No. 606,987. Patented July 5, 1898.

J. H. CLARK.

DITCHING MACHINE.

(Application filed May 26, 1897.)

(No Model.) 2 Sheets—Sheet 1.

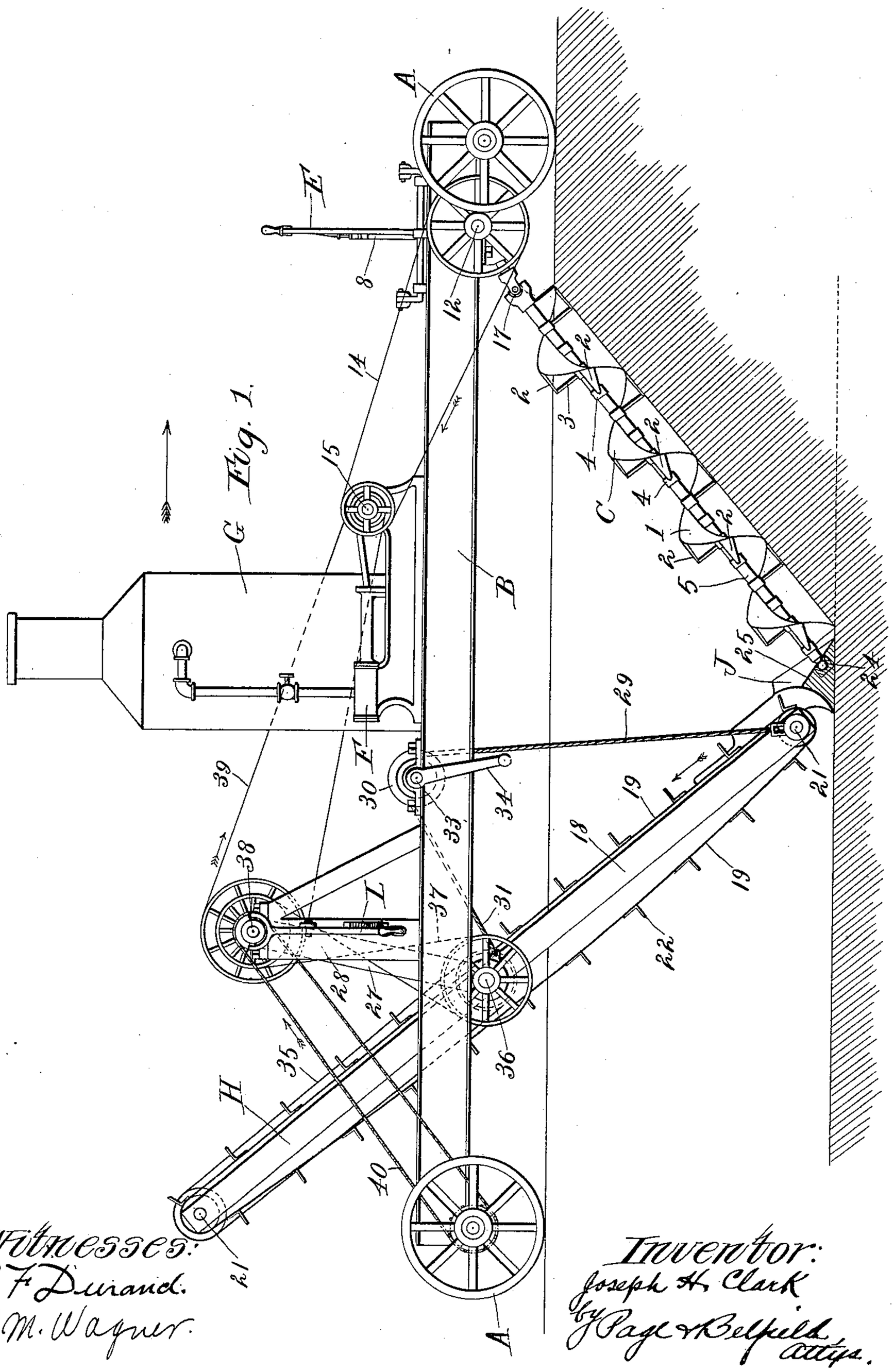

Fig. 1.

Witnesses:
A. F. Durand.
R. M. Wagner.

Inventor:
Joseph H. Clark
by Page & Belfield
attys.

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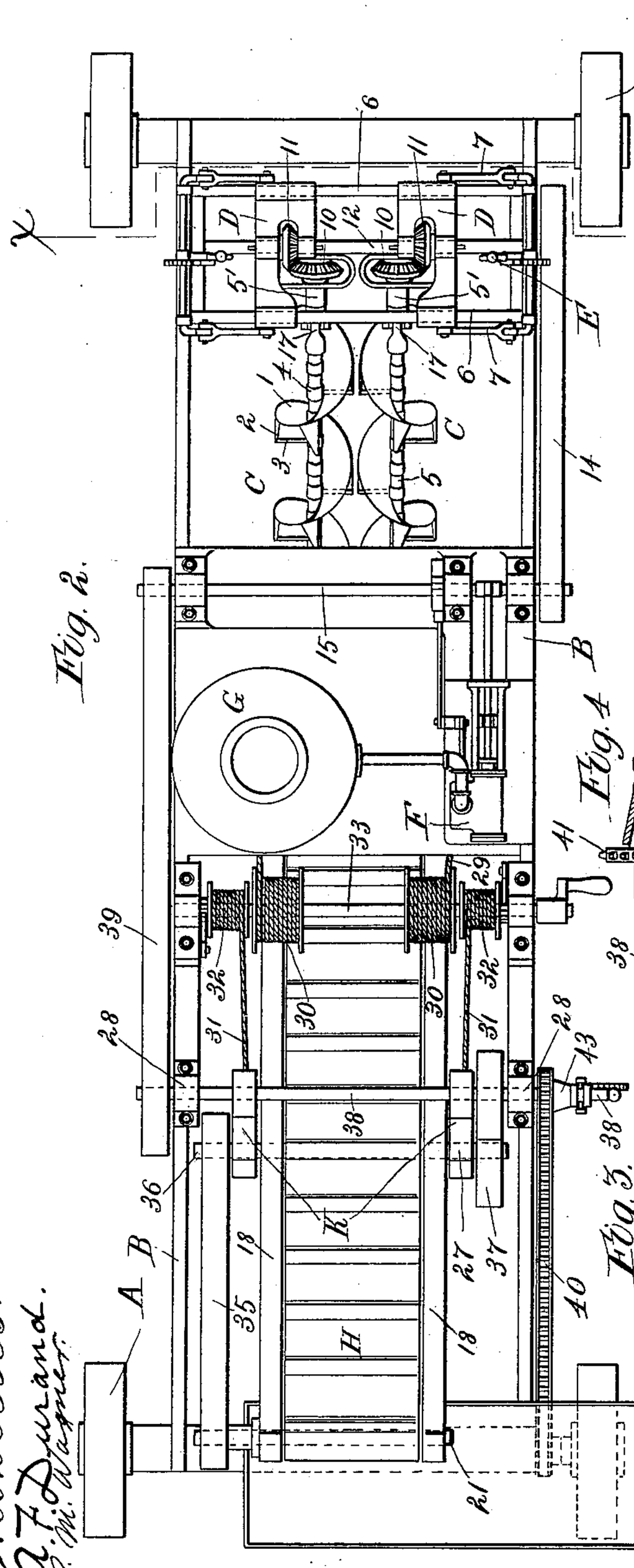

Fig. 2.

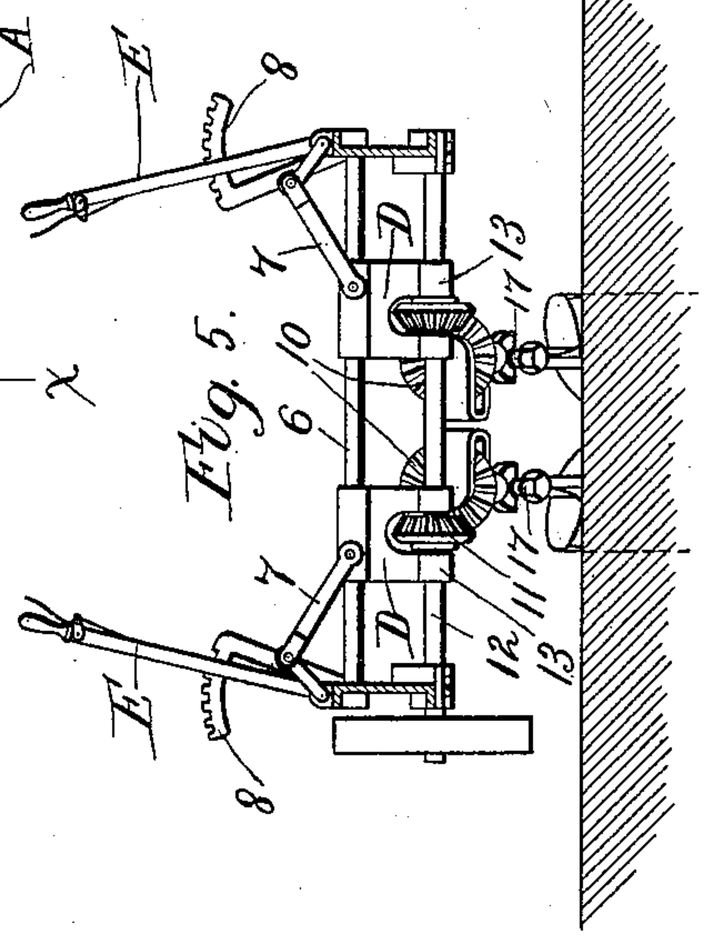

Fig. 5.

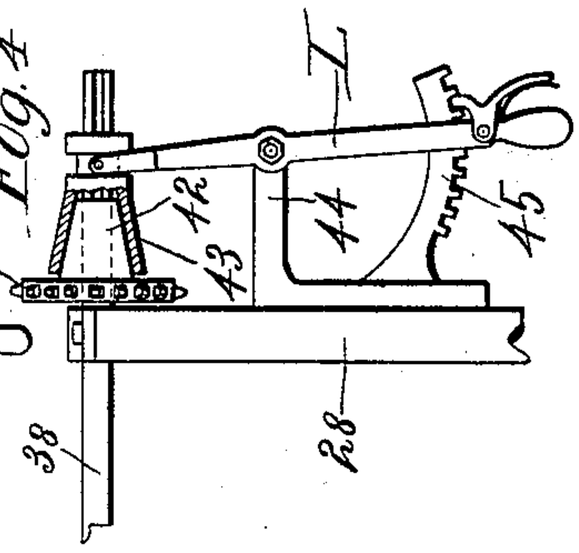

Fig. 4.

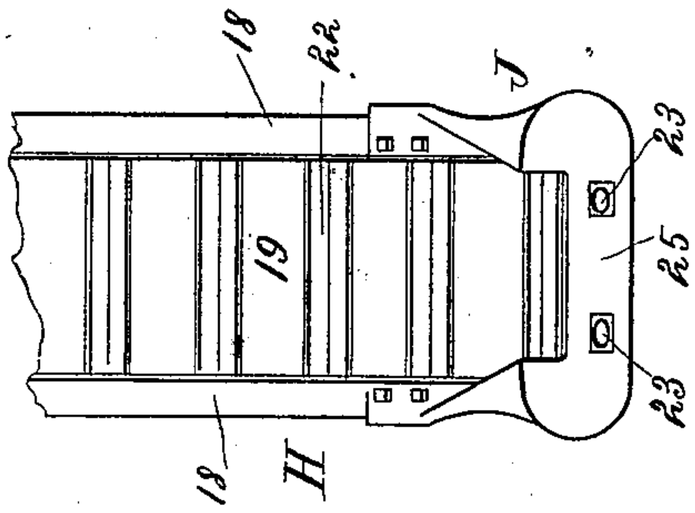

Fig. 3.

Witnesses:
A. T. Dunand.
R. M. Wagner.

Inventor:
Joseph H. Clark
by Page & Banfield
Attys.

UNITED STATES PATENT OFFICE.

JOSEPH H. CLARK, OF CHICAGO, ILLINOIS, ASSIGNOR TO FREDERICK C. AUSTIN, OF SAME PLACE.

DITCHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 606,987, dated July 5, 1898.

Application filed May 26, 1897. Serial No. 638,313. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. CLARK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Ditching-Machines, of which the following is a specification.

My invention relates to machines more particularly adapted for digging or excavating long and comparatively narrow ditches or trenches.

Prominent objects of my invention are to prevent the caving in of the side walls of the ditch, to arrange for the easy and ready adjustment of the machine for excavating ditches of various depths, to provide simple, convenient, and practical devices for excavating the ditch, and to arrange for the easy and effective operation of the machine.

In a machine characterized by my invention the ditch is excavated or cut by a couple of vertically-arranged and laterally and upwardly divergible cutting members—such, for instance, as screw-cutters—that is to say, by a couple of cutting members which are supported by the machine in a general vertical direction, so that a forward progression of the machine along the surface of the earth causes them to excavate a ditch having a depth substantially equal to their extent of dependence below the surface of the ground and which are capable of adjustment so as to diverge from one another laterally as to the machine and toward their upper ends. By such arrangement when the cutting members are adjusted so as to be upwardly divergent the side walls of the ditch or trench slope or incline inwardly toward its bottom, and consequently do not fall or cave in. The soil cut or loosened in forming the ditch is conveniently removed by a suitable elevating conveyer or carrier and may be deposited thereby in a portion of the ditch in which tiling has already been laid.

In the accompanying drawings, Figure 1 is a view illustrating in side elevation and in operation a ditching-machine embodying my invention. Fig. 2 is a top plan view of the same. Fig. 3 is a detail view of the lower end of the elevating-conveyer carrier. Fig. 4 is a detail view of the connection for propelling the machine, and Fig. 5 is a section taken on line $x\ x$ in Fig. 2.

The ditching-machine illustrated in the drawings is intended to travel over the ground as the ditch is excavated upon suitable wheels A, which are attached to the forward and rear ends of the body-frame B. As the machine advances the ditch or trench is cut by means of a couple of laterally and upwardly divergible rotary screw-cutters C C, which are arranged to extend downward when the machine is in operation, preferably at an inclination toward the rear.

While the rotary screw-cutters C could be of any suitable construction, I have shown each of them constructed with a spiral cutting-blade 1 and provided with cutting-knives 2, which are attached at intervals to the spiral blade 1. The knives 2 extend forward from the outer edge of the blade 1 in a direction longitudinally of the cutter and are desirably provided with holders 3, which are adapted to prevent the bending, breaking, or detachment of the knives 2 from the blade 1. The said holders 3 are conveniently attached to the forward ends of the knives 2 and are connected to the cutter by means of suitable rings or collars 4, formed at the inner ends of said holders 3 and fitted upon the rod or shaft 5, upon which the spiral blade 1 is arranged.

The rotary screw-cutters C could be secured to the machine in a fixed upwardly-divergent manner; but as a matter of further improvement they are supported so as to be adjustable in an upward divergent manner, by which arrangement the sides of the ditch can be inclined inwardly to any extent as required by different varieties of soil or as desired for other reasons. As a convenient arrangement the upper ends of said cutters C are confined in bearings 5′, provided at the lower ends of a couple of laterally-adjustable slides D. The slides D are supported by and arranged for bodily sliding movement upon a couple of guide rods or shafts 6, which are arranged laterally of the machine and attached at their ends to the sides of the body-frame B. By such arrangement either or

both of the side walls of the ditch will be sloped or inclined inwardly when the slides D are positioned so as to cause either or both of the cutters C to incline outwardly and upwardly, and also such inward slope of the side walls of the ditch can be varied in accordance with the requirements of different varieties of soil by laterally shifting or adjusting the slides D. As a simple arrangement for thus adjusting said slides D they are connected with adjusting-levers E by means of links 7, which said levers E are pivotally connected to the sides of the body-frame B and arranged to shift the slides D laterally with relation to the machine when the levers are swung back and forth about their pivotal connections, and as an arrangement for holding the levers E in adjustment the body-frame of the machine is provided with toothed segments 8, with which the lower ends of suitable latches on the levers E can engage.

The screw-cutters C could be driven or rotated by any suitable power-transmitting connection; but as a preferred arrangement for driving the same and for permitting the simultaneous lateral adjustment of their upper ends said upper ends of the cutters are provided with bevel gear-wheels 10, which mesh with similar bevel-wheels 11, mounted upon a rotary shaft 12, which latter is arranged transversely with relation to the machine and is supported at its ends in suitable bearings on the sides of the body-frame B.

The bevel-wheels 11 have sliding connections with the shaft 12—such, for instance, as by a spline or feather—and are respectively confined within downwardly-extending portions 13, with which each of the slides D is provided, so that in adjusting one or the other of the screw-cutters C by shifting the slide D, to which such screw-cutter is attached, the bevel-gear 11 for operating the same is also shifted correspondingly and kept in mesh with its companion bevel-gear 10.

The rotary shaft 12 is conveniently driven by means of a belt 14 from the driving-shaft 15 of a suitable engine F, which latter is provided with a boiler G and mounted upon the body-frame B.

In order to permit the side adjustment of the upper ends of the rotary screw-cutters C C and also to admit of their lower ends being adjusted for excavating ditches of different depths and also being raised above the level of the ground when the machine is not operating, said cutters are provided near their upper ends with universal joints 17, Fig. 1.

The soil which is cut or loosened by the rotary screw-cutters C C moves downwardly to the bottom of the ditch and is there taken, elevated, and carried to the rear by an adjustable elevating conveyer or carrier H.

The conveyer or carrier H has its forward end connected with the rear ends of the screw-cutters C C and extends rearwardly and upwardly therefrom. Its length can, if desired, be such that when its forward end is thus connected with the screw-cutters its rear end will be somewhat above a portion of the ditch where tiling has already been laid, so that the earth which it discharges will serve to fill in the ditch. Said carrier or conveyer H comprises a couple of longitudinally-arranged beams or sides 18 and an endless belt 19, arranged upon pulley-shafts 21, which are supported at the ends of the beams 18. The endless belt 19 is of sufficient width to extend across the lower ends of both screw-cutters C and is provided with transversely-arranged cleats or ribs 22, which are attached thereto at intervals and which serve to prevent a backward or downward slipping of the soil.

As an arrangement for attaching the forward end of the carrier H to the rear ends of the screw-cutters C C the forward end of the carrier is provided with a shoe J, having a couple of concave sockets 23 formed therein, and the rear ends of the screw-cutters C C are constructed with ball portions 24, adapted to fit into said sockets 23 and form a ball-and-socket joint. By such arrangement when it is desired to lift the carrrier H and the screw-cutters C C from the ditch all three can be lifted together without necessitating a detachment of any one of them.

The shoe J is desirably constructed with an upwardly-inclined concave forward face 25, which is adapted to serve as a hopper for the soil falling from the screw-cutters and which is so arranged that when such soil has accumulated thereupon to an extent to force a portion of it over its rear end such portion of the soil will fall upon the endless belt 19.

As an arrangement for allowing the elevation of the forward end of the carrier H, together with the rear ends of the screw-cutters C C, said carrier is suspended between its ends from the lower ends by a couple of swinging beams 27, which substantially form a swinging frame K and which are arranged for having a swinging motion longitudinally of the machine.

The upper ends of the swinging beams are conveniently pivotally connected to the upper ends of a couple of stationary standards or uprights 28, which latter are in turn supported upon the body-frame B. By such arrangement when the rear ends of the screw-cutters C and the forward end of the carrier H connected thereto are elevated the said carrier H is free to swing to the rear, as required, by reason of its connection with the cutters C C, it being observed that as the rear ends of such cutters rise the horizontal distance between the same and the forward end of the machine increases and that the carrier H must therefore move to the rear. As a simple arrangement for thus elevating the connected ends of the carrier H and the screw-cutters C C a couple of ropes or cables 29 are respectively attached to the opposite sides of the forward end of the carrier H and are coiled about a couple of rotary drums 30, whereby the rotation of the drums 30 will elevate or

lower said connected ends of the carrier H and screw-cutters C C, according to their direction of rotation.

As a desirable arrangement for steadying the lower end of the swinging frame K and for allowing the movement of said end as required by the adjustment of the carrier H a couple of ropes or cables 31 are respectively attached to the lower ends of the swinging beams 27 and wound about a couple of rotary drums 32, by which arrangement the lower end of the frame K can be moved toward the front of the machine or allowed to move toward the rear of the same by a rotation of the drums 32 in one or the other direction.

The rotary drums 30 and 32 are all conveniently mounted upon a rotary shaft 33, arranged transversely upon the machine and having a suitable crank-handle 34, whereby both sets of drums can be adjusted at once, it being observed, however, that owing to the fact that during such adjustment the points of attachment of the ropes or cables 29 to the lower end of the carrier H travel a greater distance than the distance traveled by the points of attachment of the cables 31 to said carrier H and move in a direction with reference to their rotary drums opposite to the direction in which said latter points of attachment move the rotary drums 30 are relatively larger than the drums 32 and the ropes or cables 29 are coiled about the drums 30 in a direction opposite to the direction in which the ropes or cables 31 are wound about the drums 32.

As an arrangement for operating the traveling belt 19 of the carrier H the upper pulley-shaft 21 of said carrier is driven by a belt 35 from a rotary shaft 36, which latter extends through the sides 18 of the carrier H and also through the ends of the swinging beams 27 and thus serves as a connection between said carrier and the lower ends of the swinging frame K. The rotary shaft 36 is driven by a belt 37 from a rotary shaft 38, which latter is mounted at the upper ends of the standards or uprights 28 and extended through the upper ends of the swinging beams 27 and thereby serves as a pivotal connection between said standards or uprights 28 and the upper ends of the swinging frame K, formed by said beams 27. The rotary shaft 38 is in turn driven by a belt 39 from the main driving-shaft 15 of the engine F. By such arrangement the endless traveling belt 19 can be driven at all times irrespective of the position in adjustment of its forward end.

As an arrangement for propelling the machine as the ditch is excavated the rear axle is shown connected by a sprocket-chain 40 with a sprocket-wheel 41, which latter is mounted loosely on the rotary shaft 38, Fig. 4, and is provided with a clutch comprising a friction-cone 42. The friction-cone 42 of the sprocket-wheel 41 is engaged by a corresponding concave or cup-shaped friction-cone 43, which is keyed or feathered to the rotary shaft 38 and which has a sliding connection therewith, so as to permit of its being thrown into clutch with the cone 42. By such arrangement when said two friction-cones 42 and 43 are in position against one another or in clutch the latter tends to rotate the former and thereby turn the rear axle of the machine. The hollow cone 43 is engaged by an adjusting-lever L for moving it into and out of clutch or contact with the cone 42, which said lever L is pivotally connected to a bracket 44, attached to one of the uprights 28 and provided with a toothed segment 45, whereby the lever, which has a latch for engaging said rock or toothed segment, can be locked when moved into contact or clutch with more or less force against the cone 42.

In Fig. 2 I have shown a trough or chute M arranged below the rear end of the carrier H for the purpose of conveying the soil to one side of the ditch should it not be desired to deposit the same in the latter.

What I claim is—

1. In a ditching-machine, the combination of a couple of vertically-disposed cutting members mounted for laterally and upwardly divergent adjustment, and means for adjusting the same so as to vary the extent of such upward divergence; said cutting members being arranged to occupy and retain positions respectively at opposite sides of the ditch, substantially as described.

2. In a ditching-machine, the combination of a couple of vertically-disposed spiral screw-cutters provided with longitudinally-extending cutting-knives, and mounted for laterally and upwardly divergent adjustment; and means for adjusting the same so as to vary the extent of such upward divergence; said spiral screw-cutters having separate axes of rotation, substantially as described.

3. In a ditching-machine, the combination of a couple of cutting members connected with the body-frame so as to permit of their being lowered into a vertically-disposed position within the ditch, and mounted for laterally and upwardly divergent adjustment; means for lowering and raising the same into and out of the ditch; and means for adjusting the same so as to vary the extent of lateral divergence independently of the position thereof in vertical adjustment, as set forth.

4. In a ditching-machine, the combination of a couple of upwardly and laterally divergible rotary screw-cutters having separate axes of rotation and a rearwardly-extending traveling elevator arranged to receive the soil cut by the screw-cutters and to deposit the same in the ditch to the rear of the latter, as set forth.

5. In a ditching-machine, the combination of one or more cutting members connected with the body-frame so as to permit of their being lowered into a vertically-disposed position in the ditch; a traveling elevator adapted and positioned to receive the soil cut by said cutting member or members, and sup-

ported so as to permit of its being lowered into, and raised from the ditch; and means for simultaneously raising and lowering both the cutting member or members and the traveling elevator, as set forth.

6. In a ditching-machine, the combination of a couple of vertically-arranged cutting members having their lower ends connected with one another and adapted to retain positions respectively at opposite sides of the ditch; and a couple of laterally-adjustable slides connected respectively with the upper ends of said cutting members, as set forth.

7. In a ditching-machine, the combination of a couple of rotary screw-cutters having their lower ends connected with one another; and a couple of laterally-adjustable slides having bearing portions adapted to receive the upper ends of said screw-cutters, as set forth.

8. In a ditching-machine, the combination of a couple of rotary screw-cutters having their lower ends connected with one another and having their upper ends provided with gear-wheels; a couple of laterally-adjustable slides having bearing portions adapted to receive the upper ends of said screw-cutters; and a rotary shaft provided with longitudinally-adjustable gear-wheels adapted to engage the gear-wheels of the screw-cutters, and engaged in turn, by suitable engaging portions with which said slides are provided, substantially as described.

9. In a ditching-machine, the combination of a couple of cutting members arranged to retain positions respectively at opposite sides of the ditch, and having their lower ends connected with one another; a couple of laterally-adjustable holders for the upper ends of said cutting members; and means for adjusting said holders, as set forth.

10. In a ditching-machine, a rotary screw-cutter comprising a rotary spindle provided with a spiral cutting-blade; a series of longitudinally-extending cutting-knives having their rear ends attached at intervals to the outer edge of the spiral cutting-blade; and a series of radially-extending knife-holders having their inner ends attached to the rotary spindle and their outer ends attached to the forward ends of the cutting-knives, as set forth.

11. In a ditching-machine, the combination of a cutting member having its forward end jointedly connected with the machine, and having a vertically-adjustable rear end; an adjustable elevating-carrier having its forward end connected to the rear end of the cutting member, and having a swinging connection with the machine; a couple of flexible connectors attached respectively to the connected ends of the cutting and elevating members and to the swinging connection of the latter; and a couple of rotary winding-drums having sizes differing in proportion to the difference in the distance traveled by the points of attachment of said connectors during adjustment of the elevating member, and also, having said connectors wound upon them in opposite directions, substantially as described.

12. In a ditching-machine, the combination of a couple of rotary cutters having their upper end portions provided with universal joints; a couple of holders adapted to receive the upper ends of said rotary cutters, and arranged for lateral adjustment so as to permit of a laterally and upwardly divergent adjustment on the part of the cutters; means for thus laterally adjusting the cutter-holders; means for rotating the cutters independently of the position in adjustment of their upper ends; a shoe providing a hopper for the soil excavated by the cutters, and also providing bearings for the lower ends of said cutters; and means for elevating and lowering the lower ends of the cutters and the shoe attached thereto, as set forth.

13. In a ditching-machine, the combination of a cutting member having its forward end attached to the machine-frame, and its rear end arranged for depression into and elevation out of the ditch; a traveling elevator having its forward end attached to the rear end of the cutting member; means for simultaneously raising and lowering the rear end of the cutting member and the forward end of the traveling elevator; and means for supporting the traveling elevator so as to permit of its forward end being raised and lowered, and also so as to permit of its swinging bodily backward and forward as required by the elevation and depression of its forward end, as set forth.

14. In a ditching-machine, the combination of a cutting member having its forward end attached to the machine-frame, and its rear end arranged for depression into, and elevation out of, the ditch; a traveling elevator having its forward end attached to the rear end of the cutting member; a swinging frame having its upper end pivotally connected to the machine-frame, and its lower end pivotally connected to the traveling elevator at a point near the longitudinal middle thereof; and means for simultaneously raising and lowering the rear end of the cutting member, and the forward end of the traveling elevator, as set forth.

15. In a ditching-machine, the combination of a rotary cutter having a forward end portion connected to its rear end portion by a universal joint; means for laterally and bodily shifting the forward end portion; and means for swinging its rear end portion about such joint so as to raise and lower the said rear end portion, as set forth.

JOSEPH H. CLARK.

Witnesses:
A. F. DURAND,
R. M. WAGNER.