H. J. BENTSON.

TRENCHING MACHINE.

APPLICATION FILED JAN. 10, 1913.

1,349,936.

Patented Aug. 17, 1920.

3 SHEETS—SHEET 1.

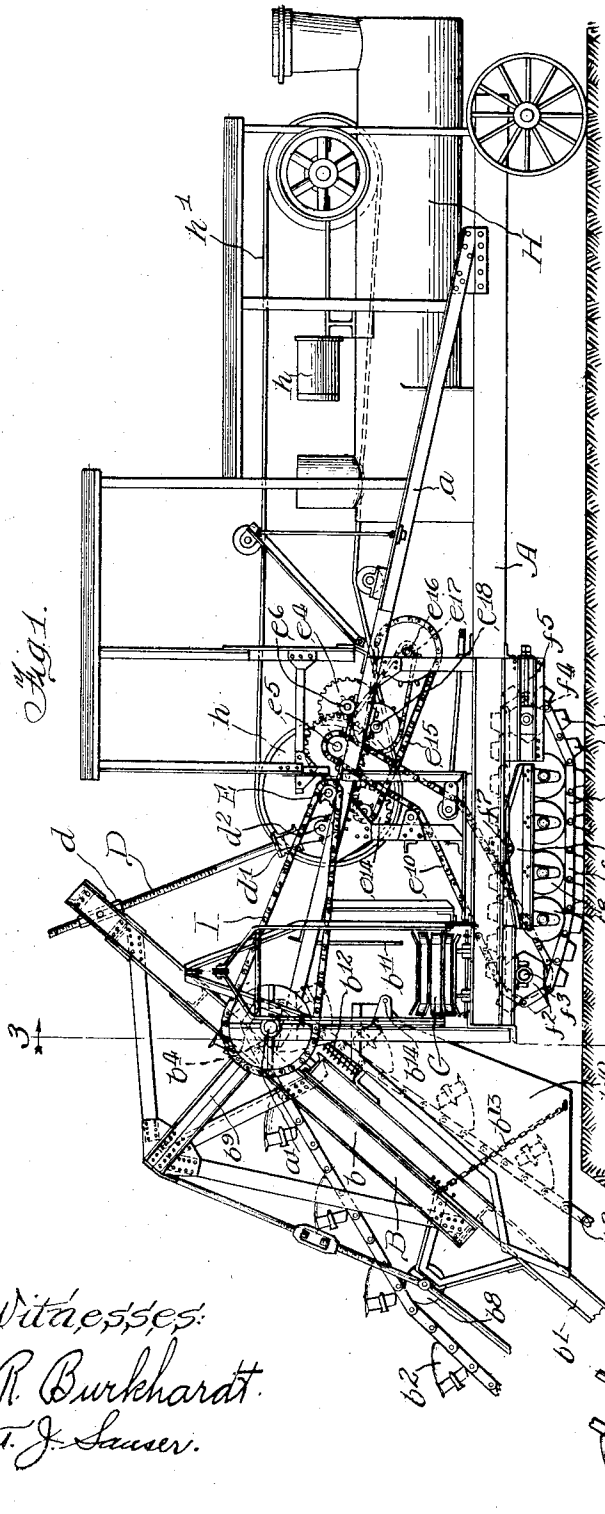


Fig. 1.

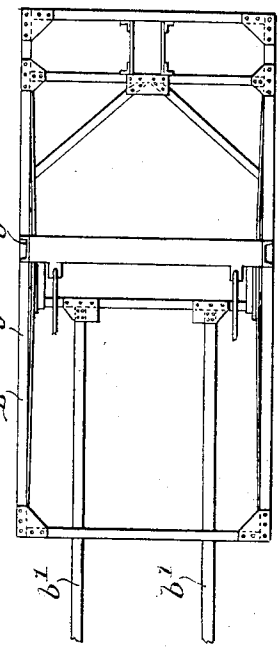


Fig. 2.

Witnesses:
R. Burkhardt.
A. J. Sauser.

Inventor:
Hans J. Bentson
By
Atty

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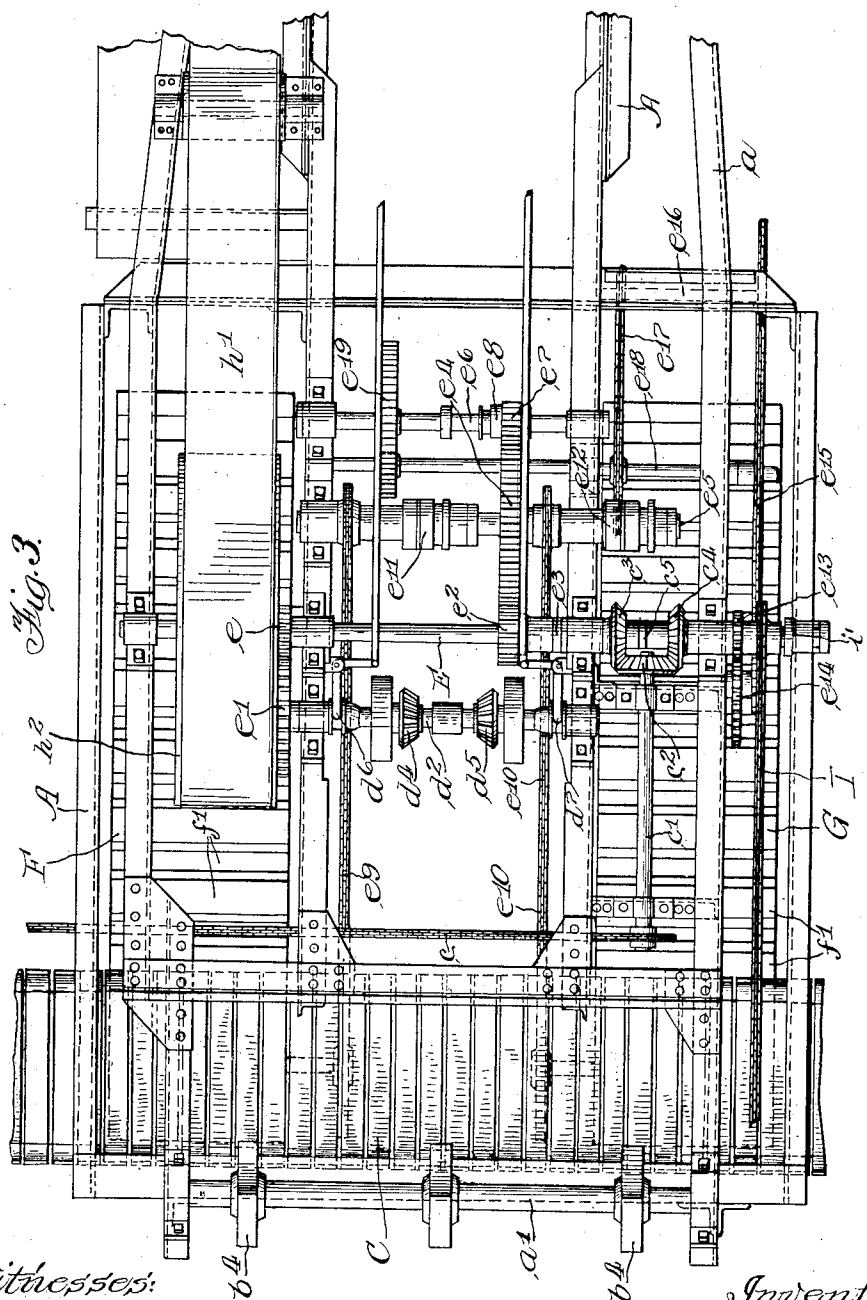
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3 SHEETS—SHEET 2.

Fig. 3.



Witnesses:

R. Burkhardt

A. J. Sauer.

Inventor:

Hans J. Bentson

By Arthur F. Durand

Atty

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3 SHEETS—SHEET 3.

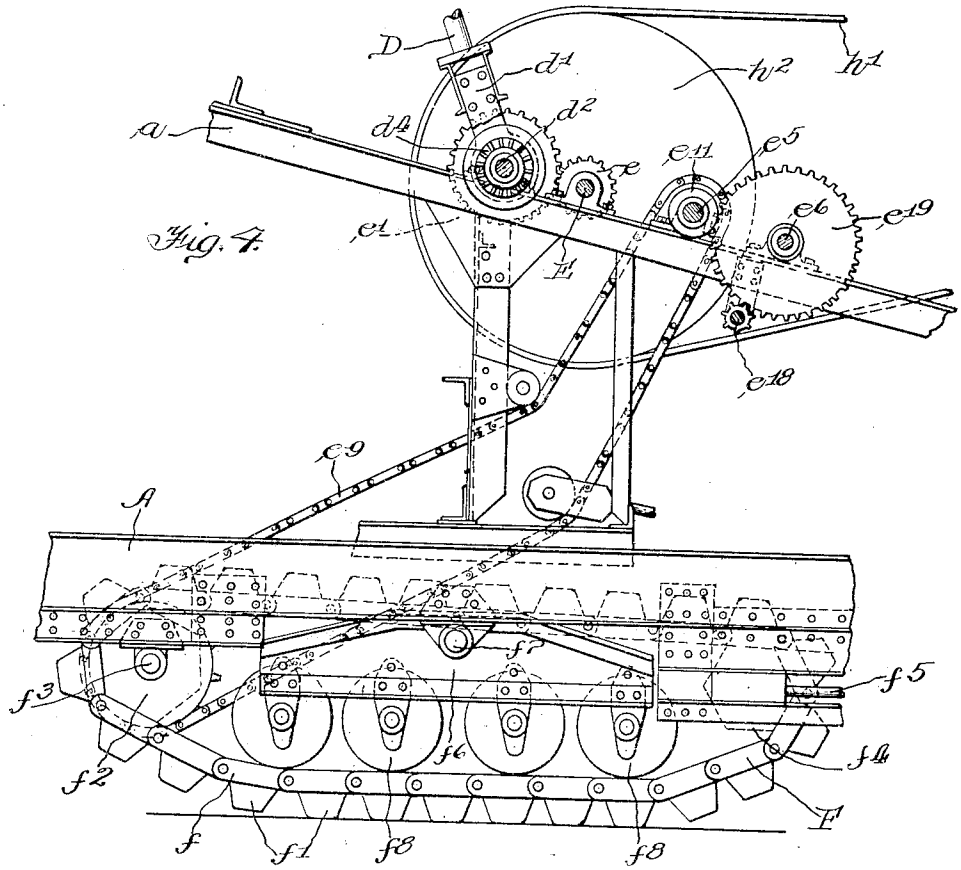


Fig. 4.

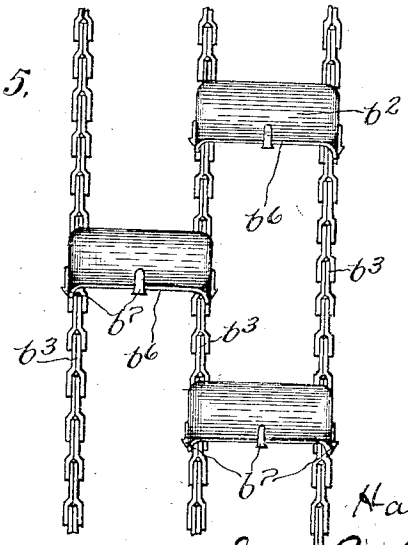


Fig. 5.

Witnesses:
R. Burkhardt.
T. J. Sauser

Inventor:
Hans J. Bentson
By Arthur J. Durand
Atty

UNITED STATES PATENT OFFICE.

HANS J. BENTSON, OF LA JOLLA, CALIFORNIA, ASSIGNOR TO FREDERICK C. AUSTIN, OF CHICAGO, ILLINOIS.

TRENCHING-MACHINE.

1,349,936. Specification of Letters Patent. Patented Aug. 17, 1920.

Application filed January 10, 1913. Serial No. 741,208.

To all whom it may concern:

Be it known that I, HANS J. BENTSON, a citizen of the United States of America, and resident of La Jolla, San Diego county, California, have invented a certain new and useful Improvement in Trenching-Machines, of which the following is a specification.

My invention relates to trenching machines of that particular kind in which the body of the machine is provided at the rear end thereof with a swinging support, and in which the excavating is done by an endless series of buckets which are caused to travel up and down the said support, by means of sprocket chains or other endless members whereby the buckets are filled while moving upward against the end wall of the trench, and in which each bucket discharges its load when turned upside down at the upper end of its upward path of travel, each bucket for this purpose being provided with an open inner side, whereby the dirt enters the open mouth of the bucket and passes entirely through the latter, in the general operation of filling and discharging its load, the upper end of said support being provided with an adjusting device for tilting the said support about a horizontal axis, in a vertical plane, to thereby vary the working depth of said buckets, depending upon the depth desired for the trench.

In certain respects, it will be seen, my invention is in the nature of a modification of the excavating machine shown in my copending application executed by me on the 6th day of January, 1913, Serial No. 741,207.

Generally stated, the object of my present invention is to provide a machine of the foregoing character, which will be capable of doing heavier work, of making a wider trench, and of doing certain kinds of excavating for which the machine of my said other application may, in some cases, be found not as suitable for the purpose.

Special objects are to provide an improved construction and arrangement whereby the excavating buckets are disposed in a plurality of parallel series, one series overlapping the other, and the buckets of one series being staggered relative to those of the other series, whereby a wider trench is made without the necessity of having each bucket as wide, or practically as wide, as the trench itself; to provide an improved construction and arrangement involving the use of a plurality of series of buckets, the one series overlapping the other, and the buckets having straight cutting edges, whereby the bottom of the trench will be flat; to provide, in a machine of this character, a pair of tractors which are operated independently of each other, whereby one can be operated without the other, as in turning a corner, or for the purpose of changing the direction of the trench; to provide a novel and effective mechanism comprising gearing for operating the buckets, driving the said tractors, operating the conveyer which receives the discharge from the buckets, and also for operating the adjusting device by which the angle of the beam or support upon which the bucket chains are mounted is changed to vary the working depth of the bucket; and to provide certain details and features of construction tending to increase the general efficiency of an excavator of this particular character.

To the foregoing and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings—

Figure 1 is a side elevation of a trenching machine embodying the principles of my invention, showing a portion of the excavating apparatus broken away for convenience of illustration, it being understood that this apparatus may be of any suitable or desired length, depending upon the maximum depth desired for the trench.

Fig. 2 is a part plan of the upper and lower frame sections of the machine.

Fig. 3 is an enlarged plan view of the gearing or operating mechanism and adjacent parts of the machine.

Fig. 4 is a detail sectional view showing the construction of one of the tractors by which the machine is propelled, and showing also the connections by which the said tractor is driven.

Fig. 5 is a fragmentary elevation of a por-

tion of the endless belt upon which the buckets are mounted, showing the three sprocket chains of which the said belt is composed, and showing how the buckets of one series are staggered relative to those of the other series, whereby each bucket of one series, while receiving its load in the trench, pushes the dirt out of its path and into the path of the next oncoming bucket of the other series.

As thus illustrated, my invention comprises a body or platform A which supports the various operative elements in suitably elevated positions, and which is provided with a frame or super-structure a upon which the upper bucket shaft a' is mounted in suitable bearings at the rear end of the machine. The beam or swinging support B is suitably mounted upon the said shaft and is composed of upper and lower sections b and b', the upper section being of such width that the buckets b^2 pass between the sides thereof. The said buckets are mounted upon the sprocket chains b^3 that travel up and down the said support, being provided with upper and lower sprocket wheels b^4 and b^5, the said sprocket chains being three in number and arranged parallel and spaced apart in the manner shown more clearly in Figs. 4 and 7. The buckets, therefore, are arranged in two endless and parallel series, each bucket being fastened to the middle chain and one outside chain, and the buckets of one series being staggered relative to those of the other series. It will also be seen that the said buckets have straight cutting edges b^6, whereby the bottom of the trench will be flat. Each bucket is rigid with two parallel links, and is open at its inner side, in the manner shown, whereby it is only capable of supporting a load while it is traveling upward at an angle, as shown in Fig. 1; but when the buckets change their course in passing around the upper sprocket wheels, the open inner side of each bucket is brought below, and when thus tilted out of carrying position, each bucket discharges its load on to the belt or conveyer C, which latter extends over the rear end of the machine and projects laterally therefrom to form a spoil bank at one side of the trench, or at the other side thereof, when the conveyer is reversed. As the buckets are staggered, in the manner explained, it follows that each bucket, while traveling upward in the trench, pushes the loose dirt ahead of it and into the path of the next oncoming bucket of the other series, whereby the dirt is practically all taken up by the buckets and discharged onto the said conveyer. To facilitate their operation, the said buckets are provided with teeth b^7 which loosen up the ground. The downwardly moving portions of the sprocket chains are supported on idlers b^8, which latter are mounted on the back or rear side of the support B, in the manner shown. Also, the said support B is stiffened by means of a truss b^9 mounted on the back of the upper section thereof. A guard or shield b^{10} is arranged around the upwardly traveling buckets above ground, and serves to prevent any falling dirt from being scattered at the sides of the machine. Another shield or guard b^{11} is disposed above the conveyer C to prevent undesirable scattering of the dirt taken up by the buckets.

With this arrangement, the machine is capable of cutting a wide trench, without the necessity of having the buckets practically as wide as the trench, and heavy work can be handled to advantage. The buckets fill as they travel upward in the trench, and then successively discharge their loads as they are tilted out of carrying position at the upper end of their upward path of travel, the discharge at this point being facilitated, if desired, by the use of an ejector or clean-out indicated at b^{12}, and which ejector or clean-out is fully described and claimed in my co-pending application. Chains b^{13} connect the shield or guards b^{10} with the support B, and serve to vary the angle or position of the said shield or guard, the latter being provided with a pivotal mounting b^{14} at the upper end thereof, whereby it can be brought close to the buckets or moved away therefrom, depending upon the character of the work.

The angle of the support B is changed or varied by means of a screw D which extends through a threaded sleeve d, the latter being swiveled or pivoted on the upper end of the support B, thus permitting the angle of the said screw to change relative to the said support during the adjustment thereof. The lower end of said screw is mounted in a bearing d^1 which is supported by the counter-shaft d^2, and upon which shaft the said bearing is adapted to turn as the screw changes its angle. The lower end of said screw is provided with a bevel gear d^3, which engages the bevel pinions d^4 and d^5 on the said shaft d^2, these pinions d^4 and d^5 being loose on said shaft. Transmission between the bevel pinion d^4 and the shaft d^2 is controlled by the clutch d^6, and the transmission between the shaft and the pinion d^5 is controlled by a similar clutch d^7, whereby the direction and rotation of the screw D may be reversed at will, thus permitting the angle of the support B to be changed when necessary.

The main drive shaft E is mounted in suitable bearings on the frame a and is provided with a pinion e that engages the gear wheel e^1 on the counter-shaft d^2. The said drive shaft is also provided with a loose pinion e^2 which is controlled by the clutch e^3, and which engages a gear wheel e^4 on the counter-shaft e^5. Another counter-shaft e^6 is provided with a loose pinion e^7, which is

in turn controlled by a clutch e^8, whereby the shaft e^5 can be rotated by either the pinion e^2 or the pinion e^7, depending upon whether it is desired to have the machine back up or go ahead. In this connection it will be seen that the shaft e^5 is connected by sprocket chains e^9 and e^{10} with the tractors F and G respectively. The chain e^9 is controlled by a clutch e^{11}, and the chain e^{10} is controlled by a similar clutch e^{12}, whereby each tractor or propelling device is operable independently of the other. Connection from the shaft E to the shaft e^6 is from the pinion e^{13} to the gear wheel e^{14}, thence through the sprocket chain connection e^{15} to a short counter-shaft e^{16}, through the sprocket chain connection e^{17} to the counter-shaft e^{18}; and then through the spur gearing e^{19} to the said shaft e^6, whereby the latter is operated in a direction to drive the machine ahead at a very slow speed when the clutch e^8 is closed and the clutch e^3 is open. To reverse the machine—that is to say, in order to cause the tractors F and G to operate in a manner to move the machine backward—the clutch e^8 must be opened and the clutch e^3 must be closed. If the two clutches e^{11} and e^{12} are both closed, the machine will then move straight ahead, but if one of these clutches is open and the other closed, the machine will then turn a corner or move to the right or left, depending upon which tractor is operated. This independent drive of each tractor can, it will be seen, be used to advantage in various ways, both while the machine is operating and while it is *en route* to some other place.

The belt or conveyer C is operated by a sprocket chain c which is parallel with the belt, and which is operated by a shaft c^1 that extends at right angles to the drive shaft E, a bevel pinion c^2 being secured to the end of said shaft. This bevel pinion c^2 is engaged by the bevel pinions c^3 and c^4, which are loose on the drive shaft E, and which are controlled by a clutch c^5 of any suitable, known or approved character, whereby the shaft c^1 can be rotated in either direction. With this arrangement the belt or conveyer C can be made to operate in either direction, whereby the dirt received from the buckets may be discharged at either side of the machine.

As the two tractors F and G are exactly alike, a description of the tractor F will be sufficient for both. This tractor is, it will be seen, by reference to Fig. 6, composed of an endless link belt f having projections f^1 which engage the ground to give the necessary traction. The rear or driving sprocket wheel f^2 is fixed to a shaft f^3, which is mounted in suitable bearings on the body A, said shaft being also provided with sprockets or wheels for the link belts f of the tractor. The sprocket wheel f^2 is engaged by the sprocket chain e^9 in the manner previously described, and in this manner the sprocket is operated by the drive shaft E of the gearing or driving mechanism previously described. Suitable wheels or sprockets f^4 are provided for the forward end of the tractor, being suitably mounted on the body A, and provided with means f^5 for adjusting the position thereof to tighten the belt or belts f of the tractor; it being understood that the means f^5 may consist of adjusting screws or any other suitable devices. The truck f^6 has a rocking connection with the body A, being provided with a pivot f^7, whereby it is adapted to rock or tilt about a horizontal axis. The wheels f^8 of this truck, four in number, as shown, rest upon the lower portion of the belt or belts f of the tractor, whereby the weight of the machine is transmitted through these wheels and the belt to the ground. The truck f^6 may rock while traveling over uneven ground, as the flexibility of the belt or belts f permits of such mode of operation, and thus the tractor, which is of the so-called caterpillar type, is adapted automatically to adjust itself to the uneven surfaces over which the machine may be compelled to travel. At the same time, however, the power transmitting connection between the tractor and the driving shaft E is not disturbed in any way, inasmuch as the shaft f^4 is mounted in fixed bearings on the body A, thus permitting the tractor to take advantage of the flexibility or rocking motion afforded by the truck f^6 without in any way interfering with the transmission of power for the operation thereof.

The boiler H is supported on the forward end of the machine, and the engine h is connected by a belt h^1 with a pulley h^2 on the main drive shaft E, whereby the various parts are operated. The drive shaft E is connected by a sprocket chain I with the shaft a^1, whereby the engine operates the buckets. A clutch i^1 on the shaft E controls the transmission to the buckets.

What I claim as my invention is:—

A trenching machine comprising a body frame, a transverse shaft on said body, at the rear thereof, a swinging support, a digging beam depending from said shaft, movable in a vertical plane to vary the depth below ground of the lower end thereof, and to permit raising of such beam above ground, an endless belt mounted to travel up and down said support, operated by said shaft, excavating buckets on said belt, mechanism for rotating said shaft, carried on said body, means for receiving the dirt from said buckets, mounted on said body, said buckets being disposed in parallel series, at opposite sides of the ditch, the buckets of one series being staggered relative to those of another series, and said support comprising

an upper frame which is wider than said belt, mounted to tilt on said shaft, a lower frame which is narrower than said belt, secured to said upper frame, the said buckets all passing between the sides of said upper frame, but extending outside of the lower frame.

Signed by me at Chicago, Illinois, this 6th day of January, 1913.

HANS J. BENTSON.

Witnesses:
E. H. CLEGG,
H. KNUDSON.