A. MATSON & F. BRONSON.

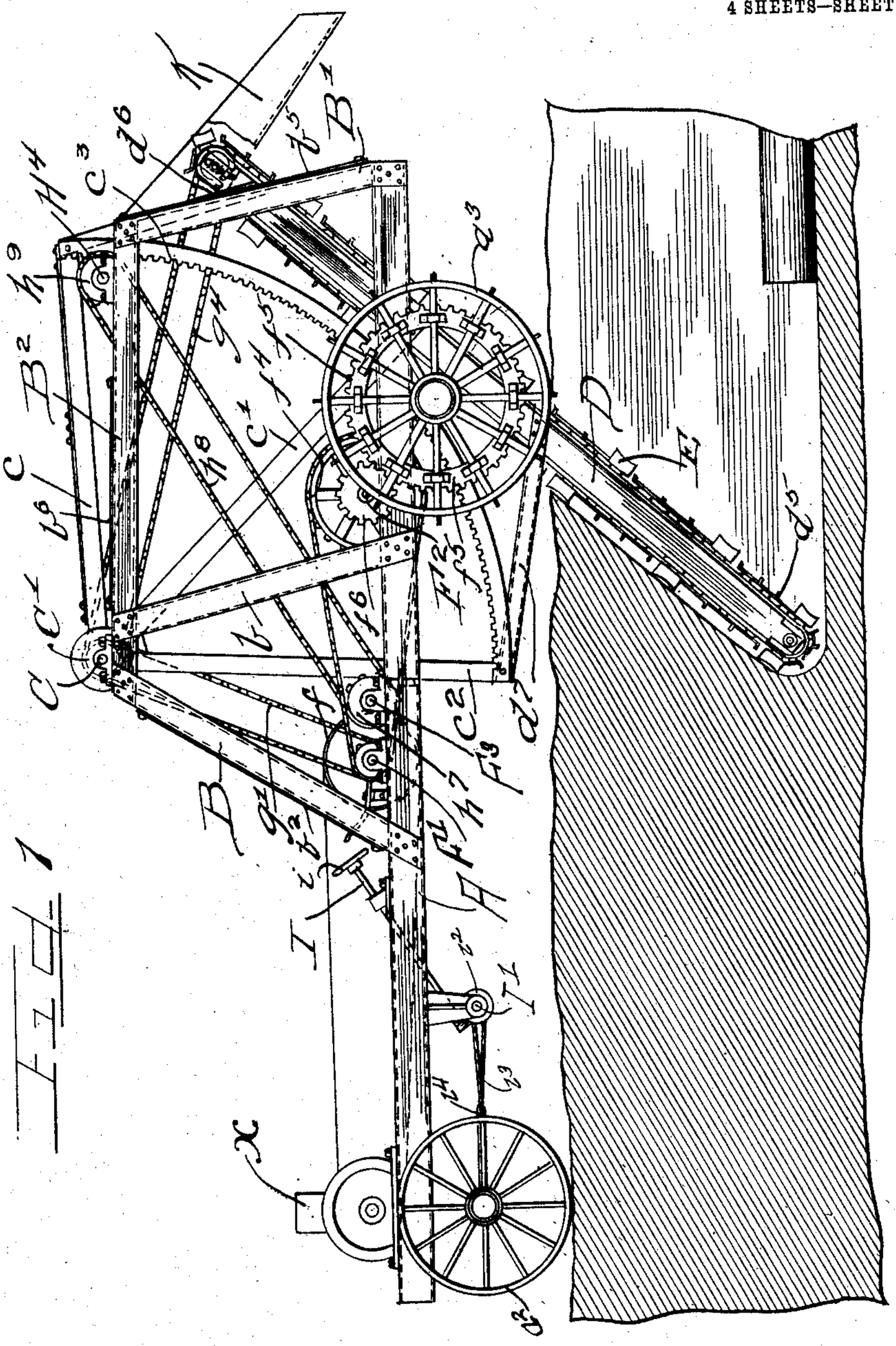
DITCHING OR TILE LAYING MACHINE.

APPLICATION FILED SEPT. 21, 1907.

905,551.

Patented Dec. 1, 1908.

4 SHEETS—SHEET 1.



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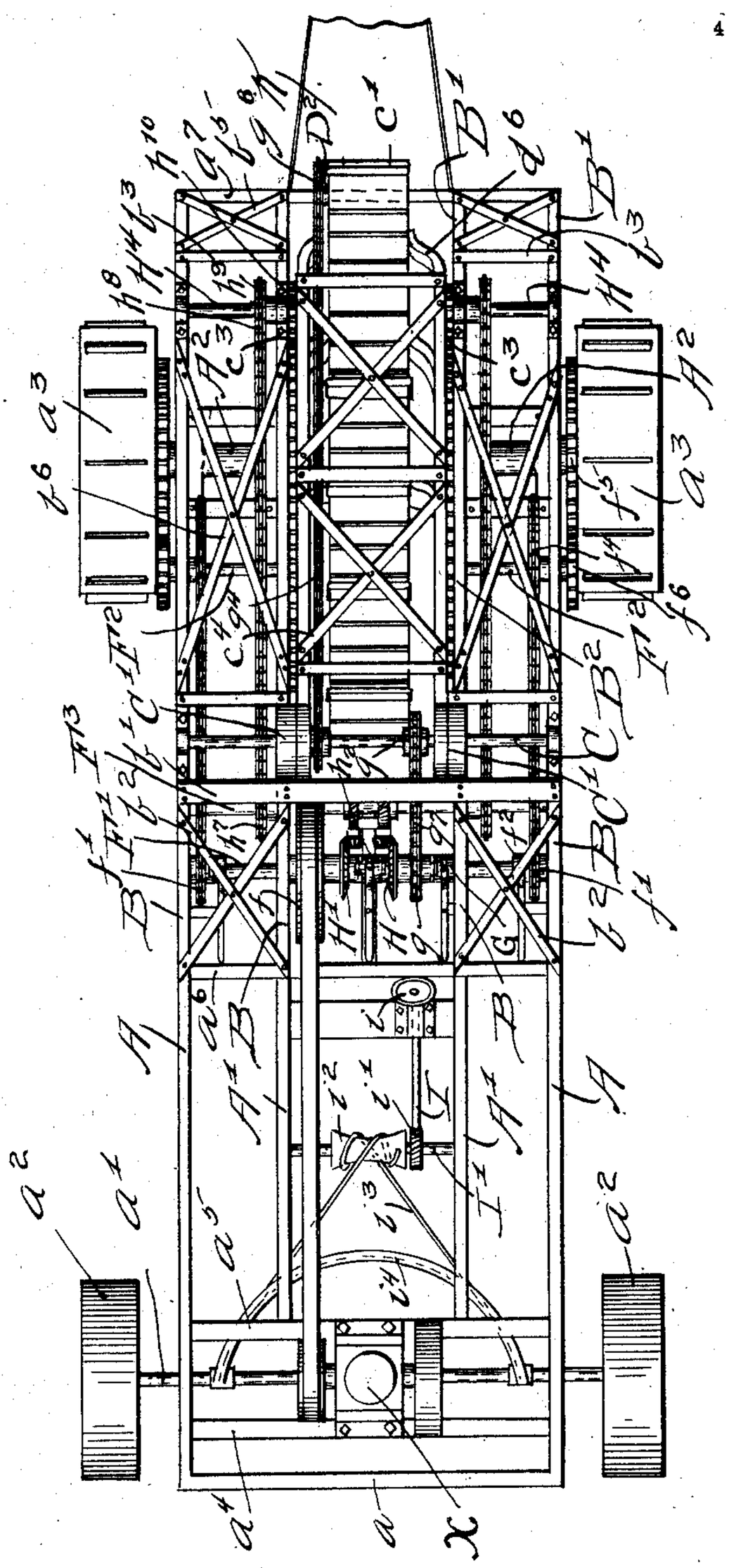
4 SHEETS—SHEET 2.

FIG. 2.



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4 SHEETS—SHEET 3.

Fig. 3

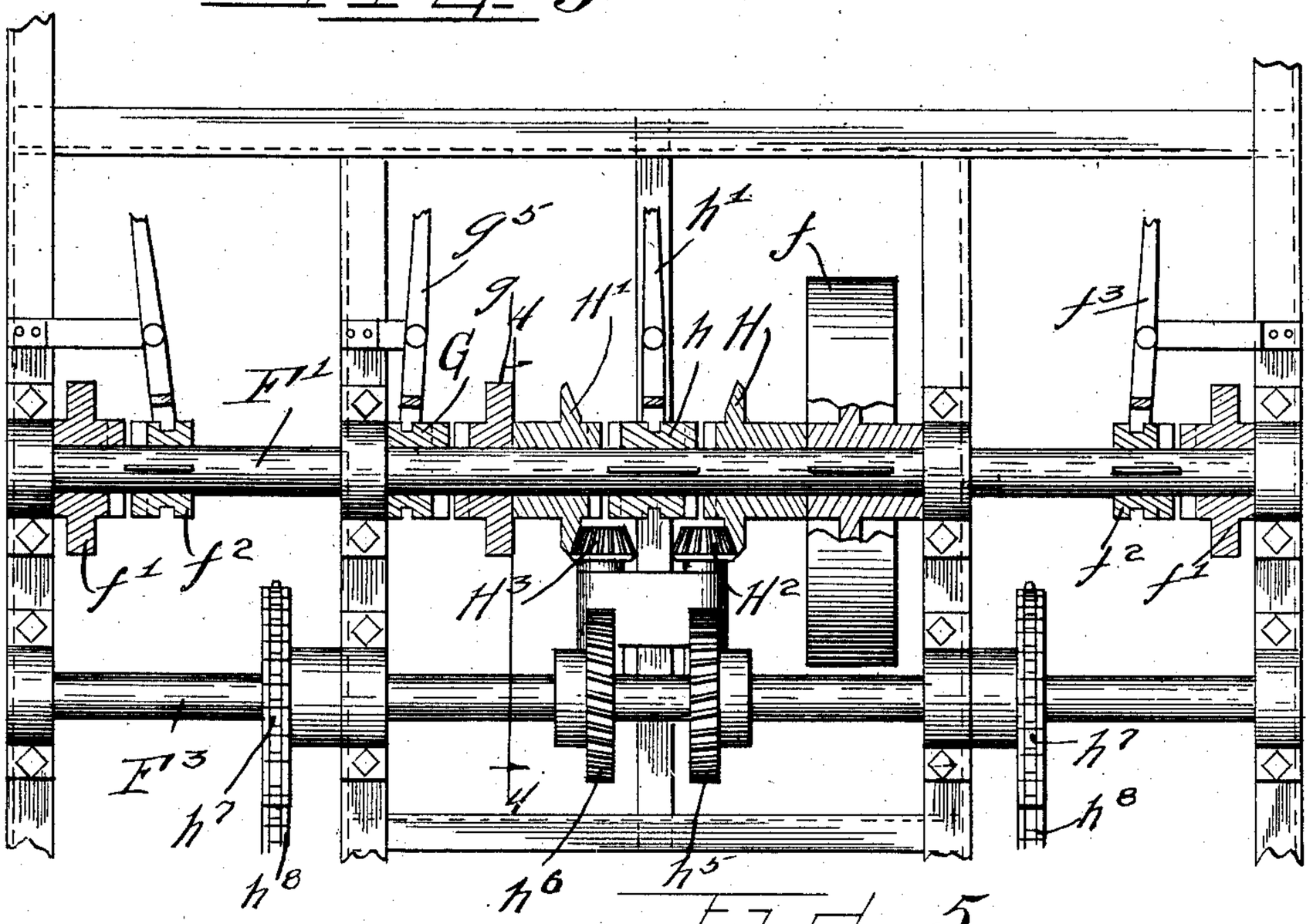


Fig. 5

Fig. 4

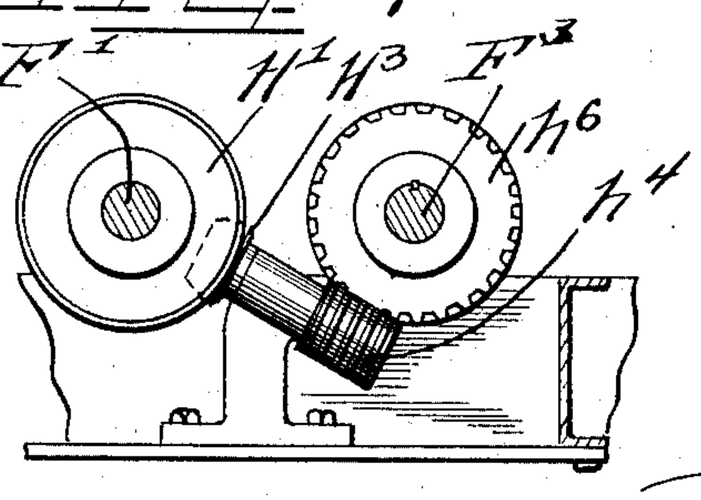
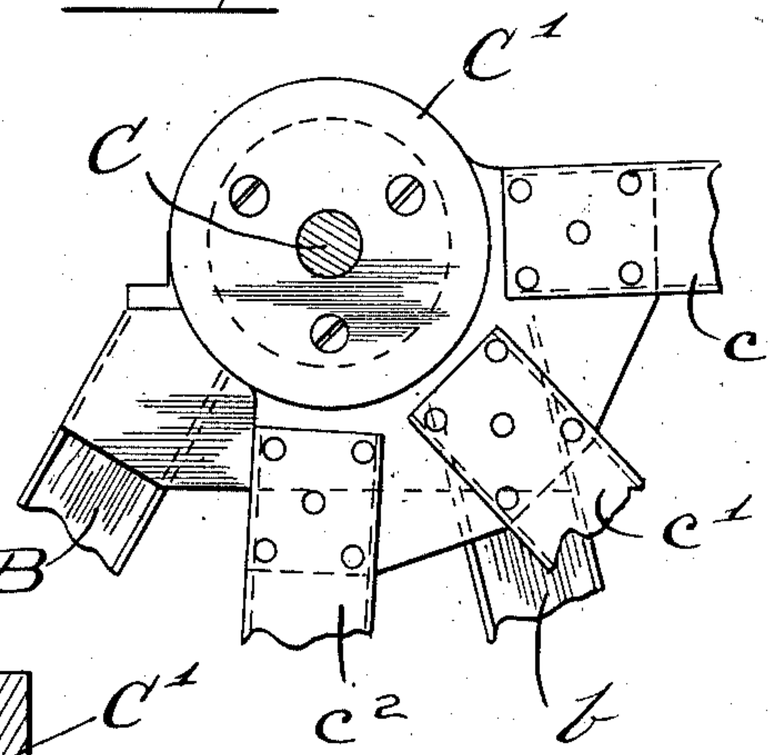
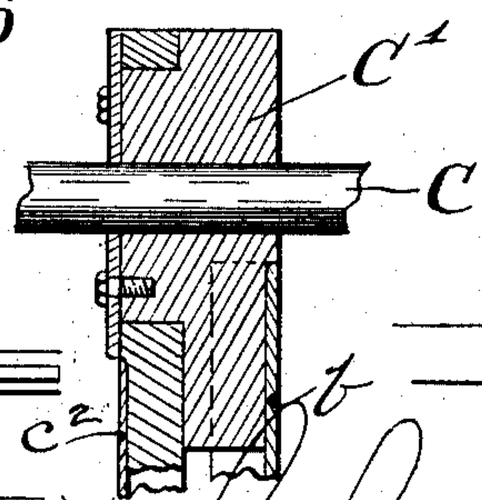


Fig. 6





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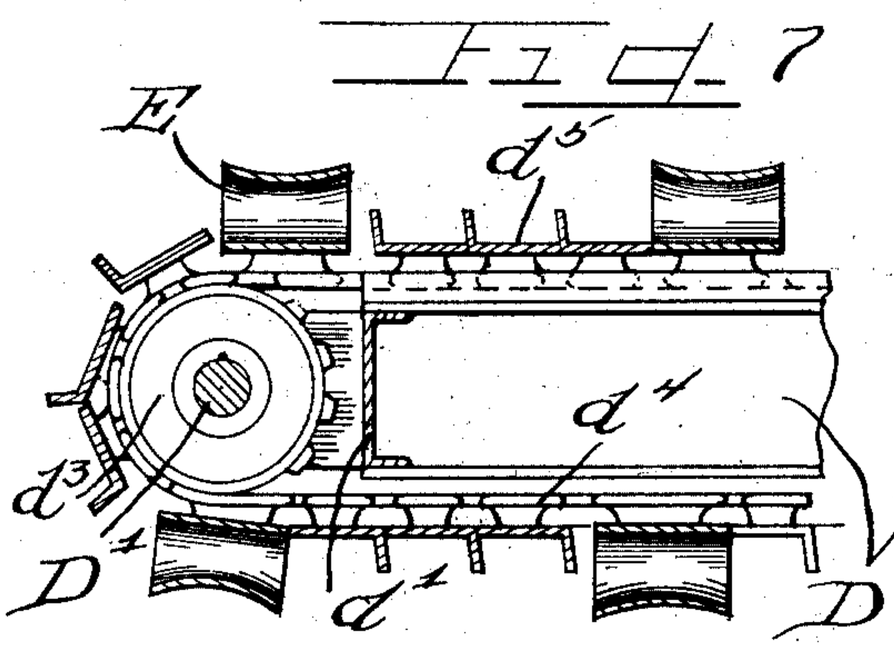
4 SHEETS—SHEET 4.

Fig. 7



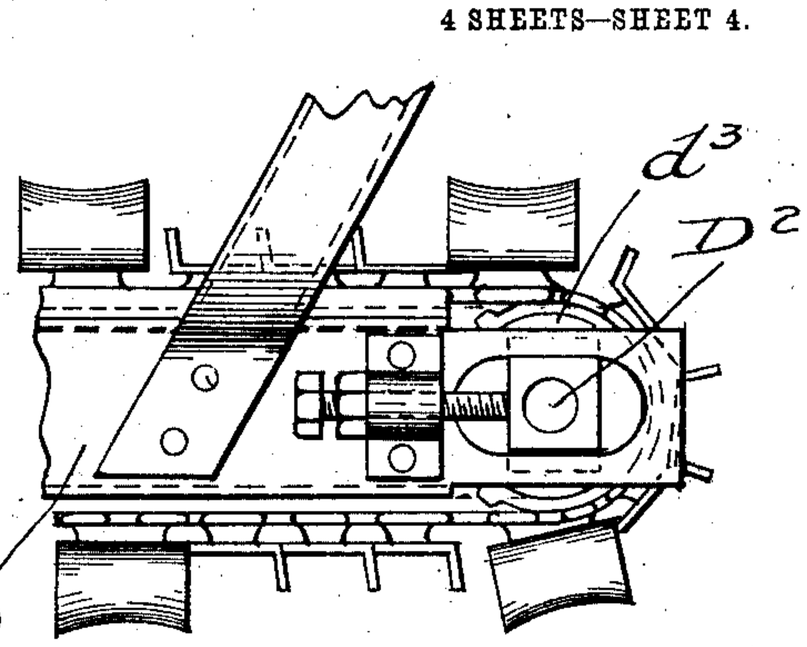


Fig. 8

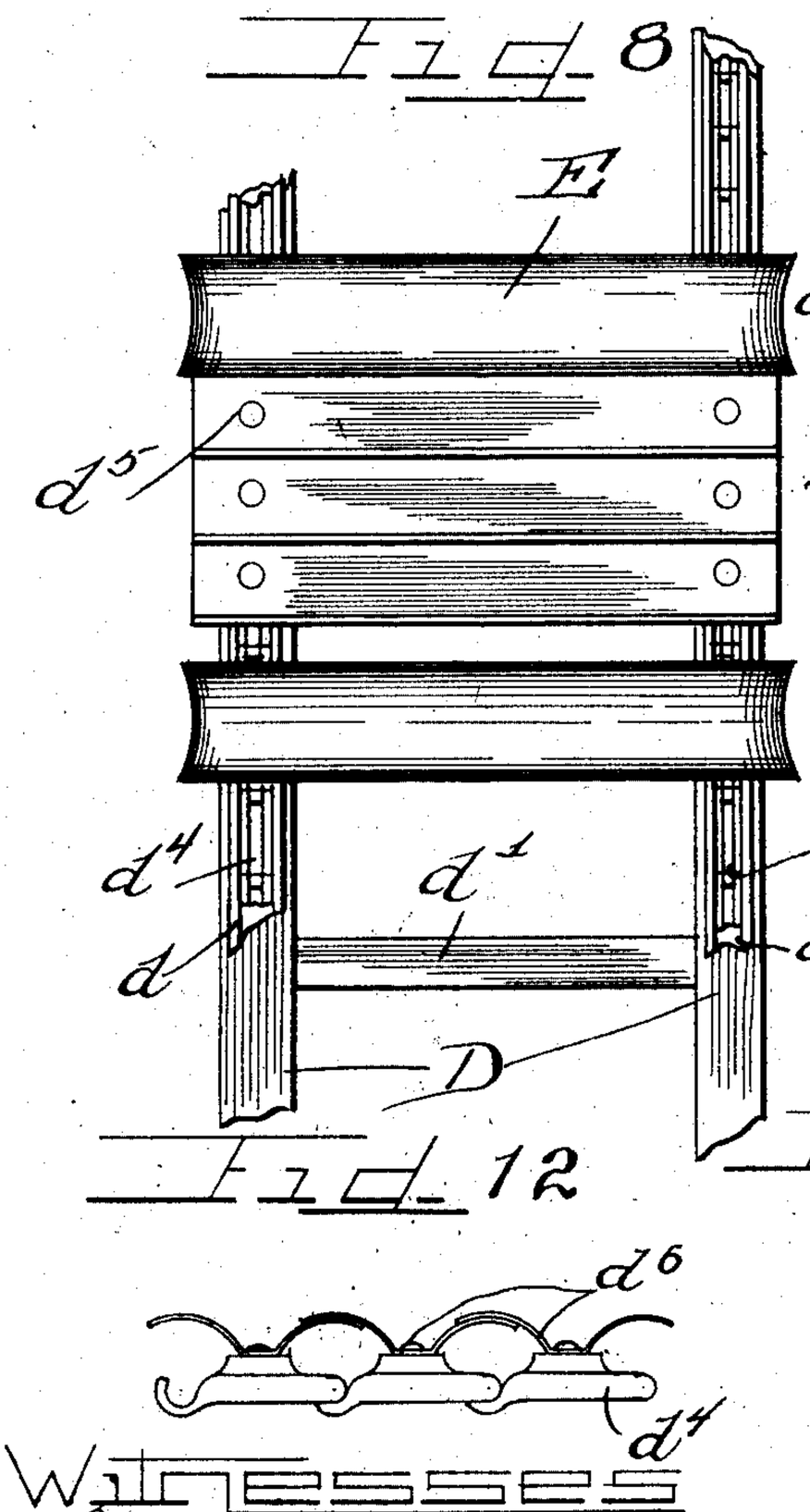


Fig. 9

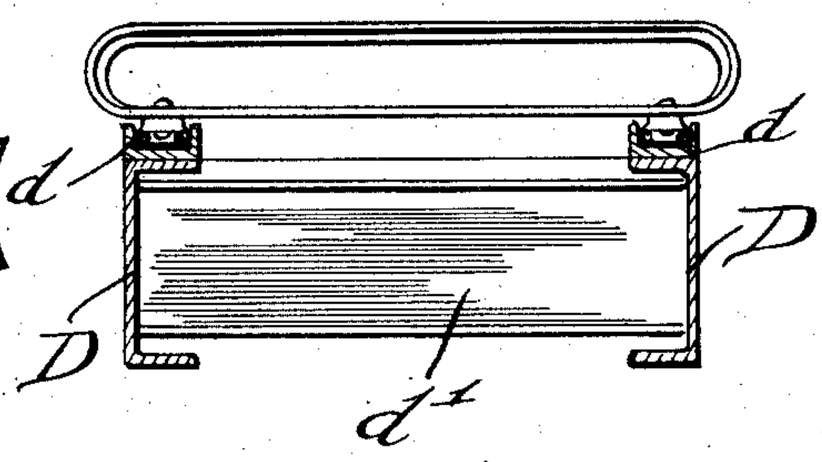


Fig. 10

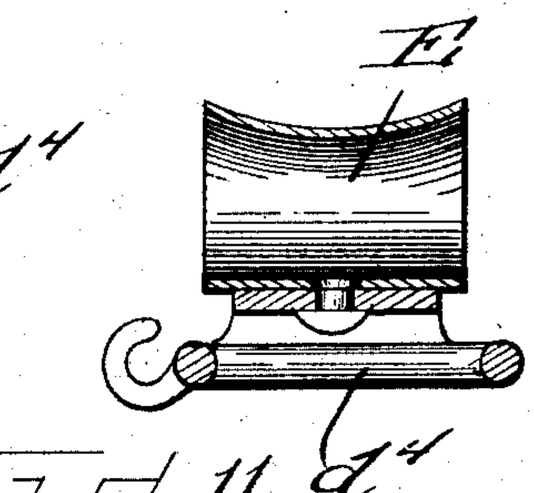


Fig. 11

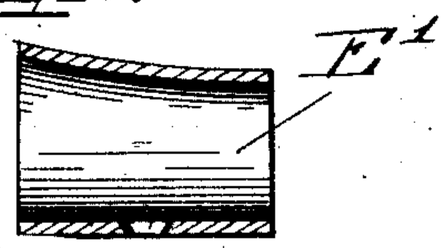


Fig. 12

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UNITED STATES PATENT OFFICE.

ALFRED MATSON AND FRANK BRONSON, OF WHITTEMORE, IOWA.

DITCHING OR TILE-LAYING MACHINE.

No. 905,551. Specification of Letters Patent. Patented Dec. 1, 1908.

Application filed September 21, 1907. Serial No. 393,923.

To all whom it may concern:

Be it known that we, ALFRED MATSON and FRANK BRONSON, citizens of the United States, and residents of Whittemore, Kossuth county, Iowa, have invented certain new and useful Improvements in Ditching or Tile-Laying Machines; and we do hereby declare that the following is a full, clear, and exact description of the same, 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 improvements in ditching or tile laying machines, and has for its object the construction of a self propelled excavator, adapted to dig a ditch of the desired width, in which the tile is laid and the material cut from the trench is automatically delivered again to fill the excavation thereby covering the tile.

It is a further object to graduate the rate of propulsion relatively to the excavating rate, thus insuring continuous operation.

It is a further object of the invention to afford a construction in which it is possible to vary the depth of the cut during the cutting operation, and also to vary the angle of the excavating means with the cut, to suit the condition of different kinds of soil.

The invention consists of the matters hereinafter described and more fully pointed out and defined in the appended claims.

In the drawings: Figure 1 is a side elevation of a device embodying our invention, showing the cut in longitudinal section. Fig. 2 is a top plan view of the same. Fig. 3 is an enlarged fragmentary horizontal section illustrating the drive. Fig. 4 is an enlarged fragmentary detail taken on line 4—4 of Fig. 3. Fig. 5 is a large fragmentary detail showing the pivotal support of the excavator. Fig. 6 is a section taken longitudinally of the shaft through the pivotal support. Fig. 7 is an enlarged fragmentary detail partly in side elevation and partly in section of the excavating conveyer. Fig. 8 is a fragmentary plan view of the same. Fig. 9 is a transverse section thereof. Fig. 10 is an enlarged transverse section of one of the conveying scoops or cutters with the chain belt link to which the same is attached. Fig. 11 is an enlarged transverse section of a modified form of scoop or cutter. Fig. 12 illustrates a modified form of conveyer.

As shown in the drawings: A indicates the side frame members or sills and a the front end sill and A′ the center sills of a frame or platform on which the excavator is constructed. Said frame is supported near its front end by means of wheels a^2 secured upon suitable axle a' on which said frame is pivotally supported to permit said axle to swing to steer the machine when in motion. Near the rear end are provided two short alined axles A^2, which are journaled in suitable bearings below the side and center sills and on the outer end of which are secured the traction wheels a^3. Said frame is provided with cross sills a^4—a^5—a^6 for approximately half the length thereof, from the front, and a rear end sill a^7, connects the rear ends of said side and center sills. By this construction a central longitudinal opening without obstruction is provided from the rear end sill a^7 forwardly for approximately half the length of the machine.

Rigidly secured on the side sill and center sills are upwardly and rearwardly inclined members or posts B and from the rear end of said frame are upwardly and slightly forwardly inclined posts B′ at the upper end of which and extending parallel and over the side and center sills are longitudinal members or beams B^2 and rigidly secured to the side and the center sills A and horizontal beam B^2 are rigid forwardly inclined braces b as shown more fully in Fig. 1. Extending transversely the machine and connecting the upper ends of the posts B and the forward ends of the horizontal members B^2 is a transverse frame member b' as shown in Fig. 2. As shown also transverse beams b^3 at the rear ends connect said horizontal frame members or beams above the side and center sills and suitable brackets b^2—b^5 and b^6 are provided to rigidly stay the frame to afford sufficient rigidity for said structure. Journaled transversely on the forward end of said upper frame superstructure, is a shaft C which serves as a pivot shaft for the excavator, and also is adapted to transmit the drive thereto. Secured on said shaft on each side said opening are radial members c—c'—c^2 which as shown, are connected at their outer ends by internal toothed racks or segments c^3 arranged concentrically with the shaft. The outer radial rib or spoke c and c^2 are rigidly braced as indicated by c^4 in Fig. 2 to afford great strength and rigidity.

Rigidly engaged on the segments at the

outer side thereof by means of the extended spoke or rib c' and braces d^6—d^7 is the excavator. Said excavator as shown in Figs. 7 to 10 inclusive comprises as shown parallel inwardly facing channel bars D forming the side frame members and having as shown a relatively narrow channel bar d secured longitudinally upon the upper flange of each and opening upwardly as shown in Fig. 9. Said side frame members are connected by transverse bars of suitable structural metal d' which may if desired also be channeled as shown in Fig. 7. Journaled transversely at the ends of said excavator frame are shafts D′—D² upon which are rigidly secured the sprocket wheels d^3 one on each side of the excavator frame and about which are trained sprocket chains d^4 comprising separable links, the upper runs of which lie in the channels d. Said chains are connected transversely by means of closely arranged angle bars d^5, each rigidly secured to a link on said chain, and each with the flange directed outwardly from the lower side as shown in Figs. 1 and 7. Instead of using angle bars a construction such as shown in Fig. 12 may be employed which comprises complemental bars d^6 convex on their outer sides which are integrally connected with a flat portion by means of which they are secured in place. As shown the adjacent bars d^6 overlap a considerable distance which allows ample movement without exposing an opening through which the excavated material can fall. Similarly connected to said chain on oppositely disposed links thereof are the excavating cutters or scoops E or E′. These as shown cut away the clay or earth in which the excavator operates, and as shown are open both at the top and bottom and of a length corresponding to the width of the excavator and of a width to extend near to the angle bars on adjacent links. As shown in Fig. 10, said cutters or scoops E are concave on their outer side or that which engages the dirt in cutting and the edge being directed completely outwardly, becomes self sharpening by wear against the excavated material. The cutter E′ in Fig. 11 also has its cutting edge directed outwardly from which the outer side inclines at a suitable angle to the rear edge. As shown also the ends of said cutters project sufficiently beyond the ways or side frame member D to afford a sufficient clearance therefor insuring at all times freedom from obstructions or being jammed in the cut.

A gasolene or other suitable motor X is supported on the front end of the machine and is belted back to a main driving shaft F′ journaled transversely the main frame and on which is rigidly secured with a driving pulley f. On each end of the shaft F′ as shown is a rotatable sprocket wheel f' and non-rotatable but slidable on the shaft is a clutch member f^2, adapted to engage a suitably shaped end or hub on the sprocket wheel to drive the same therewith. A shifting lever f^3 is provided on said clutch member f^2, to throw the same into or out of engagement with the sprocket wheel. Sprocket chains are engaged about said sprocket wheels and about larger sprocket wheels f^4 secured on a shaft F² journaled on the side and center sills near the rear axle. Gear wheels f^6 are provided on the outer ends of said shaft F², and mesh with gears f^5 rigidly bolted to each of the traction wheels a^3 to drive the same as shown in Figs. 1 and 2. Owing to the difference in the size of said sprocket wheels and gear wheels the machine is driven ahead at a relatively slow rate of speed. As shown also a sprocket wheel g is secured on said shaft F′ and engaged about the same is a sprocket chain g', which is trained over a sprocket wheel g^2, rigidly secured on the pivot shaft C. A clutch member G is slidable on said shaft by means of a lever g^5 to engage said sprocket wheel g. A suitable sprocket wheel is secured on the shaft C and trained about the same is a driving chain g^4 which drives to a suitable sprocket wheel g^6 on the shaft D² of the excavator, whereby inasmuch as the sprocket wheels are approximately of the same size, a rapid rate of drive for the elevator relatively the forward movement of the machine is secured.

Means are provided for moving the segment upwardly or downwardly to elevate the excavator, thereby or to press the same into the cut, and for this purpose as shown inwardly facing beveled gears H—H′ are rotatably engaged upon the shaft F′, near the middle thereof and facing outwardly between the same is a clutch member h, the ends of which are adapted to engage in suitable complemental faces on the hub of said gears, as shown in Fig. 3. An operating lever h', is provided for throwing said clutch member h in either direction to engage either of said gears. Beveled pinions H²—H³ are engaged on suitable shafts to mesh respectively with said bevel gears and the opposite ends of the shafts therefor incline downwardly and rearwardly and are each provided with a worm h^4, as shown in Fig. 4. These mesh each with a worm wheel h^5—h^6 said worms being right and left worms adapted to drive the shaft F³ on which they are secured, in either direction. Sprocket wheels h^7 are rigidly secured on the shaft F³ and trained about the same are sprocket chains h^8, which are trained about corresponding sprocket wheels h^9, secured upon transverse shafts H⁴, of the rear end of the superstructure and on the inner ends of which are gears or pinions h^{10} which mesh with the segments as shown in Figs. 1 and 2. In consequence, if the lever h' is thrown in

one direction, said segment is swung downwardly pressing the excavator into the cut. When swung in the other direction the opposite worm gear is actuated to reverse the shaft F^3, in consequence elevating the segment and excavator. When said clutch member h is left in neutral position, the worm gears act to rigidly hold the segment and excavator in adjusted position. Of course any suitable steering mechanism may be employed. For this purpose however, as shown, a steering shaft I is suitably journaled in operative relation with the operating levers for the machine to enable a single operator to control all parts of the machine. Said steering shaft I is provided with a worm adapted to drive a worm gear i', which is secured on a shaft I'. Also secured on said shaft is a drum i^2 on which are the oppositely wound ends of the cables i^3, the other ends of which are engaged around a suitable segment i^4, as shown in Fig. 2. In consequence the rotation of said shaft I serves to correspondingly adjust or swing the front axle.

The operation is as follows: A construction described is operated ordinarily by two men one of whom controls the various mechanisms by means of levers as shown in Fig. 3 and steers the machine. The other in tiling places the tile in the bottom of the trench, as closely as possible to the foot of the excavator, working just at the rear of the machine and sufficiently close thereto to permit the dirt and material from the excavator to be delivered behind him into the trench by means of the rearwardly and downwardly directed chute or apron K. The machine thus travels slowly along the line of the proposed drain and not only excavating the trench therefor, but as well covering the tile thus completing the cutting operation and enabling the work to be quickly accomplished. Of course if it is desired to dig a ditch without tiling, one man may conveniently operate the machine inasmuch as the operating mechanism is very conveniently placed for that purpose. Should he desire to stop the forward movement of the machine he may do so by means of the lever f^3, and should he desire to elevate or depress the excavator, it is accomplished by actuating the lever h', in the proper direction to engage the gear H or H' as the case may be thus actuating the hoisting shaft to swing the segments of the excavator in the direction desired. It is of course important to propel the machine at a relatively slow rate while cutting at a high rate of speed thus removing unnecessary stress from the mechanism and enabling the work to be accurately and satisfactorily accomplished. Though the cutters or scoops cut the material and carry portions of it to the discharge it is to be noted that these are self sharpening and the finer material may pass therethrough and be carried upon the transverse angular or convex lags, thus better distributing the load.

Details of construction may be varied without departing from the principles of our invention. We therefore do not purpose limiting this application otherwise than necessitated by the prior art.

We claim as our invention:

1. The combination with a self propelled vehicle of an excavator pivotally supported at the rear end thereof and inclining forwardly and downwardly when in operative position, a vertically swinging, automatically adjustable frame supporting the excavator and means propelling said vehicle at a relatively slow rate and driving the excavator at relatively high speed.

2. The combination with a self propelled vehicle of a frame pivotally supported at the rear end thereof, an excavator rigidly secured to the frame and inclining forwardly and downwardly when in operative position, mechanism for swinging the frame vertically to vary the depth of operation of the excavator, a motor connected to propel said vehicle, at a slow rate and to drive the excavator at a relatively high speed and a chute adapted to deliver the material from the machine.

3. The combination with a self propelled vehicle of a trench excavator pivotally supported at the rear thereof, and inclining forwardly and downwardly beneath the vehicle when in operative position, a motor connected to propel the vehicle at a slow rate and to drive the excavator at relatively high rate of speed, toothed segments, gears intermeshing therewith for varying the cut of the machine while in action and operative connections for driving the gears from the motor.

4. In a device of the class described a movable frame, a segment pivoted thereon, to swing vertically, an excavator rigidly secured on the segment, a motor for propelling the frame, and driving the excavator simultaneously at a low and a high rate of speed respectively and mechanism adapting either to be driven independently.

5. In a device of the class described a frame, a motor thereon for propelling the same, a segment pivoted on the rear end of the frame, a belt excavator rigidly secured on the segment and movable vertically thereby, operative connections for driving the excavator from said motor at a high rate of speed, relatively the forward movement of the frame and self sharpening cutters on said excavator.

6. In a device of the class described a frame, a motor thereon, operative connections between the motor and wheels of the frame to propel the same, a segment frame pivoted centrally of the frame to swing ver-

tically, a belt excavator carried on said segment frame, connections for driving said excavator from said motor and self sharpening cutters arranged on the belt of said conveyer.

7. In an excavator of the class described a forwardly and downwardly inclined frame, an apron conveyer trained about the same, cutters open at both the top and bottom on said apron, and transverse lugs between the cutters each provided with an outwardly turned flange and power operated means for swinging said excavator upwardly or downwardly.

8. In an excavator of the class described a forwardly and downwardly inclined frame, an apron conveyer trained about the same, self sharpening cutters on said conveyer composing scoops open at both the top and bottom and transverse lags between said scoops, a flange along the lower edge of each and power operated means for swinging said excavator upwardly or downwardly.

9. In an excavator of the class described a forwardly and downwardly inclined frame, an apron conveyer trained about the same, self sharpening cutters thereon comprising scoops open at both the top and bottom, transverse lags between said scoops, a flange along the lower edge of each and a motor connected both to advance the excavator and to actuate the same.

10. In a machine of the class described a pivotally supported segment, a belt excavator rigidly secured thereon, means acting on the segment to elevate said excavator upwardly from the cut, or downwardly and forwardly into the cut, and a rearwardly directed chute at the rear of the excavator adapted to deliver the material excavated back into the trench at a distance from the cut.

11. In a machine of the class described a pivotally supported segment, a belt excavator secured thereon, means actuating said belt excavator, self sharpening cutters on the belt or apron, means acting to lift said excavator from the cut, or downwardly and forwardly into the cut, and a chute at the rear of the excavator adapted to deliver the material excavated back into the trench at a distance from the cut.

12. In a machine of the class described a vehicle, a belt excavator frame pivotally supported at the middle of said vehicle, a belt or apron thereon, means actuating the apron or belt, self sharpening cutters secured to the apron and a chute at the rear of the excavator adapted to deliver the material excavated back into the trench at a distance therefrom.

13. In a machine of the class described a self-propelling vehicle, a racked segment pivoted thereon, pinions for actuating the rack, motor driving said pinion to swing the segment upwardly or downwardly, a belt conveyer and excavator frame rigidly secured on the segment, a conveyer apron thereon, self sharpening cutters on said apron, and a chute adapted to deliver the excavating material back into the cut.

14. In a machine of the class described a self-propelling vehicle, a segment shaped rack pivoted thereon, to swing through the middle of the vehicle longitudinally thereof, pinions engaging the racks, means for driving said pinions to adjust the segment upwardly or downwardly, a belt conveyer and excavator frame rigidly secured on the racks, and adapted to be adjusted upwardly from the cut or downwardly or forwardly into the cut thereby, an apron or conveyer belt thereon embracing lateral chain belts, transverse flanged bars engaged to the links thereof, cutters secured between the bars, means actuating the apron and a chute adapted to deliver the material back into the cut.

15. In a machine of the class described a vehicle, a segment shaped rack pivoted thereon, pinions engaging the rack, a motor connected to propel the vehicle and to drive said pinion, a belt or apron excavator secured on the segment and adapted to be adjusted upwardly from the cut or downwardly and forwardly into the cut by adjustment of the segment rack, cutters secured on the apron and acting to deliver the material thereto and operative connections to drive the apron from said motor.

16. In a machine of the class described, an excavator, mechanism for elevating or depressing the excavator, embracing a shaft, inwardly facing beveled gears rotatable thereon, a clutch member rotatable with and slidable on the shaft and adapted to engage and drive either gear, means for shifting the clutch, beveled pinions engaging said gears, worms connected with the pinions, a worm shaft driven thereby in either direction and operative connections driven from the worm shaft to raise or lower the excavator.

17. In a machine of the class described, an excavator mechanism for elevating or depressing the excavator, embracing a shaft with inwardly facing beveled gears rotatable thereon, a clutch member rotatable with and slidable on the shaft and adapted to engage and drive either gear, a beveled pinion engaging each gear, a worm connected with each pinion, a shaft, worm wheels thereon meshing said worms and driving said shaft in either direction thereby, and operative connections driven from said shaft to actuate the excavator in raising or lowering the same.

18. In a machine of the class described, an excavator mechanism for elevating or depressing the excavator, embracing a segment rack secured to the excavator, a pinion meshing said rack, a rotative shaft, inwardly fac-

ing beveled gears rotatable thereon, a clutch member rotatable with and slidable on the shaft and adapted to engage and drive either gear, beveled pinions engaging said gears, a worm connected with each pinion, a shaft, worm wheels thereon meshing said worms, sprocket wheels driven thereby, and sprocket chains trained around the same and around sprocket wheels connected on the pinions meshing the racks whereby the excavator may be raised or lowered by engaging the respective beveled gears by said clutch.

19. In a trench or ditch excavating machine, means cutting the material for the full width and depth of the trench or ditch, said means concave on their cutting faces, means simultaneously removing the material as cut from the trench or ditch and means simultaneously delivering material back into the trench or ditch.

20. In a ditch or trench excavating machine power operated mechanism for propelling the machine, means automatically digging the ditch or trench as the machine advances, means for automatically removing the excavated material from the ditch or trench and a toothed segment and pinion for adjusting the depth of operation of the automatic digging means.

21. A machine comprising coöperating mechanisms for automatically digging a ditch and removing the material from the ditch and a segment pivoted to adjust the depth of operation of the coöperating digging and removing mechanism.

22. A machine comprising concave cutting bands for automatically digging a ditch, overlapping relatively movable means for removing the material from the ditch and means for automatically delivering the material back into the ditch.

23. A ditching machine comprising self sharpening bands inclined to a cutting edge for digging, means for removing the material to form the ditch the desired size and mechanism for actuating said mechanisms.

24. A ditching or trenching machine comprising means for excavating the material, means for removing the material, a pivotal segment and means for swinging the segment on its pivot for varying the depth of excavating the ditch or trench.

25. In a device of the class described a conveyer comprising chains, overlapping bars secured to said chains, cutters rigidly secured to the chains at equal distances apart, a chute into which the conveyer empties and the cutters adapted to make the cut of greater width than the conveyer.

26. In an excavating machine an adjustable conveyer adapted at its lower end to extend into the excavation, cutters of greater width than the conveyer adapted to cut from the bottom of the excavation upwardly, means for advancing the cutters and conveyer as the material is removed and mechanisms for actuating the cutters and conveyer.

27. In an excavating machine a conveyer, cutters secured to the conveyer at suitable distances apart comprising metallic bands inclined to a cutting edge and self sharpening and providing a space for the material to fall through, independent movable sections adapted to receive the material from the bands and means for actuating the conveyer.

28. In an excavating machine cutting or scraping devices embracing metallic bands having a concave cutting and an attaching part and affording a space between said parts for the loosened material to fall therethrough and a conveyer consisting of angle irons upon which the material falls.

29. In an excavating apparatus a conveyer, cutting devices secured thereto at suitable intervals apart, comprising metallic bands having a cutting edge, said bands rigidly secured to the conveyer and providing a space between the same and conveyer to permit the material as cut to fall upon the conveyer and a pivotal toothed segment for varying the depth of operation of said cutting devices and the conveyer.

30. In a device of the class described cutting mechanism pivoted to swing upwardly or downwardly comprising bands having self sharpening cutting edges, a conveyer to which the bands are secured and adapted to receive the material thereon as cut and gravity acting means receiving the material from the conveyer adapted to deliver the material to the desired place.

31. An excavating apparatus comprising a suitable conveyer, mechanism for actuating the same at a high speed, mechanism for advancing the same at a low speed, mechanism cutting the material as the conveyer advances segments rigidly connected with the conveyer and pivoted to swing vertically and means for actuating the segments.

32. An excavating machine embracing a body, wheels for supporting the same and traveling on each side of the excavation, a conveyer operating between the rear wheels, knives secured thereto for continuously excavating, lags between the knives for supporting the excavated material, means advancing the machine at a rate depending upon the rate of excavation and means for automatically adjusting the height of the conveyer.

33. In an excavating device a supporting frame, wheels supporting the same, an adjustable conveyer adapted to extend below the surface in operation and to be elevated above the surface, self sharpening cutters movable with the conveyer and on a different plane adapted to cut the material loose and deliver the same upon the conveyer and a

racked segment for effecting the adjustment of the conveyer.

34. In an excavating machine a frame mounted on wheels, a motor on said frame, a main drive shaft driven by said motor, a pivotally supported frame secured to the aforesaid frame, an excavator carried by said pivotally supported frame, means carried by the pivotally supported frame for adjusting the depth of cut of the excavator, clutch mechanisms on the main drive shaft and mechanism connecting the appropriate clutch mechanisms to drive the machine, to actuate the excavator and to adjust the pivotally supported frame.

35. In a device of the class described a frame, a motor thereon, an excavator pivoted to swing vertically, a main drive shaft driven by the motor, a double clutch member rigid on said shaft, gears loosely mounted on the shaft adapted either to be engaged by the clutch member, mechanism driven by the gears for varying the depth of operation of the excavator, a clutch on said drive shaft, a gear adapted to be engaged thereby, mechanism driven by said gear for actuating the excavator and clutch mechanisms on said drive shaft for controlling the rate of movement of the machine.

In testimony whereof we have hereunto subscribed our names in the presence of two subscribing witnesses.

ALFRED MATSON.
FRANK BRONSON.

Witnesses:
JOHN S. CULLEN,
E. HURLBUT.