M. G. BUNNELL.

DRAINAGE EXCAVATOR.

APPLICATION FILED DEC. 11, 1908.

940,126.

Patented Nov. 16, 1909.

3 SHEETS—SHEET 1.

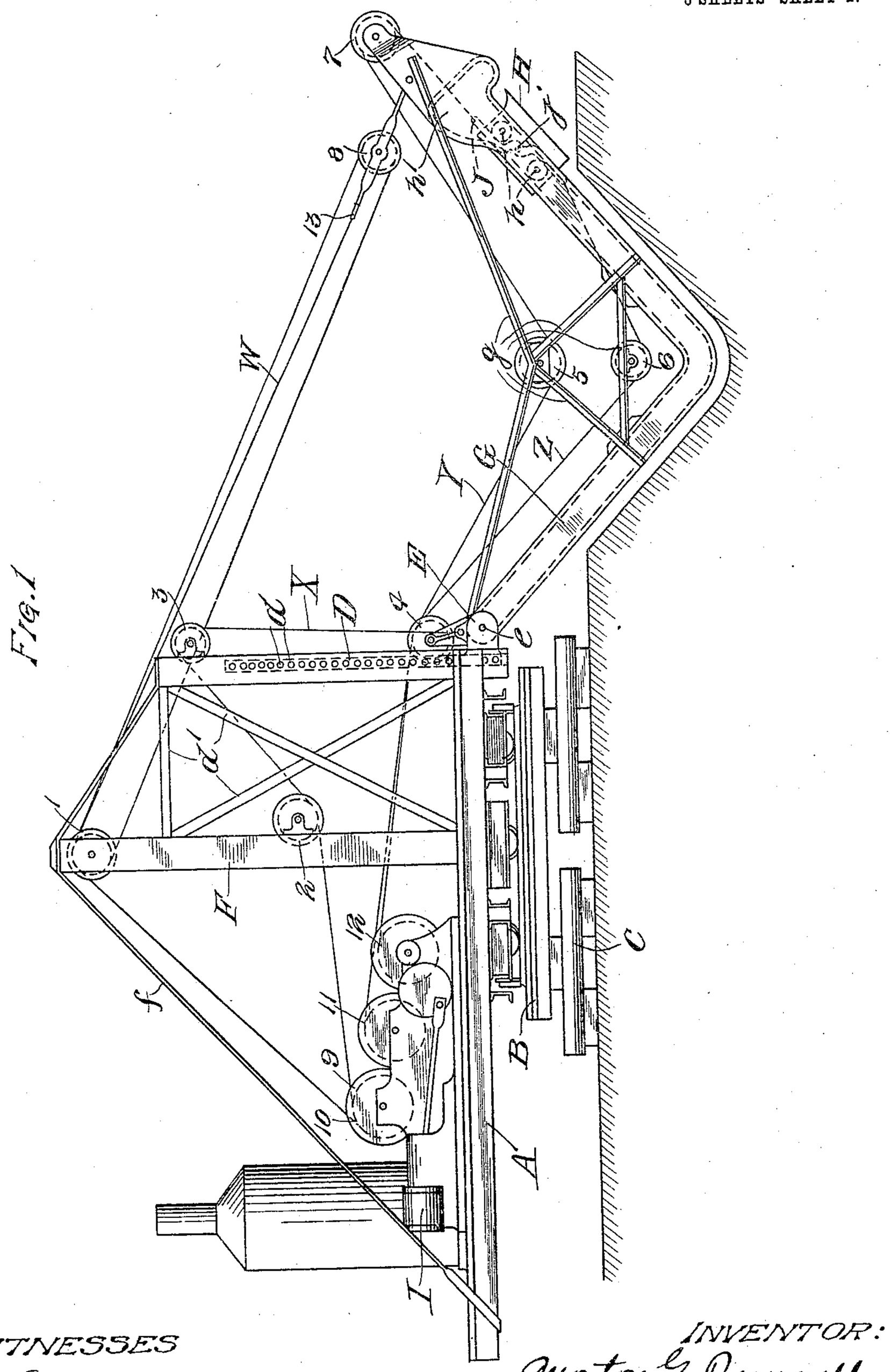

Fig. 1

WITNESSES

A. Andersen.

C. E. Taylor.

INVENTOR:

Morton G. Bunnell

By Bulkley Girard & Drury

ATTORNEYS

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3 SHEETS—SHEET 2.

FIG. 4

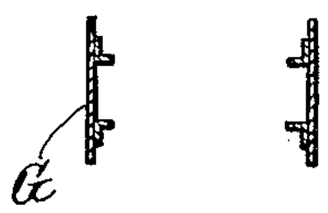


FIG. 2

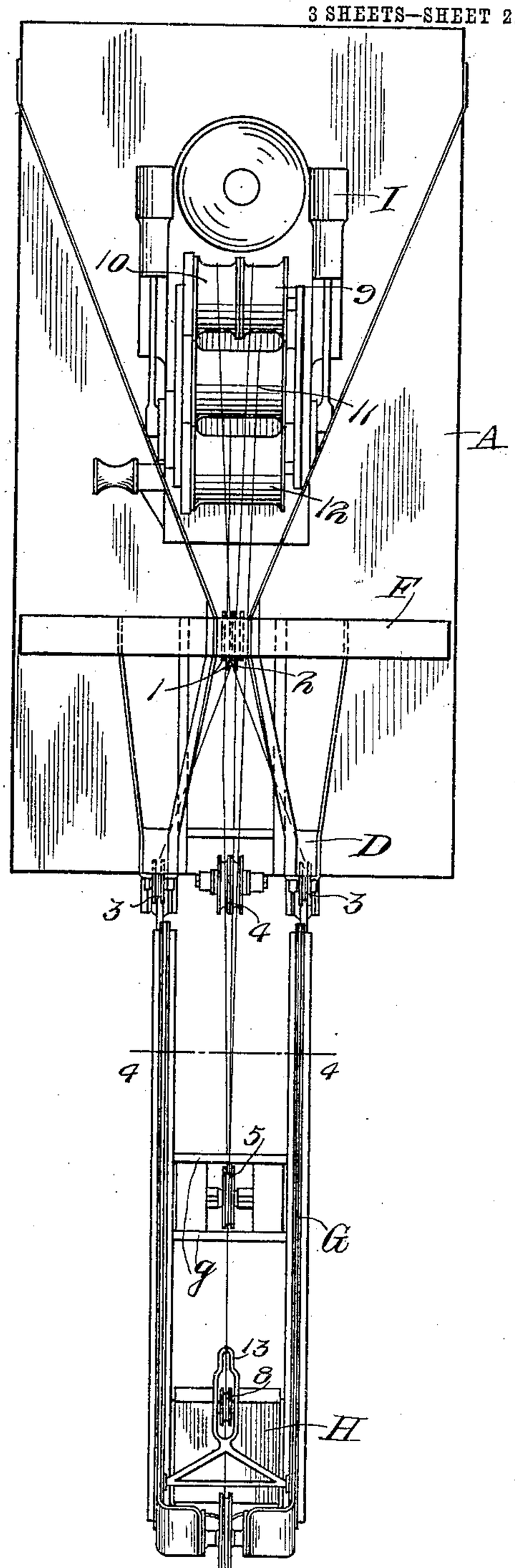
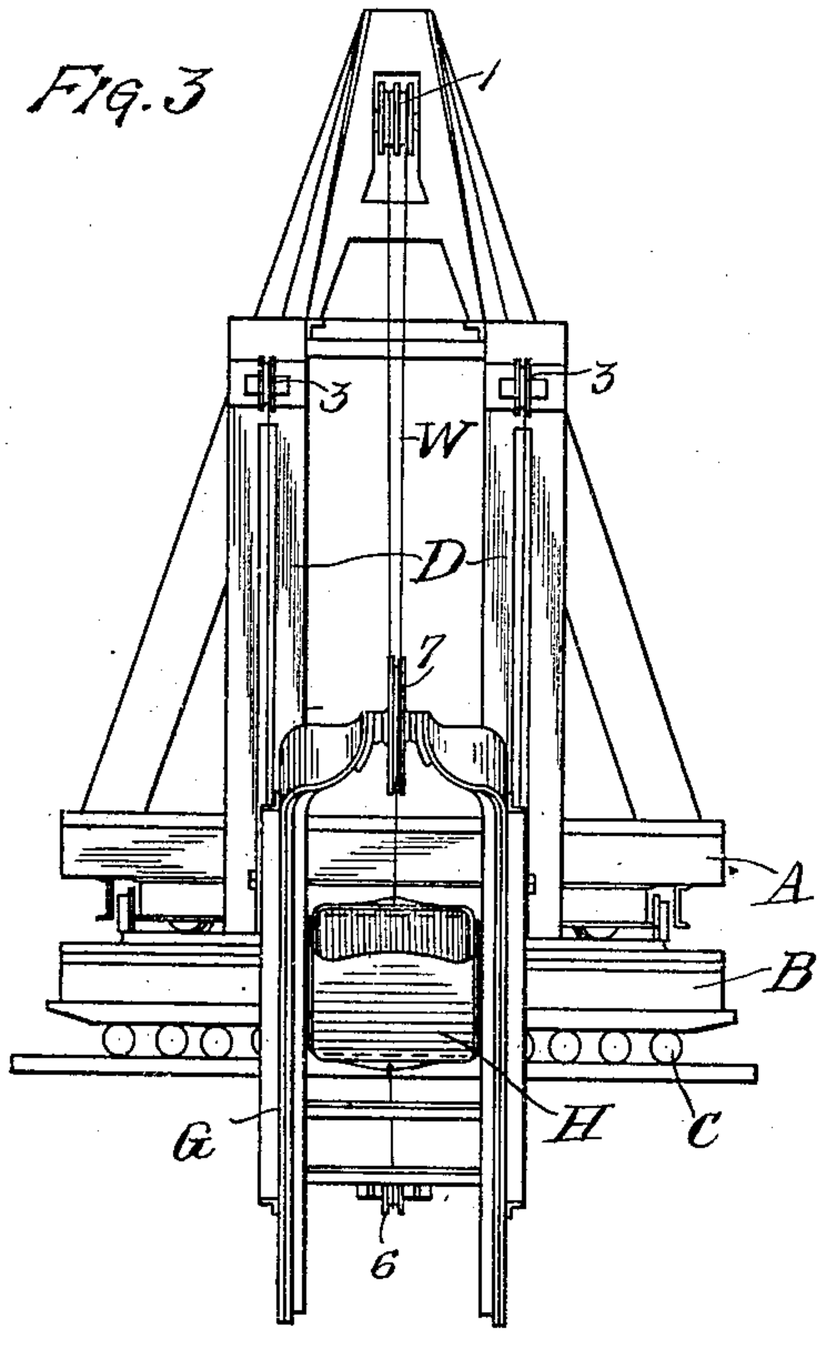


FIG. 3



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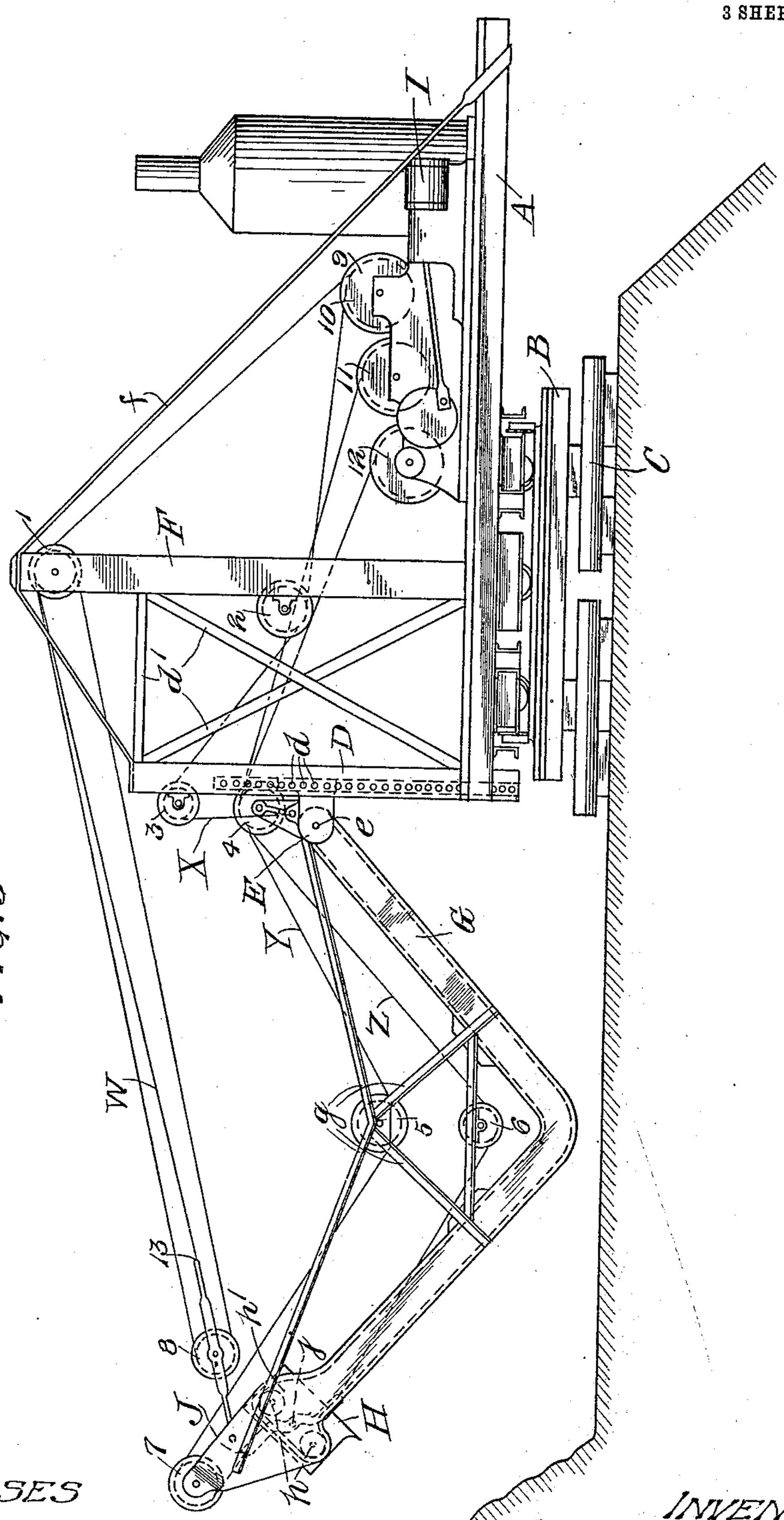

Fig. 5

WITNESSES

A. Andersen.

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UNITED STATES PATENT OFFICE.

MORTON G. BUNNELL, OF CHICAGO, ILLINOIS, ASSIGNOR TO FREDERICK C. AUSTIN, OF CHICAGO, ILLINOIS.

DRAINAGE-EXCAVATOR.

940,126. Specification of Letters Patent. Patented Nov. 16, 1909.

Application filed December 11, 1908. Serial No. 467,051.

To all whom it may concern:

Be it known that I, MORTON G. BUNNELL, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Drainage-Excavators, of which the following is a specification.

There is a class of excavators known as drainage excavators, because they are used largely in the construction of drainage systems.

My invention relates to drainage excavators of that particular type in which the excavating is accomplished by means of a bucket arranged to travel back and forth upon a runway or arm extending laterally from the body of the machine.

In an excavator of this type the runway reaches across the ditch or trench, while the body of the machine stands at one side of the same, and the load is dumped at some point in the length of the runway. Prior to my invention the said runway has been arranged to swing up and down, so that the bucket may travel back and forth and gradually work itself down to the desired depth in the ground, as the weight of the runway carries it down. Each time the bucket reaches the desired depth or level, or some predetermined level, the runway is raised and the machine moved along and the operation repeated. So far as I am aware, however, no attempt has been made to arrange the said runway in such manner that it could be raised and lowered bodily and vertically, as well as moved about its axis, so as to vary the depth of the ditch; and no effort has been made to employ the shape of the runway as a means for uniformly determining the slant or angle of the sides of ditches of varying depth, but practically uniform cross sectional outline, and of a uniform distance from the side of the body of the machine. In every instance, so far as I am now aware, a manipulation of the bucket, in conjunction with a raising and lowering of the pivoted runway about its axis, has been resorted to for the purpose of properly shaping the sides of the ditch, when the depth of the same was such as to prevent the runway from assuming a normal horizontal position; but in no case has the arrangement been such that the cross sectional outline of the ditch was, regardless of the depth, and without varying the distance of the same from the side of the body of the machine, determined by and allowed to follow the shape of the runway. Furthermore, the arrangement has always been such, so far as I am now aware, that the dumping of the load was accomplished by a return movement of the bucket, after it had been filled, rather than at the end of the forward motion along the runway by which the bucket was filled; and if this method was not used, then the bucket was run across the machine for the purpose of dumping at some distance from the other side thereof. For these reasons, and prior to my present invention, these machines have not been altogether successful and satisfactory, and have not fully accomplished the desired results.

Generally stated, therefore, the object of my invention is the provision of a machine of the foregoing general character, adapted to stand at one side of the excavation, in which provision is made for raising and lowering the runway bodily and vertically, and in which the shape of the runway determines the shape of the ditch in cross section, regardless of the depth of the same, and at a uniform distance from the body of the machine, whereby the depth of the ditch can be varied at will, and whereby the sides of the ditch, regardless of its depth, will always have the same slant or angle, without varying the distance of the longitudinal center of the ditch or trench from the body of the machine.

A further object is to provide an arrangement whereby the load will be dumped from the bucket at the end of the movement by which the same is filled, without causing the load to first travel across the machine, the arrangement being preferably such that the bucket discharges its load at the outer end of the runway, whereby it is not necessary for the bucket after filling to then travel either in the opposite direction or across the machine before dumping. I also preferably combine the feature of raising and lowering the runway bodily and vertically, so as to vary the depth of the ditch without varying the slant or angle of the sides thereof, and

also the feature of dumping the load at the outer end of the runway, when the bucket reaches the end of the forward or outward movement by which it is filled, with a body which is supported on a turn table, whereby the runway may be raised or swung up after the bucket is filled, and the entire machine then swung around for the purpose of discharging the load at the other side of the ditch—that is to say, at the side of the ditch where the excavator is standing, rather than at the farther side thereof.

Another object of my invention is the provision of means affording a new mode of operation, namely whereby the bottom of the ditch or trench may be kept perfectly level from start to finish, while the excavator travels or moves along at one side thereof, and whereby the same is symmetrical in cross sectional contour at all stages of its formations, as distinguished from the old method by which the ditch or trench being formed at one side of the excavator was never level until it reached the desired depth.

With a machine thus characterized by the improvements which constitute my invention, as herein disclosed, the operation of excavating to build a ditch is greatly facilitated, much time and labor are saved, and better results are obtained, as will hereinafter more fully appear.

In the accompanying drawings—Figure 1 is a side elevation of a drainage excavator embodying the principles of my invention, showing the same engaged in the operation of making a trench or ditch, it being understood that the building of the trench or ditch may be for ordinary purposes, such as drainage, or for the purpose of making an embankment to form a levee. Fig. 2 is a plan view of the machine shown in Fig. 1. Fig. 3 is an end elevation of the machine shown in Fig. 1. Fig. 4 is a cross section of the runway. Fig. 5 is a view similar to Fig. 1, but with this difference, namely that the machine is shown in a reversed position, illustrating the manner in which the entire excavator is swung around on the turn table for the purpose of enabling the bucket to discharge its contents at the side of the ditch or excavation where the machine is standing, rather than at the farther side thereof.

As thus illustrated, my invention comprises a body or platform A which is preferably supported upon a turn table B. As shown, the said turn table is supported by rollers C, whereby the excavator can move along in a direction parallel with and at one side of the ditch or trench. It will be understood, however, that the said body A can be mounted upon anything else that will travel, either upon land or water, depending upon the character of the work to be handled. At the side of the machine next to the ditch or trench the said body is provided with an upright guide-way D, which is provided with a vertical series of bolt holes *d*, in which the pivot bearing E is adapted to slide up and down and be secured in any desired position by one or more bolts extending through the said holes. This vertical guide-way D is supported by suitable braces *d'* with an upright structure F, which latter is in turn braced and connected with the other side of the machine by braces *f*, as illustrated. In this way a strong and at the same time light suitable structure is provided for supporting the sheaves 1, 2 and 3 in suitably elevated positions.

The sheave 4 is carried by the casting or pivot bearing E, to which latter is pivoted or hinged the double track runway G. The said runway, when viewed from the side, is practically V-shaped, and its two upwardly diverging arms or sides are connected and braced apart by means of braces *g*. The axis about which the said runway swings up and down is provided by the pivot *e* which connects the runway with the casting or bearing E, as illustrated. The said runway is provided with sheaves 5 and 6 at the center thereof, these sheaves being arranged above the more or less rounded or blunt apex of the V-shaped runway. The outer end of the runway is provided with sheaves 7 and 8, for the purpose to be described. The two inner or opposing surfaces of the said runway provide tracks or ways for the bucket H, which latter is provided with wheels *h* that travel in the said tracks or ways. It will be observed that at its outer end the said runway has its tracks or ways broadened to provide a portion *h'* within which the bucket can upset to dump the load. The said bucket travels back and forth upon the said runway, and is adapted to dump its load at the outer end of said runway, without the necessity of either traveling backward or crossing the machine to do so. Upon the body or platform A there is mounted an engine I, which practically balances the runway, and there is also a set of drums 9, 10, 11 and 12.

A hoisting cable W is applied to the sheaves 1 and 8, one end of which cable is secured to the outer end 13 of the frame of the bearing E, and the other end of which is wound upon the drum 9. With this arrangement the said drum 9 can be used for raising and lowering the outer end of the runway. Another hoisting cable X is applied to the sheaves 2 and 3, one end of which cable is secured to the casting or pivot bearing E, and the other end of which is wound upon the drum 10. With the latter drum, therefore, the pivoted end of the runway can be raised and lowered. Both ends

of the runway can be raised and lowered simultaneously, or one end can be raised independently of the other, and the pivoted end can be fixed at any point on the guide-way D, thus affording opportunity for various modes of operation. The runway can be raised and lowered at its outer end only, so as to give it a swinging motion up and down, or it can be allowed to descend bodily, keeping the bottom of the ditch level at all times. With the arrangement for raising and lowering the pivoted end of the runway, ditches and trenches of varying depth can be constructed, and in each case the shape of the runway determines the cross sectional contour of the said ditch or trench.

The bucket H is provided with a frame J, the side members of which are pivoted at *j* to the sides of the bucket, and in such position that the bucket may tilt to dump the load upon reaching the outer end of the runway, as shown more clearly in Fig. 5. A loading cable Y is applied to the sheaves 4, 5 and 7, and has one end attached to the outer end of the frame J, the other end of the same being wound upon the drum 11. Another cable Z for retracting the bucket—that is to say, for drawing it back to starting point—is applied to the sheaves 4 and 6, and one end of this cable is attached to the rear end of the frame J, while its other end is wound upon the drum 12. By means, therefore, of the drums 11 and 12 and the cables Y and Z, the bucket H may be drawn back and forth along the runway, one cable being wound in while the other is paid out, and vice versa, during the operation of forming the excavation. When the cable Y is wound in and the cable Z paid out, then the bucket is drawn downwardly on the pivoted side of the runway, then around the apex or lower end of the runway, and up the free or outer end portion of the runway, gathering a load of dirt as it travels. When the bucket reaches the outer end of the runway, it is upset or overturned in the broadened portion *h'* of the track or way, and the load is dumped upon the farther side of the ditch or trench. Then the bucket is drawn back to starting point, the outer end of the runway is lowered a little and the operation repeated. In this way the runway will, by means of the bucket, work itself down into the ground, and will do this until the sides of the runway strike the ground at each side made by the cut of the bucket. After this, the excavator is then moved along a distance equal to the width of the bucket, and the operation repeated on the first section of the ditch or trench.

When the excavator reaches the end of the trench or ditch, or reaches the end of a section thereof, it then works back over the same territory, taking off another lift as it goes. It will be understood, of course, that the depth of each lift is determined by the distance between the bottom of the bucket and the lower edges of the runway, inasmuch as the runway can each time only descend until its sides rest upon the ground at each side of the cut being formed by the bucket. In other words, the runway does not descend until it reaches the ultimate depth of the ditch or trench, before being moved a step forward. Consequently, therefore, as stated, the ditch or trench is formed by taking off successive lifts of the dirt from one end of the ditch or trench to the other, or from one end or the other of a section of a ditch. In this way each fall or drop of the runway is for only a portion of the depth of the ditch or trench.

As previously explained, the V-shaped runway determines the cross sectional contour or outline of the ditch or trench, regardless of the depth of the latter, inasmuch as the pivoted end of the runway can be set at any height whereby when the runway reaches the bottom of the ditch it is always level. Furthermore, a ditch of maximum depth can be kept level from start to finish, because the runway can be started at its maximum height and then allowed to descend bodily, keeping it level at all times. Thus, as stated, a ditch or trench of maximum depth can be built, and the bottom of the same will be level from start to finish, and at no time in the course of its construction will it be otherwise than perfectly level and symmetrical in cross sectional outline.

The load of the bucket can be dumped at the farther side of the ditch or trench, or the runway can be raised and the entire excavator swung around and the load dumped at the other side thereof. Thus in an excavator adapted to move along at one side of the ditch or excavation, I make provision whereby the load can be dumped at either side of the excavation, without causing the bucket to either first run backward or across the machine. Also, with this arrangement the dumping can be accomplished at either side of the excavation, in a machine in which the excavator stands at one side of the trench or excavation and in which the shape of the runway determines the cross sectional contour of the ditch for all depths thereof, or for ditches of different depths. Whether a ditch is shallow or deep it is important and desirable that its bottom be perfectly level, and it is also desirable that it be symmetrical in cross section—that is to say, the two sides thereof have a similar slant or angle. With my improved drainage excavator in which the pivoted end of the runway can be raised and lowered and in which the dumping occurs at the end of the movement of the bucket by which it is filled, and at the outer end of the runway that forms the excava-

tion, this is all accomplished in a simple and efficient manner. Obviously, as explained, it is never necessary for the bucket to run backward before dumping, nor is it necessary, in order to dump, for the bucket to first run across the body of the excavator. The dumping is always at the outer end of the runway that forms the excavation, regardless of whether it is desired to dump at the farther side of the trench or excavation, or at the side at which the excavator is standing.

I also contemplate that with a machine of this character a hill or embankment can be torn down, and the dirt thereof either moved farther away or brought around and deposited at the other side of the machine. With this kind of work the runway would be raised bodily to the maximum height, and it could then be kept level while the bucket is gradually working down through the hill or embankment. In other words, the feature of moving the runway up and down bodily and vertically in a machine that stands at one side of an excavation can be used for clearing away a hill or embankment, as well as for cutting a ditch or trench in a piece of ground of the same level as that upon which the machine stands.

It will be understood, of course, that for the broader purposes of my invention I do not limit myself to the exact construction shown and described.

What I claim as my invention is:

1. In a drainage excavator, a runway pivoted at one end to swing up and down, an excavating bucket, means for causing the bucket to travel back and forth on the said runway, means whereby the bucket dumps without leaving the runway, and means for effecting a raising and lowering of the pivoted end of said runway.

2. In a drainage excavator, a runway arranged to swing up and down, adapted to hang down in the excavation, an excavating bucket and means for causing the same to travel back and forth on the said runway, to form the excavation, and means on the outer end of the runway for causing the bucket to automatically discharge its load before returning to starting point.

3. In a drainage excavator, a vertically swinging runway, an excavating bucket and means for causing it to travel back and forth on the runway, said runway being substantially V-shaped, and having one or more sheaves arranged above and in line with or centrally of the rounded apex or bottom thereof, the said sheave or sheaves constituting part of the said means for causing the bucket to traverse the runway.

4. In a drainage excavator, a substantially V-shaped runway pivoted at one end, means for raising and lowering the pivoted end of said runway, an excavating bucket and means for causing it to travel back and forth on the said runway, and means on the outer end portion of the runway for automatically causing the bucket to discharge its load.

5. In a drainage excavator, a vertically swinging runway, an excavating bucket, means for causing the bucket to travel back and forth on the said runway, means whereby the bucket dumps without leaving the runway, and means for effecting a vertical and bodily raising and lowering of the entire runway, whereby the depth of the ditch or trench may be varied without varying the slant or angle of the sides thereof.

6. In a drainage excavator, a runway having a definite shape, being substantially V-shaped when viewed from the side, with a rounded apex or bottom, an excavating bucket and means for causing the same to travel back and forth on the runway, means whereby the bucket dumps the load without leaving the runway and without crossing the excavator, and provisions consisting of means of adjustment for the runway, whereby the shape of the runway alone determines the cross sectional outline of ditches or trenches of different depths.

7. In a drainage excavator, a runway pivoted at one end to swing up and down, an excavating bucket and means for causing the same to travel back and forth on the said runway, the mouth of said bucket facing away from the excavator and toward the outer end of the runway, whereby the said bucket is caused to fill by movement away from the excavator, and means for effecting a raising and lowering of the pivoted end of said runway.

8. In a drainage excavator, a runway arranged to swing up and down, an excavating bucket and means for causing the same to travel back and forth on the said runway, to form the excavation, the mouth of said bucket facing away from the excavator and toward the outer end of the runway, whereby the said bucket is caused to fill by movement away from the excavator, means on the outer end of the runway for causing the bucket to automatically discharge its load, an engine for operating the bucket, and a turn table upon which the engine tends to counterbalance the bucket at the other end of the runway.

9. In a drainage excavator, a vertically swinging runway, an excavating bucket and means for causing it to travel back and forth on the runway, the mouth of said bucket facing away from the excavator and toward the outer end of the runway, whereby the said bucket is caused to fill by movement away from the excavator, said runway being substantially V-shaped, and having one or more sheaves arranged above and in

line with the apex thereof, the said sheave or sheaves constituting part of the said means for causing the bucket to traverse the runway.

10. In a drainage excavator, a substantially V-shaped runway pivoted at one end, means for raising and lowering the pivoted end of said runway, an excavating bucket and means for causing it to travel back and forth on the said runway, the mouth of said bucket facing away from the excavator and toward the outer end of the runway, whereby the said bucket is caused to fill by movement away from the excavator, and means on the outer end portion of the runway for automatically causing the bucket to discharge its load.

11. In a drainage excavator, a vertically swinging runway, an excavating bucket and means for causing it to travel back and forth on the said runway, the mouth of said bucket facing away from the excavator and toward the outer end of the runway, whereby the said bucket is caused to fill by movement away from the excavator, and means for effecting a vertical and bodily raising and lowering of the runway, whereby the depth of the ditch or trench may be varied without varying the slant or angle of the sides thereof.

12. In a drainage excavator, a runway, an excavating bucket and means for causing it to travel back and forth on the runway; the mouth of said bucket facing away from the excavator and toward the outer end of the runway, whereby the said bucket is caused to fill by movement away from the excavator, said runway having the same shape and slant at both sides of the ditch, whereby the shape of the runway alone determines the cross sectional outline of the ditch or trench.

13. In a drainage excavator, a runway pivoted at one end to swing up and down, an excavating bucket and means for causing the same to travel back and forth on the said runway, means for swinging the runway laterally about a vertical axis, whereby the load may be dumped at either side of the ditch or trench, and means for effecting a raising and lowering of the pivoted end of said runway.

14. In a drainage excavator, a vertically swinging runway, an excavating bucket and means for causing it to travel back and forth on the runway, means for swinging the runway laterally, whereby the load may be dumped at either side of the ditch or trench, said runway being substantially V-shaped, and having one or more sheaves arranged above and in line with the apex thereof, the said sheave or sheaves constituting part of the said means for causing the bucket to traverse the runway.

15. In a drainage excavator, a substantially V-shaped runway pivoted at one end, means for raising and lowering the pivoted end of said runway, an excavating bucket and means for causing it to travel back and forth on the said runway, means for swinging the runway laterally, whereby the load may be dumped at either side of the ditch or trench, and means on the outer end portion of the runway for automatically causing the bucket to discharge its load.

16. In a drainage excavator, a vertically swinging runway, an excavating bucket and means for causing it to travel back and forth on the said runway, means for swinging the runway laterally, whereby the load may be dumped at either side of the ditch or trench, and means for effecting a vertical and bodily raising and lowering of the runway, whereby the depth of the ditch or trench may be varied without varying the slant or angle of the sides thereof.

17. In a drainage excavator, a runway, an excavating bucket and means for causing it to travel back and forth on the runway, means for swinging the runway laterally, whereby the load may be dumped at either side of the ditch or trench, said runway having the same shape and slant at both sides of the ditch, whereby the shape of the runway alone determines the cross sectional outline of the ditch or trench.

18. In a drainage excavator, a runway having a definite shape, being substantially V-shape when viewed from the side, an excavating bucket and means for causing the same to travel back and forth on the runway, means for swinging the runway laterally, whereby the load may be dumped at either side of the ditch or trench, and provisions, consisting of means of adjustment for the runway whereby the shape of the runway alone determines the cross sectional outline of ditches or trenches of different depths.

19. In a drainage excavator, an excavating bucket and means for causing it to load or fill by movement thereof away from the excavator, means for causing the bucket to automatically discharge its load upon reaching the end of its movement away from the excavator, means whereby the bucket returns to starting point after the load is discharged therefrom, and means for raising and lowering the said starting point of the bucket.

20. In a drainage excavator, an excavating bucket and means for causing it to load or fill by movement thereof away from the excavator, means serving automatically to upset the bucket at the end of its movement away from the excavator, whereby the load is dumped by an upsetting of the bucket before the return movement of the same to

starting point, and means for shifting the axis of the runway.

21. In a drainage excavator, a swinging runway adapted to be raised and lowered in the excavation, an excavating bucket movable back and forth only on the runway, said bucket adapted to fill by movement thereof toward the free or outer end of the runway, and means for shifting the axis of the runway.

Signed by me at Chicago, Illinois, this 7th day of December 1908.

MORTON G. BUNNELL.

Witnesses:

C. E. TAYLOR,

E. H. CLEGG.