

A. I. HOVLAND.

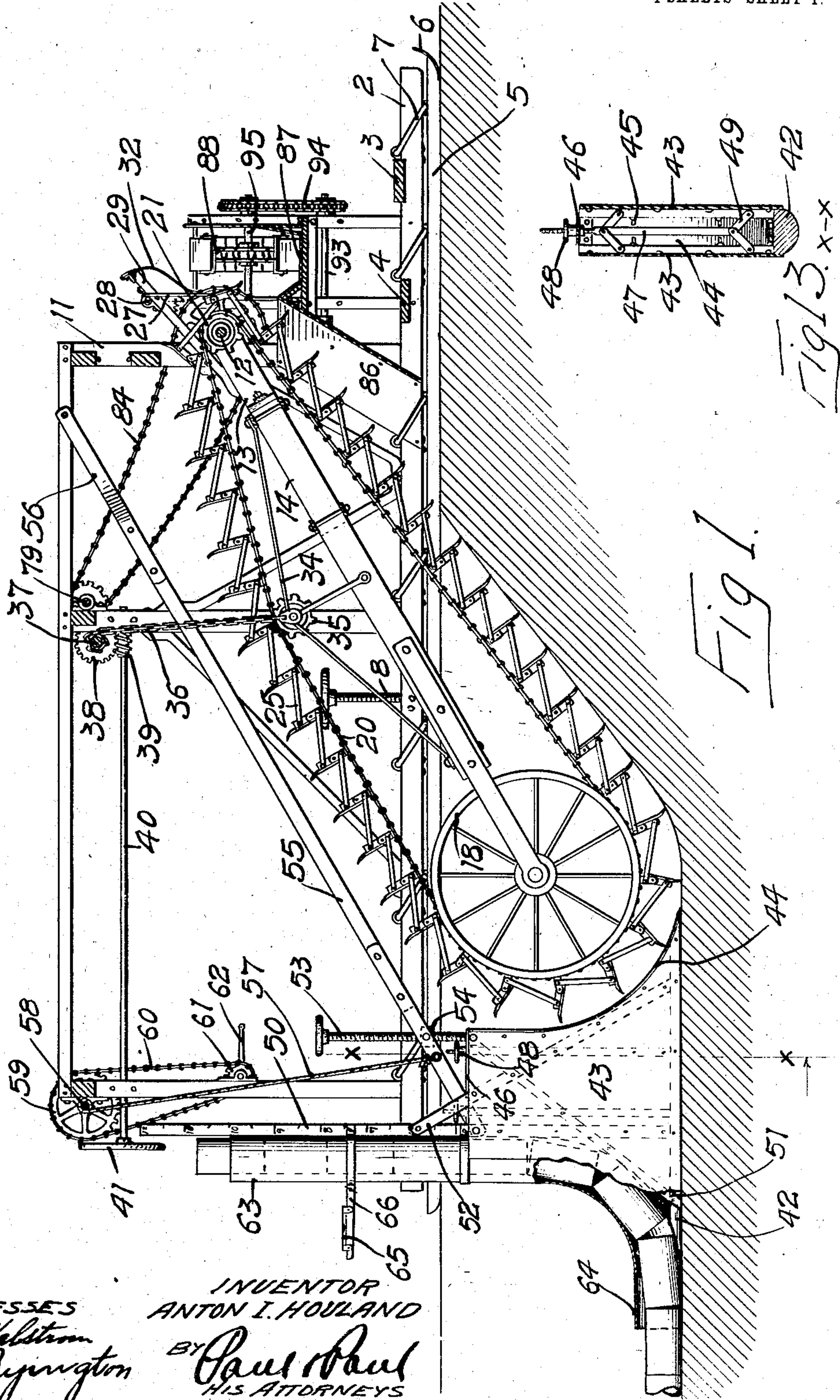
DITCHING MACHINE.

APPLICATION FILED MAR. 25, 1908.

915,963.

Patented Mar. 23, 1909.

4 SHEETS—SHEET 1.



WITNESSES

*J. A. Byington*

INVENTOR  
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BY *Paul Paul*  
HIS ATTORNEYS



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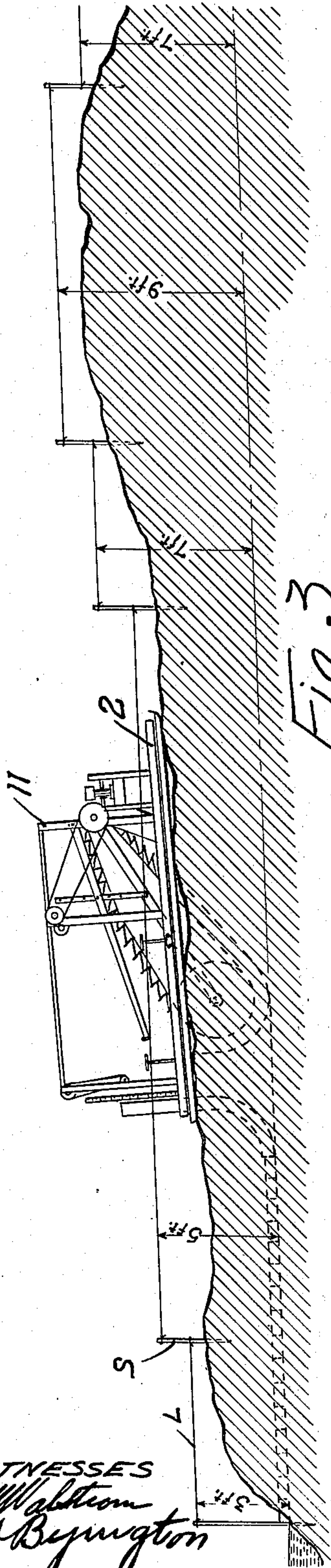


Fig 3.

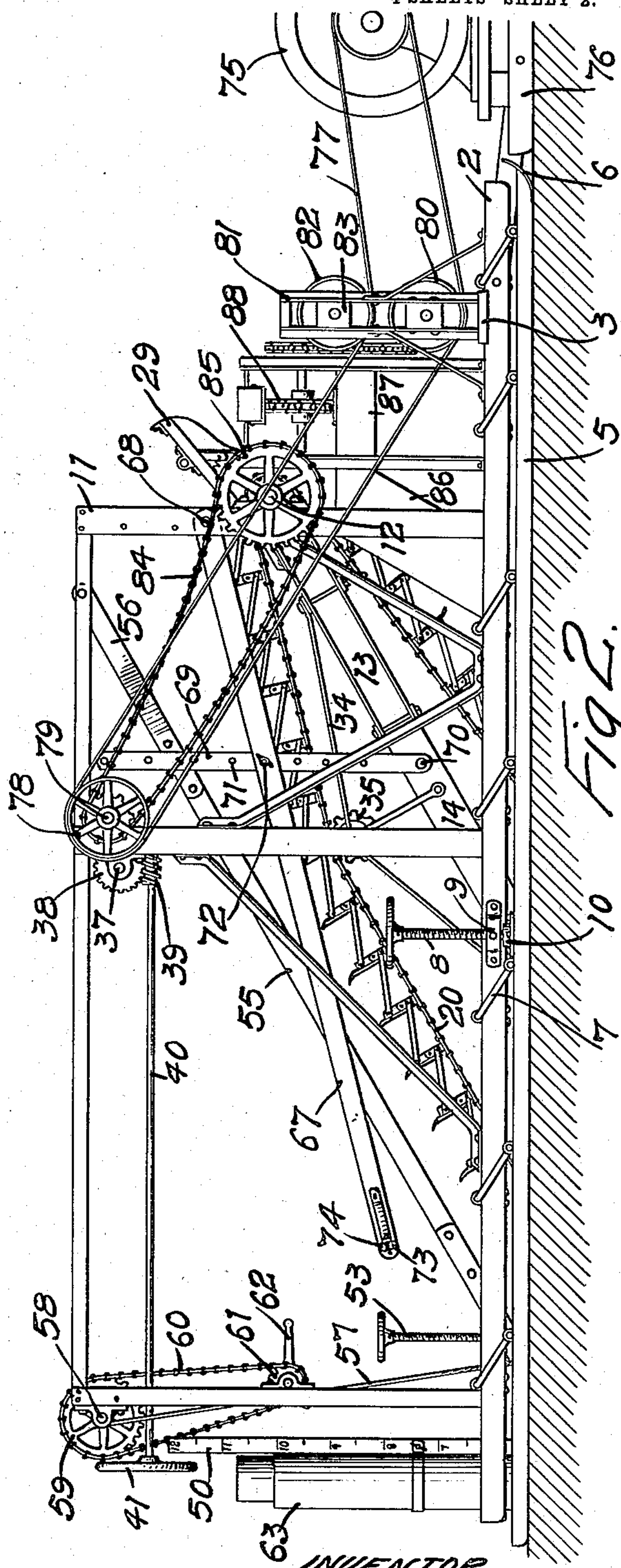


Fig 2.

WITNESSES  
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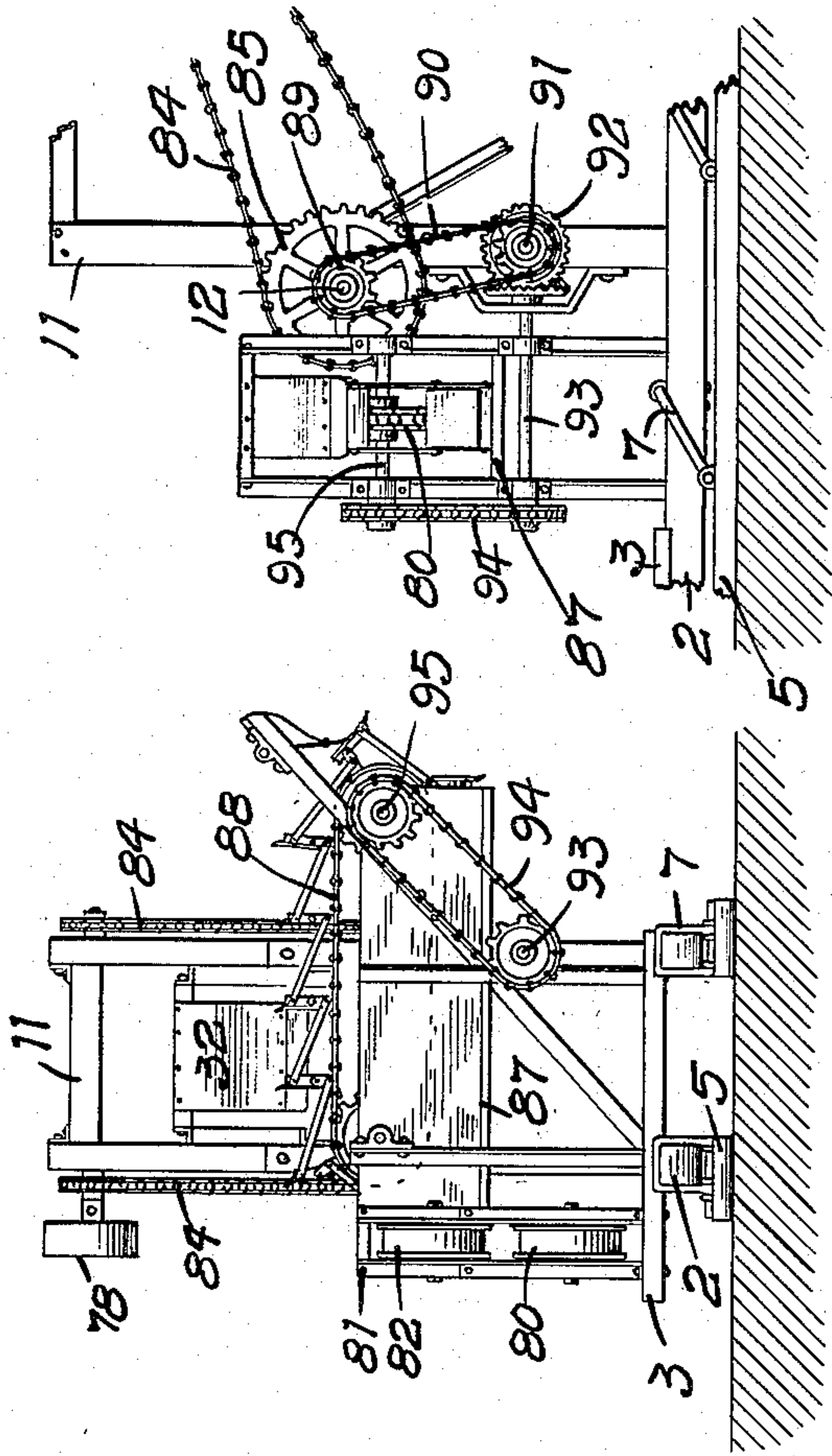


Fig. 6.

Fig. 5.

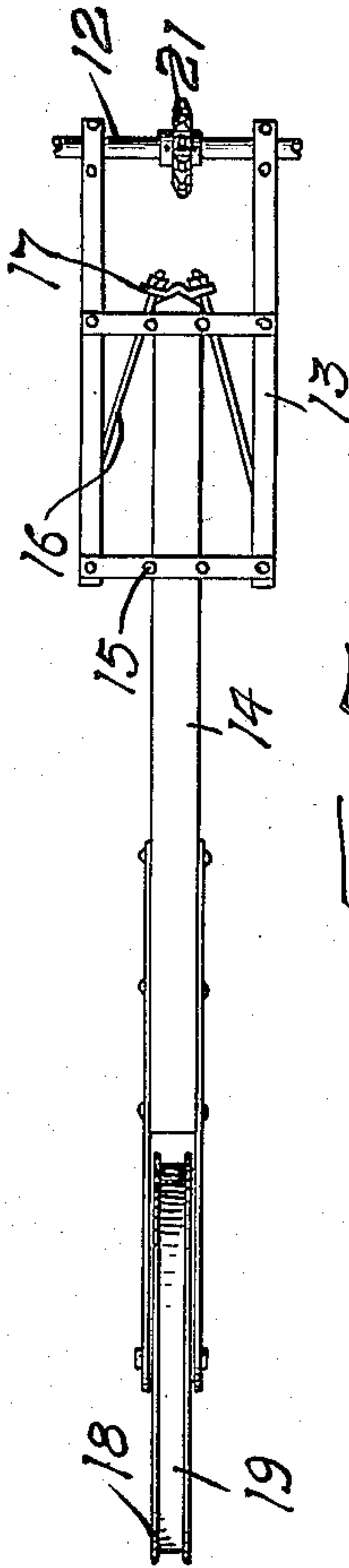


Fig. 7.

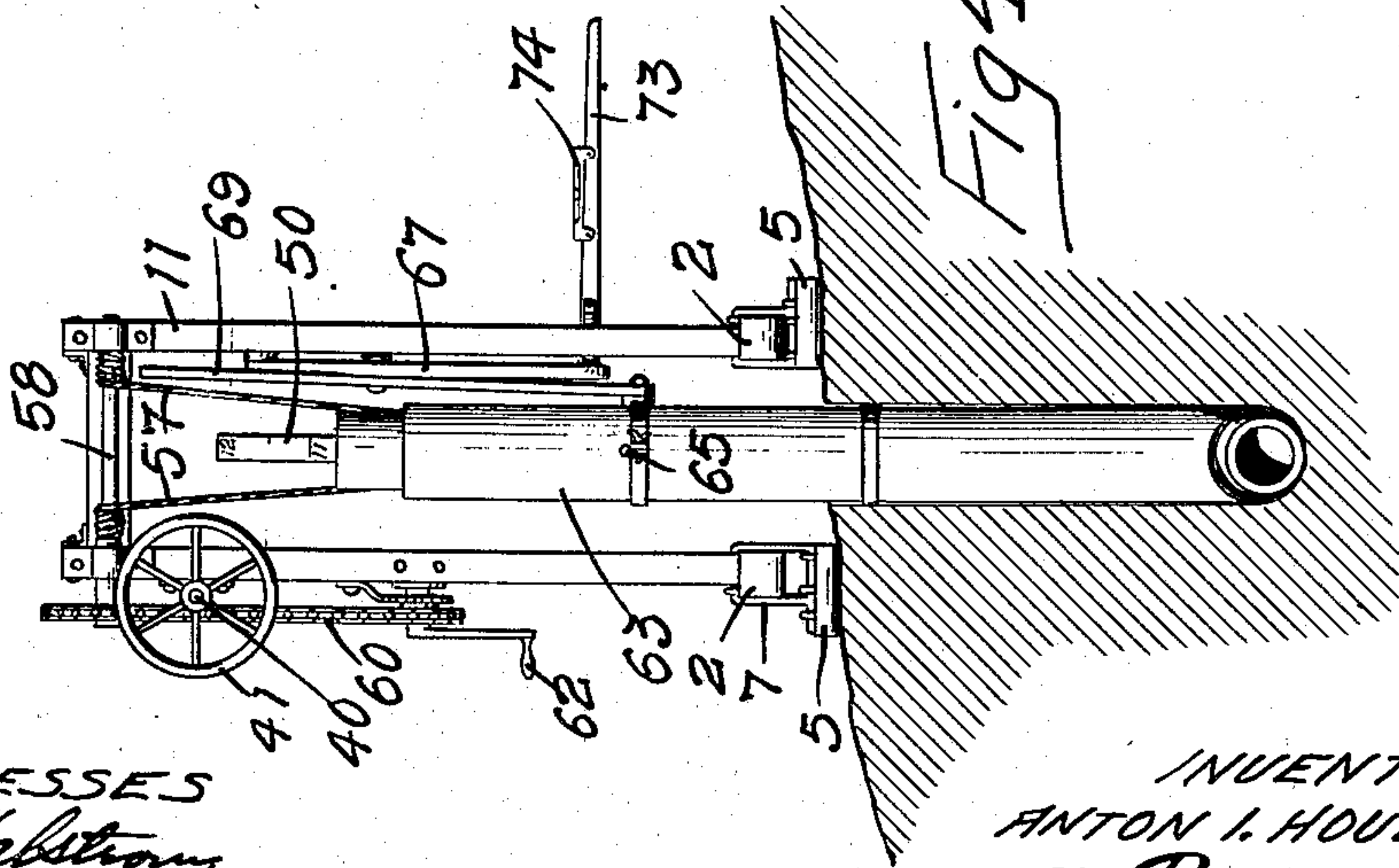


Fig. 4.

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4 SHEETS—SHEET 4.

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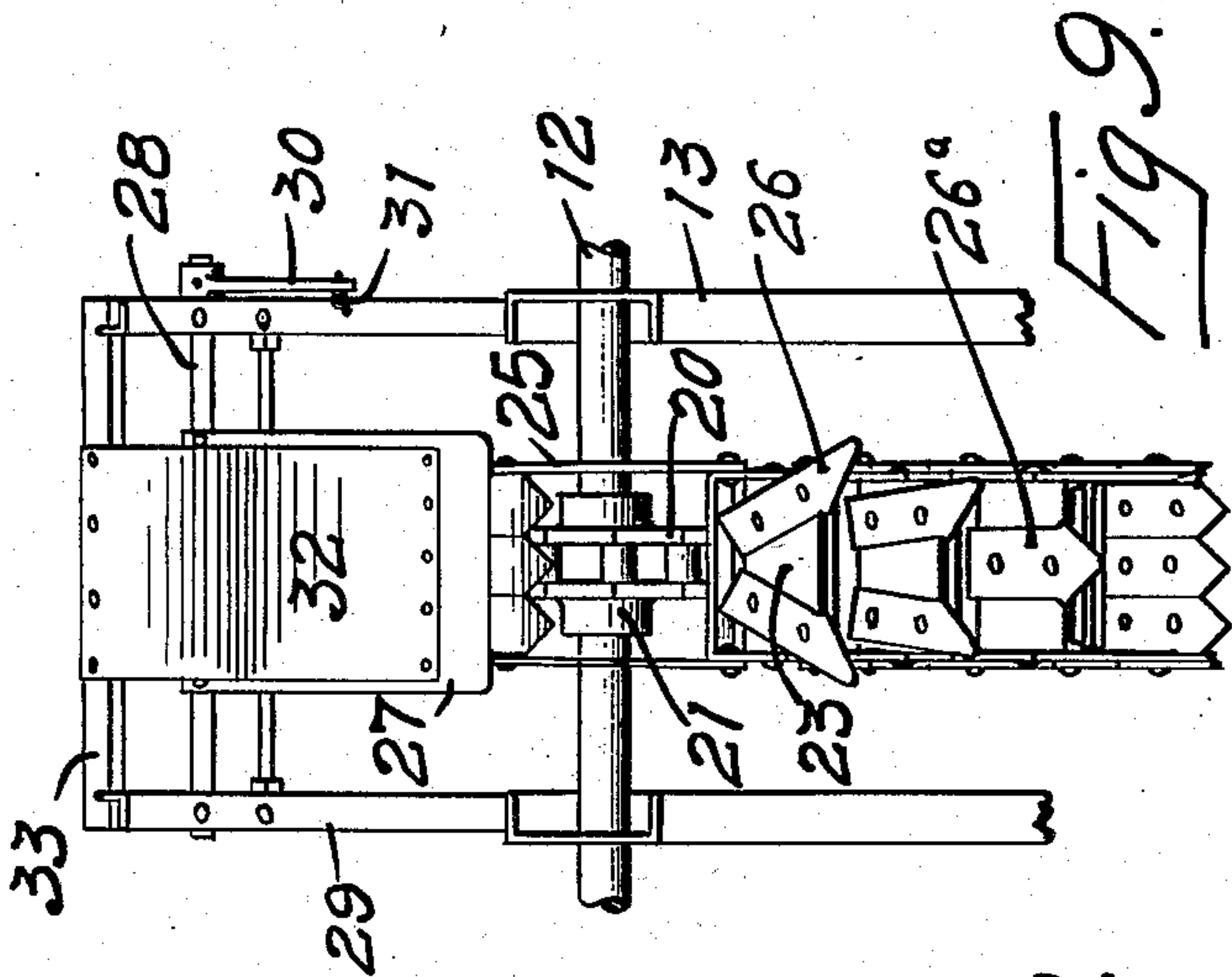


Fig. 9.

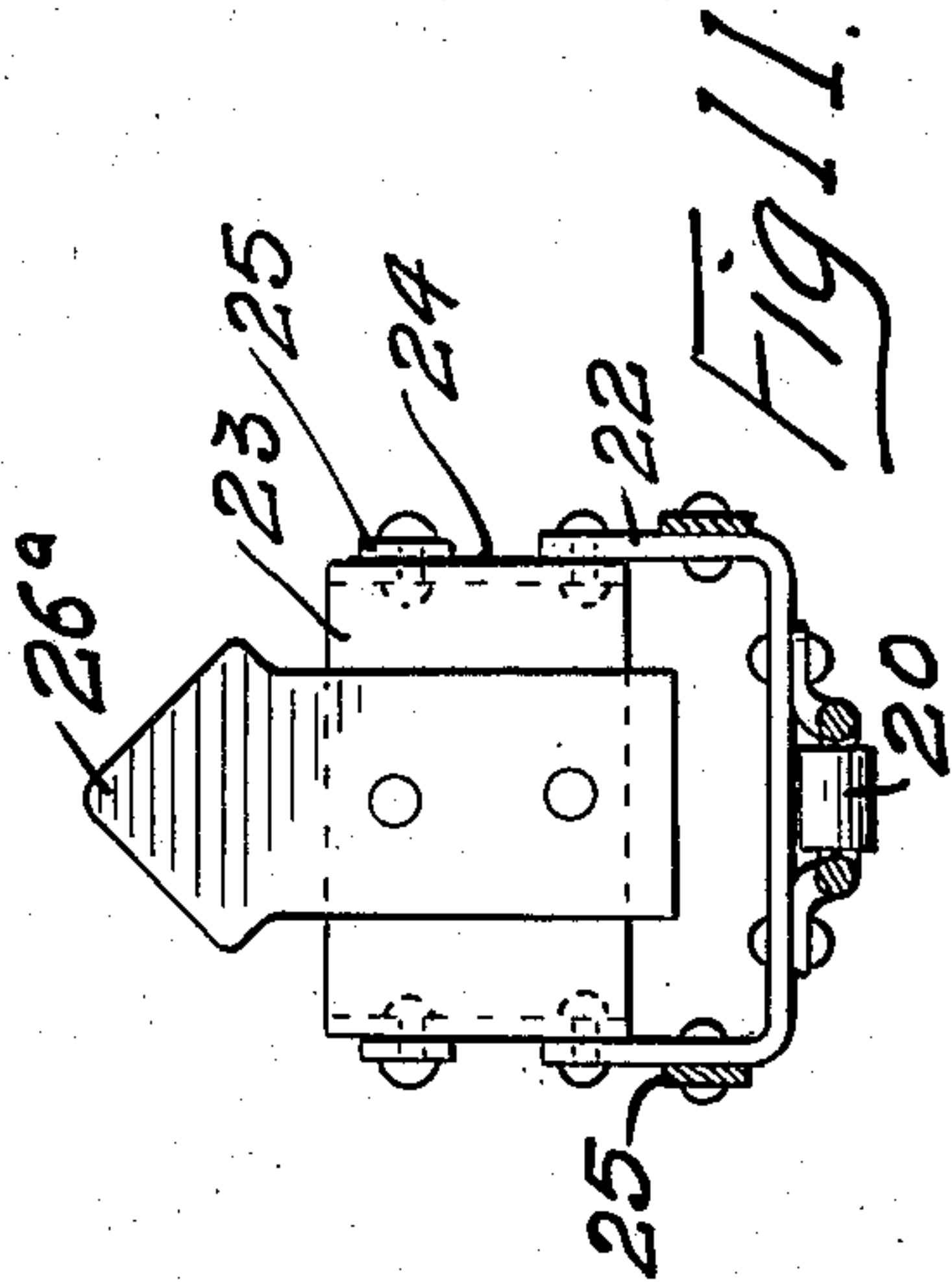


Fig. 11.

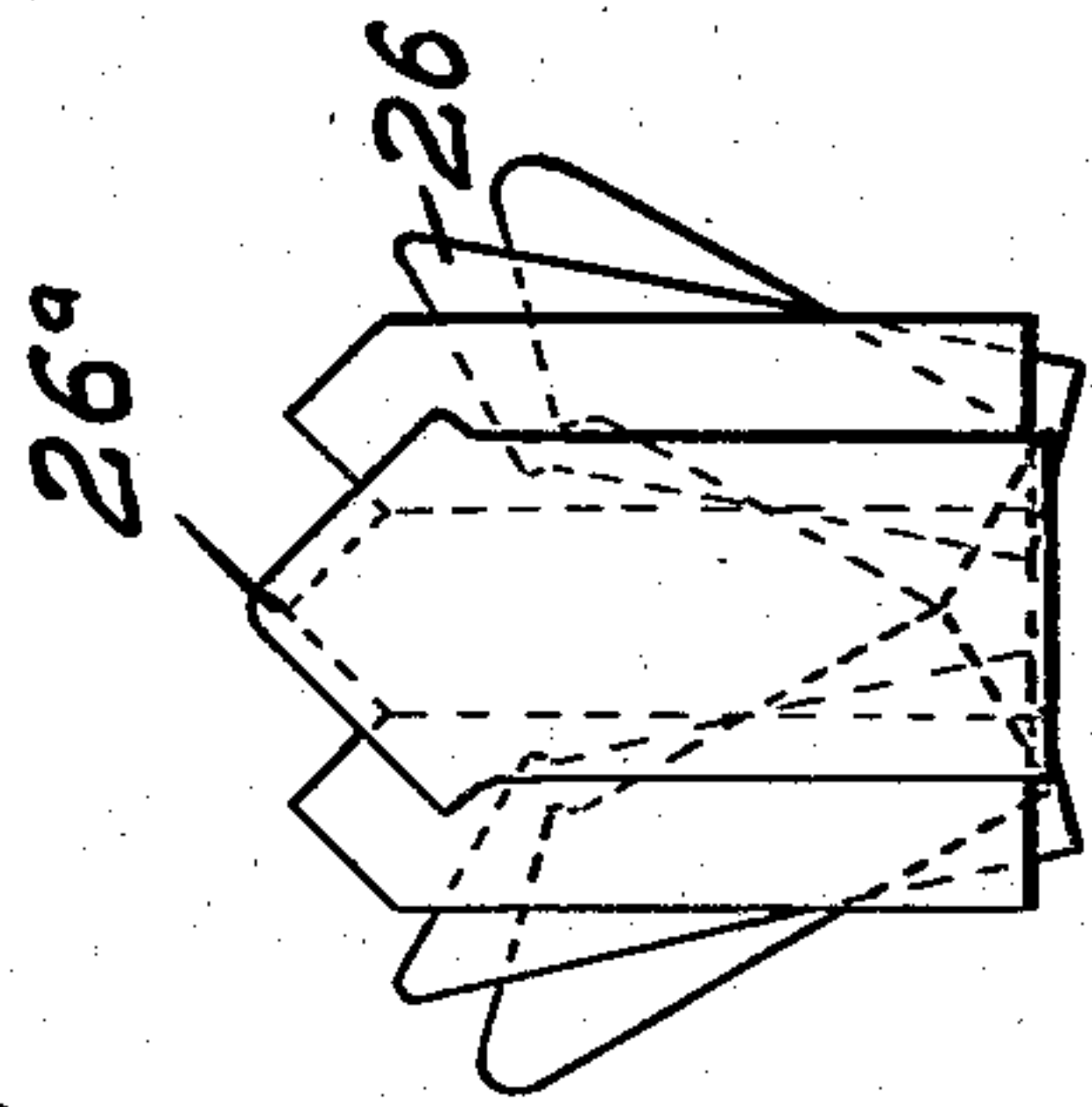


Fig. 10.

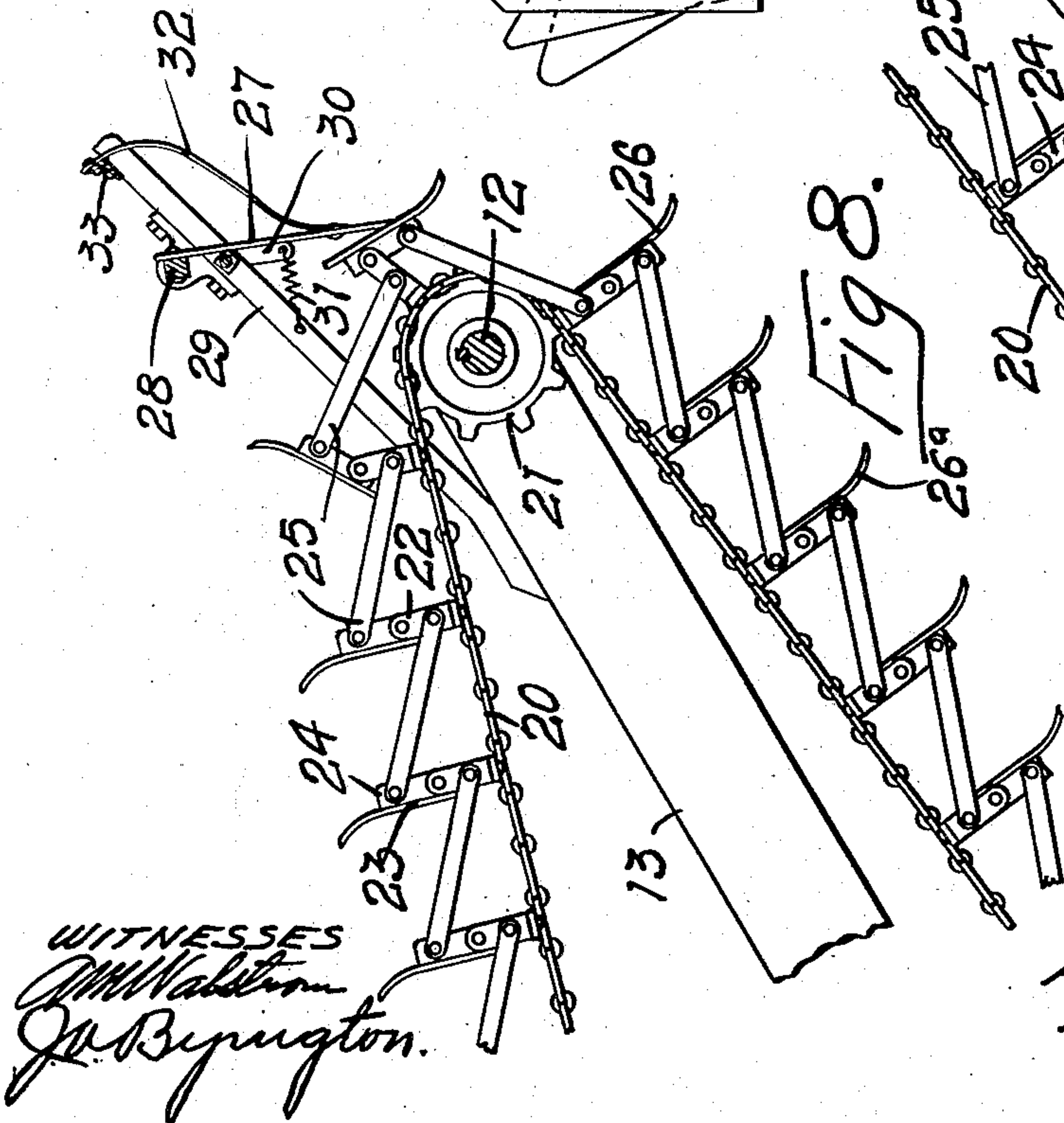


Fig. 8.

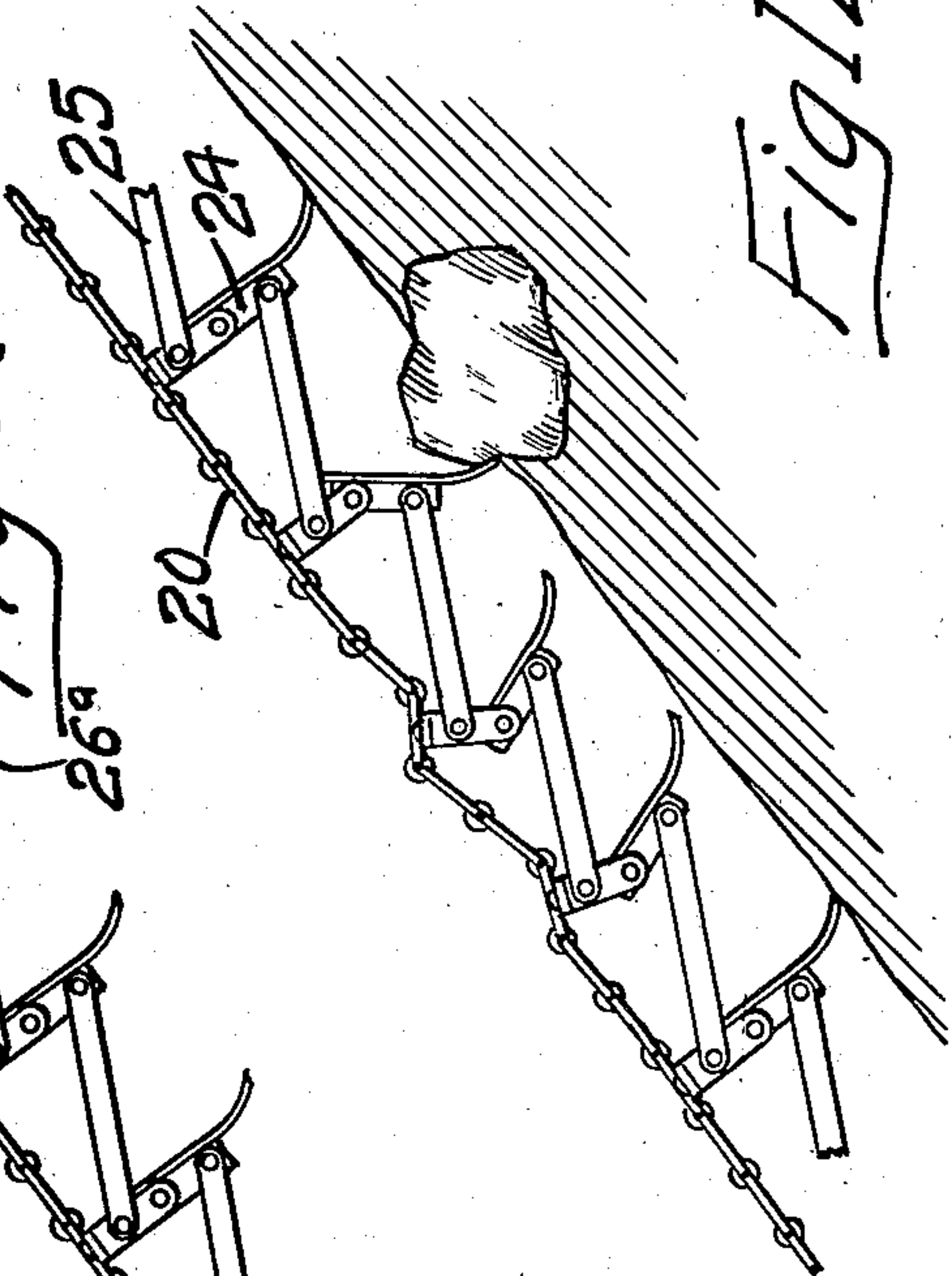


Fig. 12.

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# UNITED STATES PATENT OFFICE.

ANTON I. HOVLAND, OF MARSHALL, MINNESOTA.

## DITCHING-MACHINE.

No. 915,963.

Specification of Letters Patent.

Patented March 23, 1909.

Application filed March 25, 1908. Serial No. 423,170.

*To all whom it may concern:*

Be it known that I, ANTON I. HOVLAND, of Marshall, Lyon county, Minnesota, have invented certain new and useful Improve-  
5 ments in Ditching-Machines, of which the following is a specification.

The object of my invention is to provide a ditching machine for cutting a ditch and laying the tile in marshy or swampy land  
10 which ordinarily is too wet for cultivation.

A further object is to provide a machine that is adapted for use in any kind of soil and with which a ditch of any desired depth may be cut having the necessary fall to carry  
15 off the water.

The invention consists generally in a ditching machine having skids and shoes therefor to adapt the machine for use in soft marshy ground where a machine with wheels  
20 could not be successfully operated.

Further, the invention consists in providing means whereby the operator of the machine is able to follow accurately the surveyor's lines and vary the depth of the ditch  
25 according to the rise and fall of the surface over which the machine is moving.

Further, the invention consists in providing an improved type of shovel or excavating device and an improved cleaning apparatus therefor.  
30

Further, the invention consists in means adapted to prevent the walls of the ditch from caving in between the passage of the shovels and the laying of the tile.

Further, the invention consists in various constructions and combinations, all as hereinafter described and particularly pointed  
35 out in the claims.

In the accompanying drawings, forming  
40 part of this specification, Figure 1 is a vertical sectional view of a ditching machine embodying my invention. Fig. 2 is a side elevation of the machine. Fig. 3 is a diagrammatic view illustrating the machine at work.  
45 Fig. 4 is a rear view of the machine. Fig. 5 is a front view illustrating the side delivery carrier. Fig. 6 is a detail, side elevation of a portion of the machine illustrating the driving mechanism for the side delivery carrier.

Fig. 7 is a detail view of the tilting frame which carries the excavator belt. Fig. 8 is a detail view of a portion of the belt illustrating the action of the shovel cleaner. Fig. 9 is a detail view illustrating the manner of mounting  
55 the shovels on the belt. Figs. 10 and 11

are additional detail views of the same. Fig. 12 is a detail view illustrating the position assumed by the shovels and belt when one of the shovels strikes a stone. Fig. 13 is a detail sectional view of the device arranged  
60 in the rear of the excavator belt to prevent caving in of the walls of the ditch.

In the drawing, 2 represents parallel skids connected by cross bars 3 and 4 and provided with shoes 5 having turned up nose plates 6.  
65 The shoes are arranged beneath the skids and a series of links 7 inclose the skids and are arranged at an incline to the horizontal, and are pivotally connected to the tops of the skids and the tops of the shoes, and are  
70 capable of swinging on their pivots to allow the skids to be raised a limited distance for the purpose of leveling the machine when it is running over uneven or sideling ground. Any suitable means may be provided for  
75 raising the skids off the shoes but I prefer to provide screws 8 having nuts swiveled in guards 9 on the skids and adapted to bear at their lower ends in steps 10 on the shoes. The skids and shoes extend the entire length  
80 of the machine and the shoes are of suitable width to present broad bearing surfaces on the ground and form substantial supports and prevent the machine from sinking into the soft ground in wet or marshy places.  
85 Generally in machines of this type broad faced wheels are employed but these have been found unsuitable and inefficient to prevent the machine from sinking in the mud, and in many instances ditch work has been  
90 abandoned owing to the fact that the wheeled machines could not be operated.

The adjustment of the skids allows the machine to be leveled as it moves along and keeps the walls of the ditch substantially vertical even where the machine is operating on  
95 very sideling ground. Upon the skids an upright frame 11 is mounted. In the forward portion of this frame a transverse shaft 12 is journaled and upon this shaft a rectangular frame 13 is mounted. A beam 14  
100 is attached to said frame 13 between bolts 15, and by loosening the said bolts said frame and beam may be adjusted with respect to one another. Rods 16 are attached at one end  
105 to the frame 13 and at their opposite ends to a plate 17 that bears on the end of the beam 14, and when the bolts 15 are loosened the ends of the rods 16 may be adjusted to obtain relative movement of the frame and  
110



beam and tighten the excavating belt. A large wheel 18 is mounted on one end of the beam 14 and has a hollow face 19 that is adapted to receive a sprocket belt 20 which passes around a sprocket wheel 21 centrally secured on the shaft 12 (see Fig. 7).

A series of bails 22 are secured at regular intervals to the sprocket belt 20 and flat plates 23 have end flanges 24 thereon which are pivotally connected to the bails 22, and links 25 pivotally connect the bails 22 with the outer ends of the plates 23 (see Figs. 8, 11 and 12). Upon the plates 23 the excavating shovels or diggers are secured, preferably by bolts which will allow the shovels to be removed and others substituted in case of damage or breakage. These shovels, as indicated in Figs. 9, 10 and 11, have differently shaped cutting edges and are arranged in different ways on their supporting plates. For instance, in Fig. 9 a shovel 26 is illustrated having a cutting edge on one side, the shovels being secured so that their cutting edges diverge. The adjoining shovels have similar edges with a less degree of divergence. The next shovel 26<sup>a</sup> has a spear shaped cutting edge and is centrally arranged on its supporting plate, and the next plate is provided with a series of correspondingly shaped shovels arranged side by side and presenting a saw tooth cutting edge to the soil. These shovels follow after one another in cutting the ditch, and their irregular arrangement causes the distribution of the work among them, the forward shovels cutting out and carrying away a portion of the soil and those that come after completing the work. The pivotal arrangement of the shovels allows them to adjust themselves to any obstruction in the soil, as for instance, as illustrated in Fig. 12, should a shovel strike a rock its connection with the succeeding shovel will cause the chain to buckle and the succeeding shovel to be raised sufficiently to clear the obstruction or easily slide over it, and upon passing the rock the shovel will drop down into the soil again and each shovel carrying away a portion of the soil the rock will finally be excavated and carried off also. This flexible character of the chain and the pivotal arrangement of the shovels will prevent clogging of the excavating devices in the ditch and reduce greatly the danger of breakage.

For the purpose of cleaning the shovels I provide a plate 27 secured to a rock shaft 28 that is supported in bars 29 on the machine frame. An arm 30 is mounted on said shaft and a spring 31 is connected to said arm and normally holds the said plate in the path of the shovels. In addition to the plate 27 I provide a flexible strip 32, preferably of leather, secured at one end to a cross bar 33 and at its opposite end to the plate 27. The sheet is loose and flexible between its ends

and when the mud accumulates on the scraper plate 27 and contacts with the flexible sheet it will buckle under the pressure and dislodge the accumulation on the scraper plate and prevent it from adhering to the plate and clogging it. This sheet or means for preventing the scraper plate from clogging, I regard as a valuable feature of my invention as it is practically impossible to use a scraper plate in a wet or gumbo soil without clogging.

For the purpose of raising the excavator belt I provide a truss frame 34 secured to the beam 14 and carrying a sprocket wheel 35 that acts as an idle wheel and engages the upper run of the excavating belt. A cable 36 is attached to said truss frame and to a shaft 37 transversely mounted in the frame 11. A gear wheel 38 is mounted on said shaft 37 and meshes with a worm 39 on a rod 40 that extends lengthwise of the machine frame and is provided with an operating wheel 41. By turning this wheel the operator can raise or lower the beam 14 and the excavating belt according to the depth desired for the ditch. The weight of the beam 14 and the wheel 18 holds the excavator belt in its operating position and the plows in engagement with the soil.

It is desirable in a machine of this kind to provide means in the rear of the excavator belt to prevent the walls of the ditch from caving in prematurely. I therefore provide a shoe 42 having a curved under surface adapted to rest and travel on the bottom of the ditch, and provided with side plates 43 and a curved forward plate or share 44 with which the plates 43 having a sliding connection by means of slots and pins 45. A top plate 46 is provided, supporting a rod 47 having a threaded upper end and a thumb nut 48, said rod depending between the plates 43 and pivotally connected therewith by links 49. By adjusting this rod up or down the plates 43 are moved toward or from one another to adapt them for the width of the ditch. The contact of the plates 43 with the sides of the ditch will prevent it from caving in before the tile are laid. An upright gage bar 50 is secured to the plates 43 and extends above the skids supporting the machine and is provided with a series of graduations by means of which the operator of the machine can accurately determine the depth of the ditch.

The plates 43 are braced and held in parallel relation with one another by means of bars 51 and 52, the latter being secured at its upper end to the gage bar 50, the said plates and bars together forming a frame supporting the shoe 42 in the desired position with respect to the excavator belt. For the purpose of raising the shoe 42 I provide a screw 53 arranged to pass through a nut 54 on a bar 55 and having a threaded connection at its lower end with the frame of the plates 43.



The bar 55 is pivotally attached to the rear portion of said plates and is inclined upwardly therefrom and secured to a fork 56 that is pivoted on the upper portion of the machine frame. A cable 57 is attached to said bar and extends to a shaft 58 whereon a sprocket wheel 59 is secured. A belt 60 passes around said sprocket wheel to a pinion 61 having an operating crank 62. The operator by means of this crank can adjust the plates 43 vertically according to the depth of the ditch and allow them to assume the desired position in the rear of the excavator wheel.

A spout 63 preferably of sheet metal, is secured to the rear portion of the plate frame and has a rearwardly curved portion 64 adapted to lie upon the bottom of the ditch and discharge the sections of tile therein. These sections are fed into the top of the spout and sliding down by gravity, will as the machine is moved along, pass out through the spout portion 64 and be laid end to end along the bottom of the ditch. A level 65 is mounted on an arm 66 that is carried by the gage bar to enable the operator to determine when the shoe rests squarely on the bottom of the ditch.

It is customary, preparatory to ditching a piece of land to have a surveyor run a line and mark it off at intervals with a series of stakes, beginning with a water course or other body of water into which the ditch discharges.

The operator of the machine follows these stakes in ditching.

I have illustrated diagrammatically in Fig. 3 the arrangement of the stakes indicated by letter S, between which lines indicated by letter L, are stretched. These lines are on different levels following the variation in the height of the stakes, and are parallel with the bottom of the ditch when formed, and evidently if some means is provided to follow these lines the operator can tell at a glance whether the ditch is provided with the proper fall and is dug according to the surveyor's lines. With this end in view I provide a bar 67 pivoted at 68 on a machine frame and supported on a bar 69 that is pivoted at 70 on the beam 14 and is provided with a series of holes 71 at intervals therein adapted to receive a pin 72 which passes through the bar 67. The bar 67 will thus rise and fall with the beam 14 and may be adjusted independently of said beam according to the height of the surveyor's lines. An arm 73 is mounted on the bar 67 and projects laterally on one side of the machine, as shown in Fig. 4, and is adapted to bear on the lines L, a suitable level 74 being mounted on said arm. The operator can thus follow accurately the surveyor's lines without disturbing the stakes, and be assured that the bottom of the ditch is parallel with said lines and has the desired drop or fall sufficient to carry away the water accumulating in the tile pipe.

Any suitable apparatus may be provided for propelling the machine. Horse power is undesirable as horses cannot travel, generally speaking, on the land that is being ditched. I therefore mount an engine 75 on a suitable base 76 and provide a capstan apparatus of common construction (not shown) by means of which through the power of the engine the machine and the engine will be drawn over the ground. A driving belt 77 extends from the said engine to a pulley 78 on a shaft 79 mounted in the frame of the machine. One run of said belt passes under an idle pulley 80 mounted in standards 81 and the upper run of the belt passes under an idle pulley 82 that is mounted in vertically moving bearings 83 between said standards and has the function of a belt tightener. Sprocket chains 84 connect the shaft 79 with sprocket wheels 85 on the ends of the shaft 12 and form a driving connection for the excavator belt. An inclined plate 86 is arranged beneath the upper portion of the excavator belt against which the material brought up by the shovels is discharged and gradually raised by the successive shovels to a trough 87 in which a side delivery belt 88 is arranged to operate, said belt including shovels corresponding substantially to those already described with reference to the excavator belt. This side delivery belt is preferably driven as follows:

A sprocket wheel 89 is secured on the shaft 12 and connected by a chain 90 with a shaft 91 whereon a beveled gear 92 is secured, meshing with a similar gear on a shaft 93. A sprocket chain 94 forms a driving connection between the shaft 93 and a shaft 95 of the side delivery conveyer. This conveyer is of sufficient length to discharge the excavating material at one side of the machine and out of its path, and when the ditch is dug and the tile laid the excavated material is thrown back into the trench and the ditching operation is completed.

I claim as my invention:

1. A ditching machine comprising a frame and an excavating mechanism carried thereby, skids arranged parallel with one another and whereon said frame and excavating mechanism are supported, and means for maintaining the level of said machine on sideling ground, substantially as described.

2. A ditching machine comprising a frame, and an excavating mechanism supported thereby, skids whereon said frame and mechanism are supported, shoes for said skids and means for raising said skids on said shoes to maintain the level of the machine on sideling ground, substantially as described.

3. An excavating machine comprising a suitable frame, an excavating mechanism carried thereby, skids whereon said frame is mounted, shoes supporting said skids and pivotally connected therewith, and adjusting screws mounted in said skids and adapted to



engage said shoes, and whereby the level of said skids with one another may be maintained to adapt the machine for use on side-lining ground.

5 4. In a ditching machine, the combination with a frame, of an excavating belt and a series of shovels secured thereto, a shoe adapted to move along the bottom of the ditch in the rear of said excavating belt, and  
10 side plates provided above said shoe and secured at their lower ends thereto, and whereby the walls of the ditch are held against caving in, and a tile spout provided in the rear of said plates and shoe, substantially as  
15 described.

5. In a ditching machine, the combination, with an excavating belt and a series of shovels mounted thereon, a shoe provided in the rear of said excavating belt, a curved plate ar-  
20 ranged above said shoe, side plates slidably connected with said curved plates to adapt them for ditches of different width, means for adjusting said side plates laterally and a tile spout provided in the rear of said shoe  
25 and plates.

6. In a ditching machine, the combination, with a frame, of an excavating belt and a series of shovels mounted thereon, a shoe adapted to travel along the bottom of the ditch in the rear of said belt, plates arranged  
30 above said shoe, a gage bar carried by said plates and having suitable graduations thereon, the lower end of said bar being near the bottom of the ditch, means for raising and  
35 lowering said plates and said bar, and a tile spout mounted on said frame in the rear of said shoe and plates.

7. In a ditching machine, the combination, with a frame, of an excavating belt mounted  
40 therein and shovels provided at intervals on said belt, a tile spout into which the sections of tile are deposited and fed into the bottom of the ditch as the machine moves along, means interposed between said spout and  
45 said excavating belt for preventing the walls of the ditch from caving in after the passage of said belt and before the tile are laid, said means being laterally adjustable to adapt the device for ditches of different width.

50 8. In a ditching machine, the combination, with an excavating belt, of a series of shovels mounted thereon, said shovels having differently shaped cutting edges, and some of them having their cutting edges projecting  
55 laterally beyond the corresponding edges of contiguous shovels, for the purpose specified.

9. In a ditching machine, the combination, with an excavating belt, of a series of bails  
60 secured at intervals thereon, plates pivotally connected to said bails, shovels secured on said plates and links pivotally connecting adjoining bails and plates, for the purpose specified.

65 10. In a ditching machine, the combina-

tion, with an excavating belt, of bails secured at intervals thereon, plates pivotally mounted in said bails, shovels removably secured to said plates and having differently shaped cutting edges and irregularly arranged on  
70 said plates whereby the cutting edges of succeeding shovels will gather up the material left by the preceding shovels, and means connecting the adjoining bails and plates.

11. In a ditching machine, the combina-  
75 tion, with an excavating belt, of a series of shovel blades mounted thereon, said blades having cutting edges and being irregularly arranged, and the rear blades gathering up the material left by the forward blades, sub-  
80 stantially as described.

12. In a ditching machine, the combina-  
tion, with an excavating belt, of bails secured thereon at intervals, plates pivotally mount-  
85 ed on said bails, shovel blades secured to said plates, links connecting the adjoining bails and plates and a scraper blade having an edge in the path of said shovels, and the movement of said belt causing said shovels to contact with said blade and be held in en-  
90 gagement therewith by said links, substantially as described.

13. In a ditching machine, the combina-  
tion, with an excavating belt and a series of shovels mounted at intervals thereon, of a  
95 scraper blade arranged in the path of said shovels and a flexible sheet secured to said scraper blade and arranged to prevent the accumulation of the scrapings thereon.

14. In a ditching machine, the combina-  
100 tion, with a suitable support, of a scraper blade mounted thereon, and a flexible sheet attached at one end to said frame and at its other end to said scraper blade, the intermediate portion of said sheet being capable of  
105 buckling or bending, for the purpose specified.

15. In a ditching machine, the combina-  
tion, with a supporting frame, of a beam pivoted thereon, an excavating belt carried by  
110 said beam, means for raising and lowering said beam, a pivoted bar having an adjustable connection with said beam and adapted to rise and fall therewith, said bar having an arm extending laterally therefrom and pro-  
115 jecting beyond the side of the machine and adapted to follow and rest upon a cord stretched between the surveyor's stakes, substantially as described.

16. In a ditching machine, the combina-  
120 tion, with a frame, of a beam pivoted therein, an excavating belt carried by said beam, a bar pivoted in said frame, a bar pivoted on said beam and having a series of holes a pre-determined distance apart, and means for  
125 adjustably connecting said first and second named bars with one another through said holes, and means for raising and lowering said beam and bars, an arm provided on said first named bar and projecting laterally be-  
130



yond the side of the machine and adapted to follow a cord stretched between the surveyor's stakes, for the purpose specified.

17. In a ditching machine, the combination, with a frame, of a beam pivoted at one end therein, a wheel mounted in said beam, an excavating belt carried by said beam and wheel, means for raising and lowering said beam and belt, and means connected with said beam and adapted to project laterally beyond the side of the machine and follow a cord stretched between the surveyor's stakes.

18. In a ditching machine, the combination, with a frame, of a shaft 12 journaled therein, a frame 13 mounted at one end on said shaft, a beam 14 slidably mounted in said frame 13, a wheel 18 carried by said beam, a sprocket wheel 21 secured to said shaft 12, an excavating belt passing around said wheel 18 and said sprocket wheel 21, and means for sliding said beam 14 back and forth in said frame 13 to tighten said excavating belt or slacken the same.

19. In a ditching machine, the combination, with a frame, of a shaft 12 mounted therein, a frame 13 pivoted on said shaft 12, a beam 14 slidably mounted in said frame 13, an excavating belt carried by said shaft and beam, a plate provided at one end of said beam, rods connecting said plate with said frame 13 and said rods having adjusting nuts whereby said beam can be moved lengthwise in said frame 13 to tighten said excavating belt.

20. In a ditching machine, the combination, with a belt, of a series of shovels mounted thereon, a scraper blade in the path of said shovels and means independent of said belt and arranged to hold each shovel in sliding contact with the edge of the scraper blade during the passage of the shovels past said blade.

21. In a ditching machine, the combination, with an excavating belt, of a series of shovels pivoted thereon, a scraper blade in the path of said shovels, and means independent of said belt and connecting one shovel with the succeeding one, whereby each shovel as it passes said scraper blade will be held in sliding engagement therewith, for the purpose specified.

22. In a ditching machine, the combina-

tion, with an excavating belt, of a series of shovels pivoted thereon, and means connecting each shovel with a succeeding one, whereby when a shovel strikes an obstruction said belt will be bent and the succeeding shovel lifted, for the purpose specified.

23. In a ditching machine, the combination, with an excavating belt, of bails secured thereon, shovels pivotally supported on said bails and links connecting each shovel with the bail of the succeeding shovel.

24. In a ditching machine, the combination, with a belt, of plates pivoted at intervals thereon, and excavating shovels secured to said plates, some of said shovels being secured to the middle portions of said plates, others to the ends thereof, and some of the end shovels having points projecting laterally beyond the corresponding points of the other shovels, for the purpose specified.

25. In a ditching machine, the combination, with a suitable frame, of an excavating belt and means for raising and lowering the same, and means capable of vertical adjustment with said belt and projecting laterally therefrom and adapted to follow and rest upon a cord stretched between the surveyor's stakes, for the purpose specified.

26. In a ditching machine, the combination, with the frame, of an excavating belt provided with a series of shovels and operating at an incline in said frame, a transverse or side delivery belt, a trough in which said side delivery belt operates, and an inclined plate arranged beneath the upper portion of the excavating belt and upon which the material is delivered by said shovels and gradually raised to said trough and side delivery belt.

27. In a ditching machine, the combination, with an excavating belt, a series of shovels mounted thereon, of a scraper blade in the path of said shovels and means arranged to prevent the accumulation of scrapings on said scraper blade.

In witness whereof, I have hereunto set my hand this 18th day of March 1908.

ANTON I. HOVLAND.

Witnesses:

J. H. BALDWIN,  
RICHARD PAUL.