-carrying frame, and tractive means for advancing the apparatus, said tractive means acting on the wheel-carrying frame to lift the weight of the excavating-wheel when the same is in operation.

17. An excavating apparatus embracing a movable supporting-frame, a wheel-carrying frame pivoted thereto, a wheel mounted on said carrying-frame and provided with scoop-bearing arms, a traction-cable and means acting on the same to advance the apparatus, said traction-cable being arranged to exert tension on the wheel-carrying frame at a point distant from its pivot and in a direction to lift the wheel.

18. An excavating apparatus embracing a rotative wheel laterally-movable scoop-bearing arms pivoted thereto, a movable supporting-frame, a wheel-carrying frame pivoted to the supporting-frame, a motor and driving-gear for the wheel mounted on said wheel-carrying frame, a traction-cable acting in the supporting-frame and engaging said wheel-carrying frame at a point distant from the pivot thereof and a winch for exerting tractive strain on the said cable whereby strain on said cable in advancing the machine tends to lift the wheel.

19. An excavating apparatus embracing a rotative wheel, scoop-bearing arms on said wheel, a movable supporting-frame, a wheel-carrying frame pivoted to the supporting-frame, a motor and driving-gear for the wheel, tractive means comprising a winch and a cable having one of its ends secured to the wheel-carrying frame, at a point distant from its pivot and its other end applied to said winch, and operative connections between said motor and said winch.

20. An excavating apparatus embracing a rotative wheel provided with scoop-bearing arms, a movable supporting-frame, a wheel-carrying frame pivoted thereto, a motor and driving-gears for the wheel mounted on the wheel-carrying frame, a winch also mounted thereon and comprising a rotative barrel or drum, a pulley yieldingly secured to the supporting-frame and acting as a tension member for the winch, and operative connections between said motor and winch.

21. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivoted thereon, a movable supporting-frame, a wheel-carrying frame pivoted thereon, a motor, and driving-gear for the wheel mounted on the wheel-carrying frame, winch also mounted thereon, and operative connection between the motor and the winch comprising a ratchet-wheel on the winch-shaft, a pawl to hold said ratchet-wheel from rotation in one direction, an oscillatory pawl mounted on the frame and engaging said ratchet-wheel, a wheel rotated by the motor, a wrist-pin thereon and a connecting-rod engaging said wrist-pin and the said oscillatory pawl.

22. An excavating apparatus comprising a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect to the wheel, and means for variably limiting the inward movement of the arms, whereby excavations of varying widths may be made.

23. An excavating apparatus embracing a rotative wheel, scoop-bearing arms pivotally connected with the wheel and capable of lateral movement with respect to the wheel, a series of plows attached to the wheel between the scoops, means for variably limiting the inward movement of said scoops to give a varied width of cut, and means for adjusting said plows laterally of the wheel, whereby the latter may be changed in position to correspond with the position of the scoops.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 11th day of January, A. D. 1900.

RICHARD DALTON.

Witnesses:
C. CLARENCE POOLE,
C. W. HILLS.