No. 867,047. PATENTED SEPT. 24, 1907.

J. C. JUNKIN.

EXCAVATING APPARATUS.

APPLICATION FILED JUNE 29, 1906.

4 SHEETS—SHEET 1.

Fig. 1.

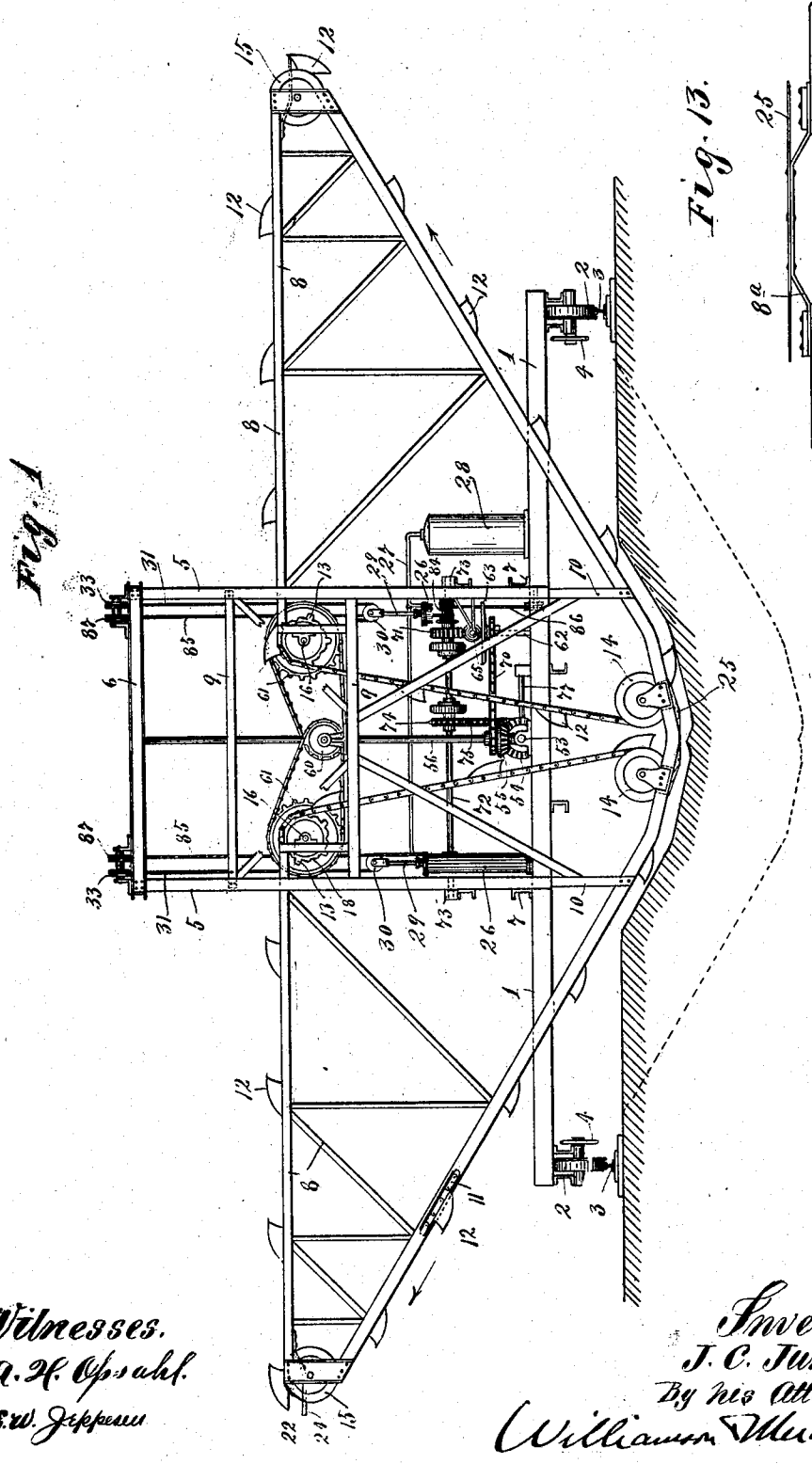
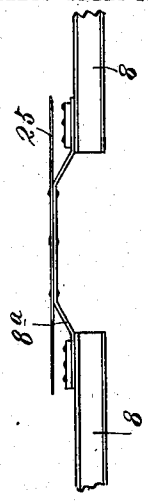


Fig. 13.



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4 SHEETS—SHEET 2.

Fig. 1.

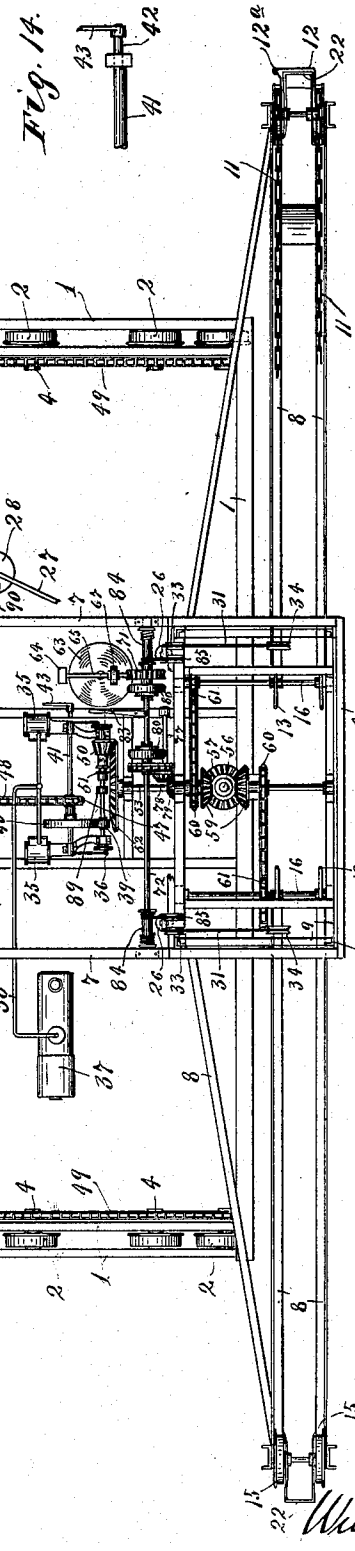


Fig. 3.

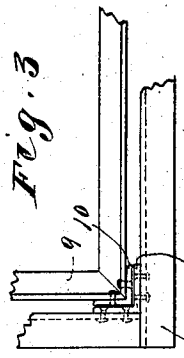


Fig. 5.

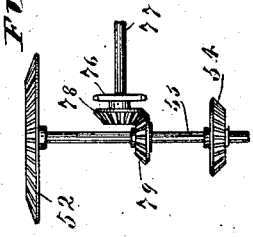
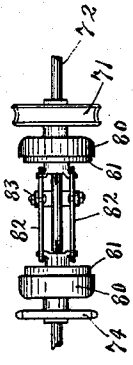


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 7.

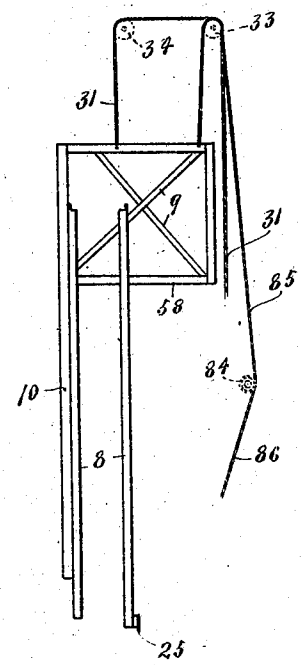
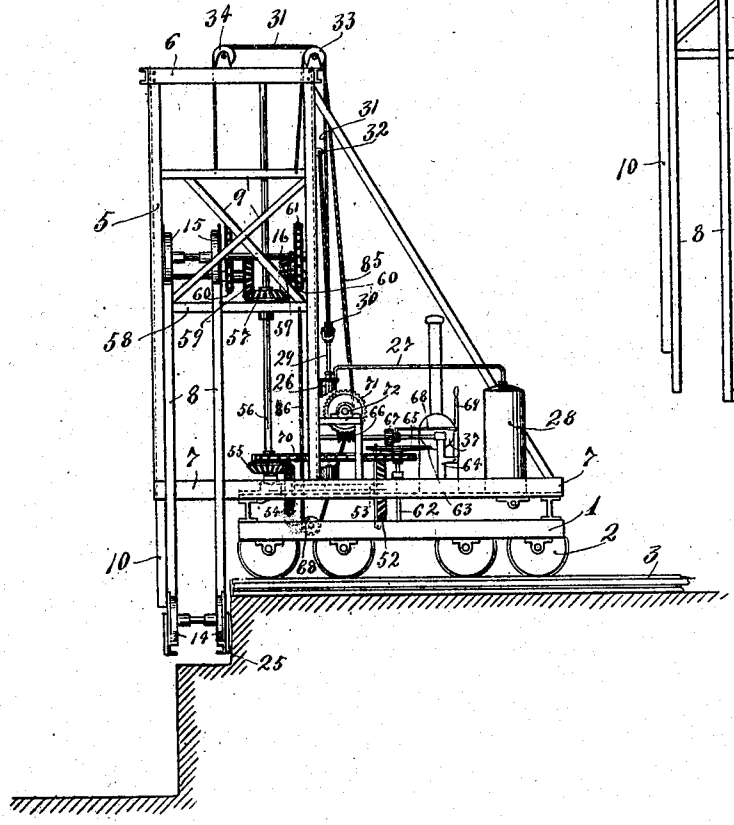


Fig. 6.



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4 SHEETS—SHEET 4.

Fig. 9.

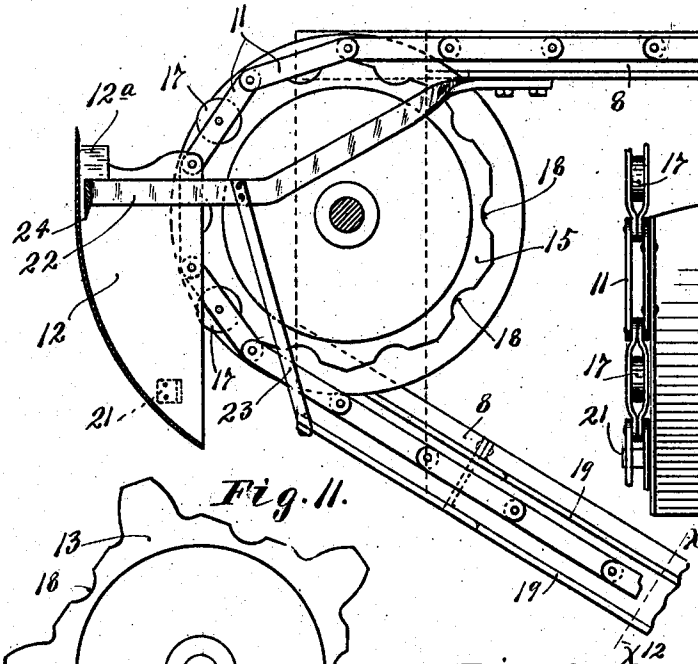


Fig. 10.

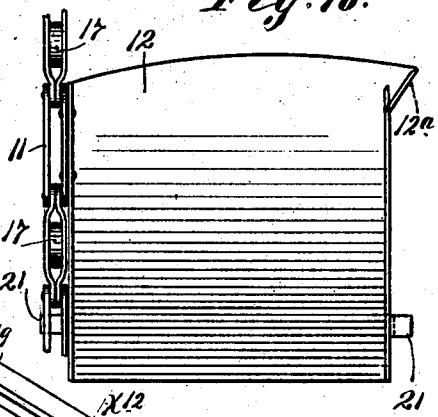
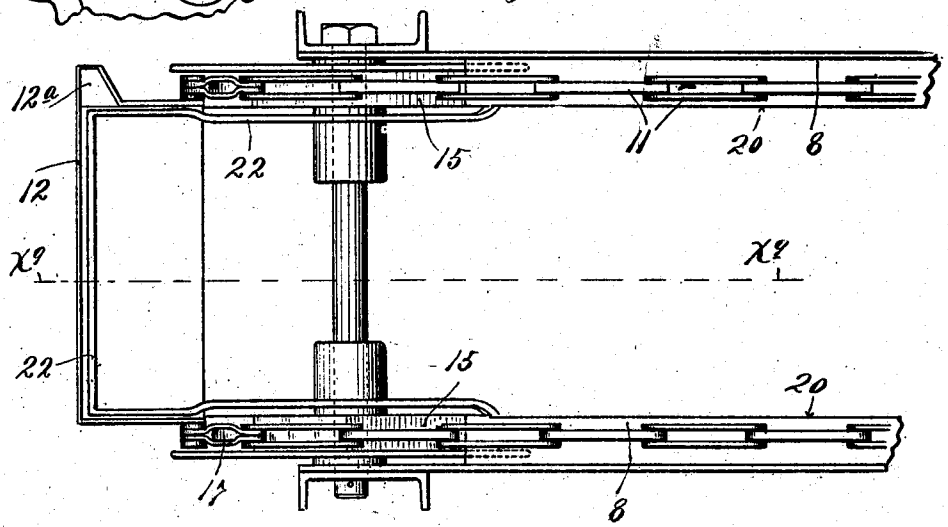


Fig. 11.

Fig. 12.



Fig. 8.



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UNITED STATES PATENT OFFICE.

JOHN C. JUNKIN, OF DRAYTON, NORTH DAKOTA, ASSIGNOR OF ONE-HALF TO GEORGE J. PATTERSON, OF BOWESMONT, NORTH DAKOTA.

EXCAVATING APPARATUS.

No. 867,047. Specification of Letters Patent. Patented Sept. 24, 1907.

Application filed June 29, 1906. Serial No. 324,020.

To all whom it may concern:

Be it known that I, JOHN C. JUNKIN, a citizen of the United States, residing at Drayton, in the county of Pembina and State of North Dakota, have invented certain new and useful Improvements in Excavating Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to excavating apparatus, and has for its object to provide an improved ditching machine of increased capacity and generally improved action, and to this end it consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

A brief outline of the general features of the machine hereinafter more specifically described is as follows: The excavating buckets or scoops employed in this machine are secured to endless chain carriers that are mounted on a vertically movable supporting frame and are so arranged that the buckets work in two series, the two chains carrying the two series of buckets being so disposed and driven that the buckets cut from the center of the ditch and scrape in opposite directions in the excavating and discharging movement. By this arrangement, several important advantages are obtained, to-wit—instead of one or two large buckets, a greater number of smaller buckets are employed, and these are arranged for continuous cutting action so that there is no lost time, inasmuch as certain of the buckets do their work while others are traveling from the discharge position back to cutting positions. Also, by arrangement of the buckets to cut simultaneously from the center toward the sides of the ditch, the machine is relieved from side thrusts, and the dirt excavated from the ditch may be deposited equally on each side of the ditch, thereby forming the desired embankments.

Another highly important feature of this invention consists in a pneumatic counter balancing device which sustains the main part of the weight of the vertically movable frame upon which the bucket equipped chains are mounted. With this improved counter balancing or counter poising device, very little power is required to move the said adjustable frame and bucket carrying chains from one vertical adjustment to another, and such vertical adjustment may be very quickly and easily accomplished.

In combination with the parts above noted, I employ, in the best form of the machine, means for adjusting the chain supporting frame vertically, comprising a variable speed frictional transmission device, and a worm and gear transmission device, by means of which former the bucket equipped chains may be fed downward to their work at any desired speed, and by means of which latter the said vertically adjustable frame will be locked in any set position. Means is also provided for coöperation with the pneumatic counter poising or balancing device for very quickly moving the vertically adjustable chain supporting frame from a lowered position to an elevated position, after one vertical cut has been made, and the machine is to be re-adjusted for another vertical cut.

Another very important feature of this invention is found in the arrangement of the buckets or scoops and in the combination therewith of scrapers or bucket cleaning devices which, under movements of the bucket carrying chains, positively clean or scrape the buckets and prevent accumulation of moist or sticky earth thereto.

The invention also involves other but minor features of invention, all of which will be hereinafter described and defined in the claims.

The invention is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Referring to the drawings, Figure 1 is a view in rear elevation, showing the improved ditcher at work, and showing a ditch in cross section. Fig. 2 is a plan view of the improved ditcher, some parts being broken away. Fig. 3 is an enlarged detail in plan, showing one corner portion of the so-called "guide tower", and a corresponding corner of the coöperating portion of the vertically adjustable chain guiding frame. Fig. 4 is a detail in plan, showing the reversible clutch mechanism of the frame raising and lowering devices. Fig. 5 is a detail in plan, showing a portion of the frame raising device. Fig. 6 is a side elevation of the ditcher. Fig. 7 is a skeleton view in side elevation, illustrating particularly the arrangement of cables for raising and lowering the chain supporting frame. Fig. 8 is a plan view, showing one end of the vertically adjustable chain supporting frame and coöperating portions of one pair of bucket equipped chains, and one of the bucket cleaning scrapers. Fig. 9 is a vertical section taken on the line x^9 x^9 of Fig. 8. Fig. 10 is a plan view of one of the buckets removed from working position, and showing one of the coöperating chains applied thereto. Fig. 11 is a side elevation, with parts broken away, showing one of the chain driving sprockets. Fig. 12 is a detail in section on the line x^{12} x^{12} of Fig. 9. Fig. 13 is a detail view in plan, showing the central portion of the inner lower rail of the vertically adjustable supporting frame; and Fig. 14 is a detail in plan, showing a portion of an eccentric clutch actuating shaft.

All parts of the machine are supported, directly or indirectly, on a wide truck or wheel equipped platform 1, the wheels 2 of which are adapted to run over portable rails 3 that are temporarily laid on the opposite sides of the ditch. The truck wheels 2 act as traction wheels and each is provided with a sprocket wheel 4,

shown as secured to the inner hub portions thereof, as shown in Figs. 1 and 2. Rigidly secured to the skeleton platform 1, and projecting from the rear central portion thereof, is a rectangular skeleton guide tower made up, as shown, of angle iron corner columns 5, and upper and lower horizontally disposed tie bars 6 and 7. The side members of the tie bars 7 are, as shown, extended over the truck platform 1, and are rigidly secured thereto, so that in a sense they form part of the said platform, as best shown in Figs. 2 and 6.

The vertically adjustable chain supporting frame is in the form of a truss 8, the upper portion of which is approximately horizontal, and the lower portion of which inclines upward from the center toward the ends, at the proper inclination to give the desired slope to the ditch. This trussed frame 8, at its central portion, is guided by the vertical tower just described, and to this end it is formed at its central portion with a vertically extended rectangular skeleton portion 9 having, as shown, angle iron corner posts 10 that are mounted to slide in the rectangular corner columns 5 of the said guide tower, as best shown in Figs. 2 and 3.

The bucket equipped sprocket chains 11 are arranged to run in laterally spaced pairs and are secured to the opposite sides of the buckets 12, the construction of which will be more particularly described later on. These two pairs of chains 11 are mounted to run over guide sprockets or wheels mounted in the opposite sides of the vertically adjustable frame or truss 8. More particularly stated, each chain 11 runs over a driving sprocket 13 mounted on the upper portion of the central section 9 of said truss frame, over an idle guide wheel 14 mounted on the lower portion of said trussed frame, and over an idle wheel 15 mounted on the extended ends of said trussed frame. The driving sprockets 13 are secured in pairs to counter-shafts 16 journaled in suitable bearings on opposite sides of the upper portion of the frame section 9. The idle guide wheels 14 and 15 are, of course, also arranged in laterally spaced pairs.

Attention is now directed to Figs. 9 to 12 inclusive. The chains 11 are secured to the outer surfaces of the sides of the excavating buckets 12. As shown, the sides of the said buckets are riveted to transversely opposite links of the coöperating parallel chains. The sprockets 15 are polygonal, and the flat peripheral surfaces thereof correspond to the distance between the pivotal connections of the chain links. The chain links that are just ahead and just at the rear of the links to which the buckets are secured, are preferably equipped with small wheels 17 that are adapted to engage in peripheral notches 18 of the wheels 15, as shown in Fig. 9. The small wheels 17, in passing from the guide wheels 14 to the guide wheels 15, run through channel-like guideways formed by laterally projecting flanges 19 of the inclined lower portions of the trussed frame 8, as shown in Figs. 9 to 12. In passing from the guide wheels 15 to the driving sprockets 13, said wheels 17 run over laterally projecting flanges 20 of the upper horizontal portions of the said frame 8 (see Fig. 9). On the sides of the buckets 12 are stop lugs 21 that engage with the coöperating chains at all times, except when the buckets are passing around the wheels 14—15 or sprockets 13.

By reference particularly to Fig. 8 it will be seen that the inner chains 11 and coöperating guide portions of the trussed frame 8 project laterally from the adjacent sides of the buckets, this, as is evident, being the necessary construction. Hence, to cut clearance for the said chains and guide portions in the bank which is being cut away by the buckets, the said buckets are provided at their inner sides and at the front and bottom of the bucket with laterally offset cutting lips or bulged portions 12^a, which under the traveling movements of the buckets pass with considerable clearance around the chain guiding portions of the frame. At each projecting end of the vertically adjustable trussed frame 8, is a bucket cleaning device or scraper that is preferably in the form of a U-shaped metal bar 22, the ends of which are shown as rigidly secured to the horizontal upper portion of said trussed frame 8, and the prongs of which are shown as secured at their intermediate portions to the inclined lower portions of said trussed frame, by means of metallic straps 23. The projecting transverse portions of the U-shaped bars are preferably formed with depending sharpened edges 24, that act to cut or scrape from the inner surfaces of the buckets all dirt which may adhere thereto.

By reference to Fig. 9 it will be noted that the bottoms of the buckets are formed on curved lines that extend appoximately concentric to the axis of the coöperating guide wheels 15, when the said bucket is passing around the said wheels. When a bucket is passing around the said wheels, as shown in Fig. 9, it is rigidly secured with respect to the said wheels, and hence with its bottom formed on the line above described, the bottom thereof will pass very close to the scraping edge 24 of the said scraper.

With a scraper of the kind above described, the dirt which adheres to the bottom and sides of the bucket will be scraped away or cut loose therefrom, and will fall from the bucket under the action of gravity. The scraper does not, however, positively force the entire load of dirt from the bucket, but simply cuts the load loose and allows the same to fall. The scraper is not, therefore, subject to very intense strains under the scraping action. As shown in Fig. 13, the inclined bottom portion of the inner rail of the frame 8 is cut away, and the two adjacent end portions are tied together by a laterally offset bar 8^a, to which is secured a depending blade 25 which serves to cut the embankment just below and inward of the chain-guiding wheels 14. This blade 25 serves to cut from the vertical wall of the embankment that portion of earth with which the buckets first engage in their downward movement around and under the guide wheels 14.

The pneumatic counter balancing or poising device as arranged comprises as follows: The numeral 26 indicates a pair of upright cylinders that are rigidly secured to the truck platform 1, and are located just in front of the guide tower 5—6—7. These cylinders are supplied at their upper ends, through air pipes 27, with air from a storage reservoir 28 which is also secured on the truck platform 1. In the cylinders 26 work pistons 29, the stems of which extend upward and are equipped with sheaves 30. Cables 31 that run one under each of the guide sheaves 30 are attached at one end to the upper portion of the vertically movable intermediate portion 9 of the vertically adjustable trussed frame 8, and at their other ends they are attached at 32 to the forward corner posts 5 of the vertical

guide tower, as best shown in Figs. 1, 6 and 7. Said cables 31 also run over guide sheaves 33 and 34 on the upper portion 6 of the guide tower. With this arrangement, when sufficient air pressure is introduced into the upper ends of the cylinders 26, the pistons 29 and guide sheaves 30 will be moved downward and through the cables 31, the trussed frame 8 carried thereby will be raised. Preferably, however, I provide independent means controlling the vertical movements of said trussed frame 8, and utilize the air actuated device above described as a counter poise or balance for sustaining in main the weight of the said vertically movable frame 8 and parts carried thereby. In the preferred arrangement, I charge the storage reservoir 28 to such pressure that air will counter balance the vertically movable truss frame 8 when the latter is in an intermediate position, or about half way between its extreme uppermost and lowermost positions. When this counter balance is effected, some force will be required to move the said frame 8 either upward or downward from its said intermediate counter poised position, which means will presently be described.

Mounted on the truck platform 1 is a duplex engine 35 which is arranged to drive a crank shaft 36, and the cylinders of which, as shown, receive steam from the boiler 37 through a supply pipe 38. From the engine driven crank shaft 36, connections are provided for driving the traction wheels 2 and for imparting motion to all the movable parts of the apparatus. For driving the said traction wheels, said shaft 36 is provided with a small friction wheel 39 that is engageable with a large friction wheel 40 carried by a counter shaft 41, which counter shaft has eccentric end portions 42 (see Fig. 14) that are journaled in suitable bearings in the frames of the engine 35. One of the eccentric ends 42 is provided with a lever 43 by means of which the shaft 41 may be located so as to throw the friction wheel 40 into and out of engagement with the friction wheel 39, at will. A long counter shaft 44 extends transversely of the front portion of the truck platform 1, is journaled in suitable bearings thereon, and is provided at its ends, with sprockets 45. At its intermediate portion, said counter shaft 44 is provided with a sprocket 46 over which and a sprocket 47 on the counter shaft 41, runs a sprocket chain 48. Sprocket chains 49 run over the sprockets 45 of the shaft 44 and over the sprockets 4 of the traction wheels 2. Suitable chain tightening wheels (not shown) may be applied to the chains 49 to maintain engagement between the same and the several sprockets 4. Means has now been described whereby the engine 35 may be utilized to cause the entire machine to travel either forward or backward on the rails 3.

On the engine driven crank shaft 36 is a loose bevel pinion 50 that is adapted to be coupled to said shaft at will, by a sliding half clutch 51. This pinion 50 meshes with a bevel gear 52 that is carried by a shaft 53 mounted in suitable bearings on the truck platform 1, and provided at its rearwardly projecting end with a bevel gear 54, (see Figs. 2, 5 and 6). The bevel gear 54 meshes with a bevel gear 55 that is carried by the lower end of a long vertical shaft 56, which shaft is mounted in suitable bearings located at the bottom and top of the guide tower 5—6—7. On the upright shaft 56 is a bevel gear 57 that is caused to rotate therewith, but is free to slide vertically thereon, by means of a suitable key and groove connection. This bevel gear 57 is rotatively mounted in and carried vertically by a horizontal support 58 of the vertically movable trussed frame 8—9. The bevel gear 57 meshes with bevel gears 59 that are located opposite to each other and are journaled in suitable bearings on the central section 9 of the vertically movable frame 8. These bevel gears 59 carry sprockets 60 (see Figs. 1, 2 and 6) that aline with sprockets 61 on the heretofore noted counter shafts 16 which carry the driving sprockets 13. By the driving connections just described, the two pairs of bucket equipped chains 11 will be driven in reverse directions, to-wit, in the directions indicated by the arrows marked adjacent thereto in Figs. 1 and 9. It is also evident that by the manipulation of the clutch 51, the said bucket equipped chains may be thrown into and out of action, at will.

Mounted in suitable bearings on the truck platform 1, is a short vertical shaft 62, which at its upper end, carries a friction disk 63 (see Figs. 1, 2 and 6). Extending above the disk 63 and mounted in suitable bearings, including a bracket 64 on the platform 1, is a counter shaft 65 which carries a worm 66 and a small friction wheel 67, which latter is mounted to slide thereon and, as shown, is adapted to be given its sliding movements through a shipper link 68 and lever 69 which latter, as shown, is pivoted to the bracket 64. The disk equipped shaft 62 is driven directly from the long vertical shaft 56 through a sprocket and chain connection 70 (see Figs. 1 and 6). The worm 66 meshes with and drives a worm gear 71 (see Figs. 1, 2, 4 and 6) which is loose on a counter shaft 72 that is journaled in suitable bearing brackets 73 on the platform 1. On the shaft 72 is a loose sprocket 74 which, however, is suitably held against sliding movement thereon. A sprocket chain 75 runs over the sprocket 74 and over a sprocket 76 of a shaft 77 that is journaled in suitable bearings on the platform 1 (see Figs. 1, 2 and 5). The shaft 77 carries a miter gear 78 that meshes with and is driven from a miter gear 79 carried by the shaft 53. The loose worm gear 71 and the loose sprocket 74 both carry friction clutch members 80. On the shaft 72 between the clutch members 80 is a pair of reversely acting clutch members 81 that are connected for common movements by links 82 and coöperate one with each of the clutch members 80, by means of a shipper lever 83 (see Figs. 2 and 4) which is pivoted to the platform 1 and to the links 82, the sliding clutch members 81 may be thrown into engagement with the coöperating clutch members 80 in reverse order, and at will. The said sliding half clutches 81 are keyed to the shaft 72 for rotation therewith. On each end of the shaft 72 is a windlass drum 84. To each windlass drum 84 is attached a pair of cables 85—86 that are reversely wound thereon. The cables 85 extend upward and run over guide sheaves 87 on the upper portion 6 of the guide tower, and their ends are extended downward and attached to the central portion 9 of the vertically adjustable frame 8, as best shown in Figs. 1, 2, 6 and 7. The cables 86 extend downward and under guide sheaves 88 on the platform 1, and then extend upward and are attached to the support 58 which is on the central portion of the said vertically adjustable frame 8. As is evident, with the cable con-

nections 85 and 86, when the shaft 72 is rotated in one direction, the frame 8 will be caused to rise, and when said shaft 72 is rotated in the reverse direction, the said frame 8 will be caused to lower. The speed with which the shaft 72 is caused to rotate, will, of course, determine the speed at which the frame 8 will be raised or lowered.

For lowering the frame 8 to keep the buckets 12 at work, a slow motion is required; and this motion is transmitted through the variable speed friction drive 63—67 and through the worm and gear device 66—71. When this slow feed movement is desired, the right hand clutch members 80 and 81 (see Figs. 2 and 4) are thrown into engagement, thereby coupling the worm gear 71 and 72, and disconnecting the sprockets 74 from said shaft. When, however, it is desired to impart a rapid upward movement to the frame 8, after one cut has been completed and it is desired to set the machine for a new cut, the left hand clutch members 80 and 81 are engaged, thereby coupling the sprockets 74 to the shaft 72 and disconnecting the worm gear 71 from said shaft, and thereby causing the said shaft 72 to be driven at a relatively high rate of speed directly from the shaft 53.

The variable speed friction drive affords means for varying the downward feed movement of the buckets to their work, just fast enough to insure complete filling of the buckets.

The engine-driven crank shaft 36 is, as shown, provided with a small pulley 89 (see Fig. 2), from which, by suitable belt connections, an air compressor (not shown) may be driven, and which air compressor may be arranged to deliver air into the storage reservoir 28 through a pipe 90 shown in part in Fig. 2. The only purpose of an air compressor is to keep up the normal supply of the air in the storage reservoir 28, and to compensate for leakage. The air, it will be understood, when the frame 8 is adjusted downward and upward will run back and forth into and out of and into said storage tank.

The buckets on the reversely-acting pairs of carrying chains should be so set that only one thereof will pass at a time between the closely positioned pairs of guide wheels 14. This arrangement permits the buckets of the two chains to cut beyond the vertical line extending midway between the two pairs of wheels 14.

When it is desired to deliver the excavated dirt entirely at one side of the ditch, an endless chain is run entirely around the frame 8, to-wit, over the end guide wheels 15 under the lower guide wheels 14, and over the so-called driving sprockets 13; but in this case one or the other of the sprocket chains 61 should be removed according to which direction it is desired to drive the bucket-equipped chain.

The expression "buckets" has been used throughout the specification in a broad sense, to include such devices as are frequently designated as scrapers and scoops, and the said expression, as broadly used, would include any suitable form of device for picking up and carrying the dirt.

It will of course be understood that any suitable elastic fluid may be used in the pneumatic counterbalancing device.

What I claim is:

1. In an excavating apparatus, the combination with a vertically adjustable excavating device, of a fluid actuated counter-balancing device therefor, and means independent of said counter-balancing device for moving the said excavating device vertically, substantially as described.

2. In an excavating apparatus, the combination with a vertically adjustable supporting frame and excavating devices mounted thereon, of a fluid actuated counter balancing device operative on said frame, and means independent of said counter balancing device, for moving said supporting frame vertically, substantially as described.

3. In an excavating apparatus, the combination with a supporting platform, a supporting frame movable vertically therewith, and excavating devices mounted on said supporting frame, of a pneumatic counter balancing device operative on said vertically adjustable supporting frame, and means independent of said counter balancing device, operative at will, to move said supporting frame vertically, substantially as described.

4. The combination with a vertically movable support, of a pneumatic counter balancing device arranged to balance said support in an intermediate position and tending to maintain the same in such intermediate position, and power actuating mechanism independent of said counter-balancing devices, operative, at will, to force said support either upward or downward, from its said counter-balanced intermediate position, substantially as described.

5. The combination with a vertically movable support, of a pneumatic counter balancing device therefor, comprising a cylinder and piston engine having connections for moving said support vertically, and a storage tank in communication with the said cylinder, and power actuated means independent of said counterbalancing devices operative, at will, for forcing the said support upward and downward, substantially as described.

6. In an excavating apparatus, the combination with a supporting platform and a counter balanced vertically adjustable frame mounted thereon, an endless bucket equipped carrier mounted on said supporting frame, means for driving said carrier in different positions of said supporting frame, and a variable speed feed device for lowering said frame, to force the buckets to their work, substantially as described.

7. In an excavating apparatus, the combination with a supporting platform and a counter balanced vertically adjustable supporting frame mounted thereon, a bucket equipped carrier mounted on said supporting frame, means for driving said carrier under different adjustments of said frame, a variable speed drive for moving said supporting frame downward to force said buckets to their work, and a relatively high speed feed device for imparting upward or return movements to said supporting frame, substantially as described.

8. In an excavating apparatus, the combination with a supporting platform and a vertically adjustable supporting frame mounted thereon, a power driven bucket equipped carrier mounted on said frame, and a device for counter balancing said supporting frame, comprising a pair of cylinders anchored to said platform and having cooperating pistons, connections between said pistons and said supporting frame, and an air storage tank having a pipe connection leading to said two cylinders, substantially as described.

9. In an excavator, the combination with a bucket equipped carrier and supporting and driving means therefor, of a scraper located at the discharging point and arranged to pass through said buckets, the said buckets being arranged to pass outward of and around the said scraper, substantially as described.

10. In an excavator, the combination with a bucket-equipped endless carrier and supporting and driving means therefor, of a fixed scraper located at the discharging position and arranged to pass through the buckets, the said buckets being arranged to pass outward of and around the said scraper, substantially as described.

11. In an excavator, the combination with an endless bucket-equipped carrier, of an approximately U-shaped scraper fixed at the discharging position and arranged to

pass through the buckets, the said buckets being arranged to pass outward of and around the said scraper, substantially as described.

12. In an excavating apparatus, the combination with an endless power driven bucket carrier and guiding devices therefor, including guide wheels located at the dumping point, buckets attached to said endless carrier, said buckets having their bottom portions formed on such lines that said bottoms extend approximately concentric to the axis of the said guide wheel when said bucket is at the dumping point, and a fixed scraper located in position to engage closely with the bottom of said buckets as the latter are moved in the vicinity of the dumping point, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN C. JUNKIN.

Witnesses:
MALIE HOEL,
F. D. MERCHANT.