March 26, 1929. K. BESTELAND 1,706,689

EXCAVATOR AND LOADER

Filed June 28, 1926 3 Sheets-Sheet 1

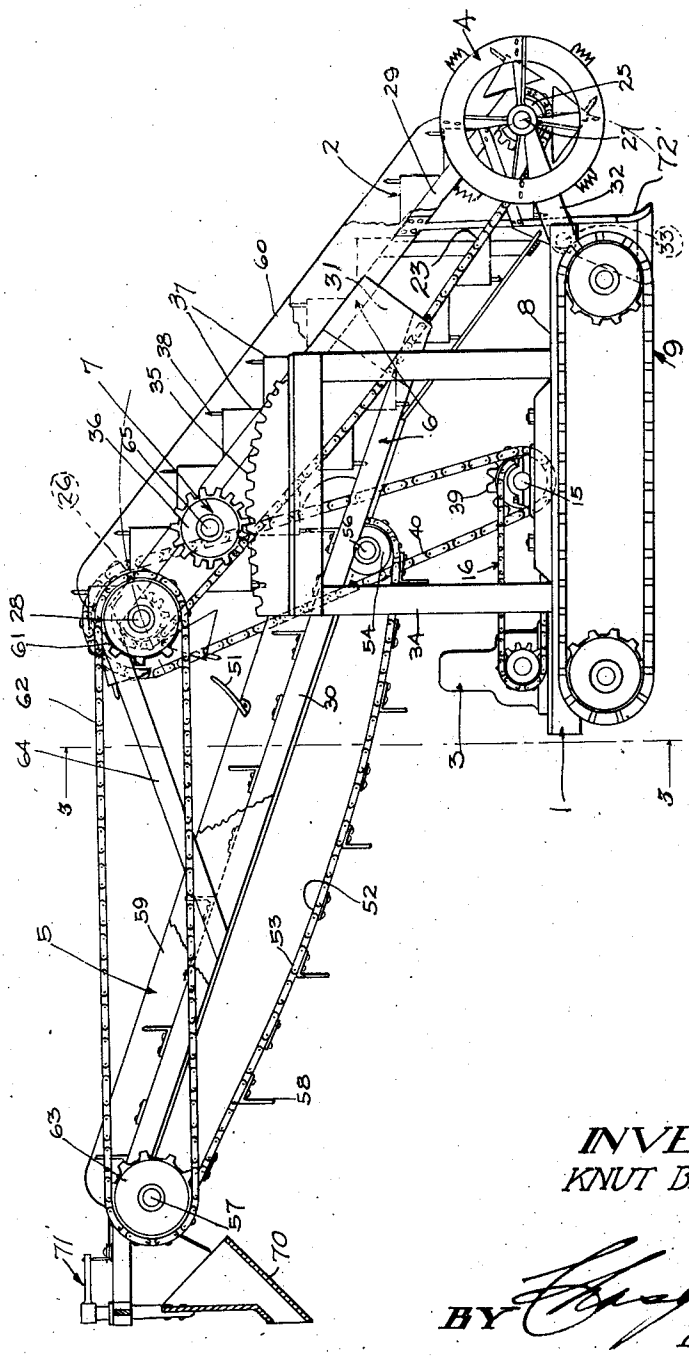


Fig. 1

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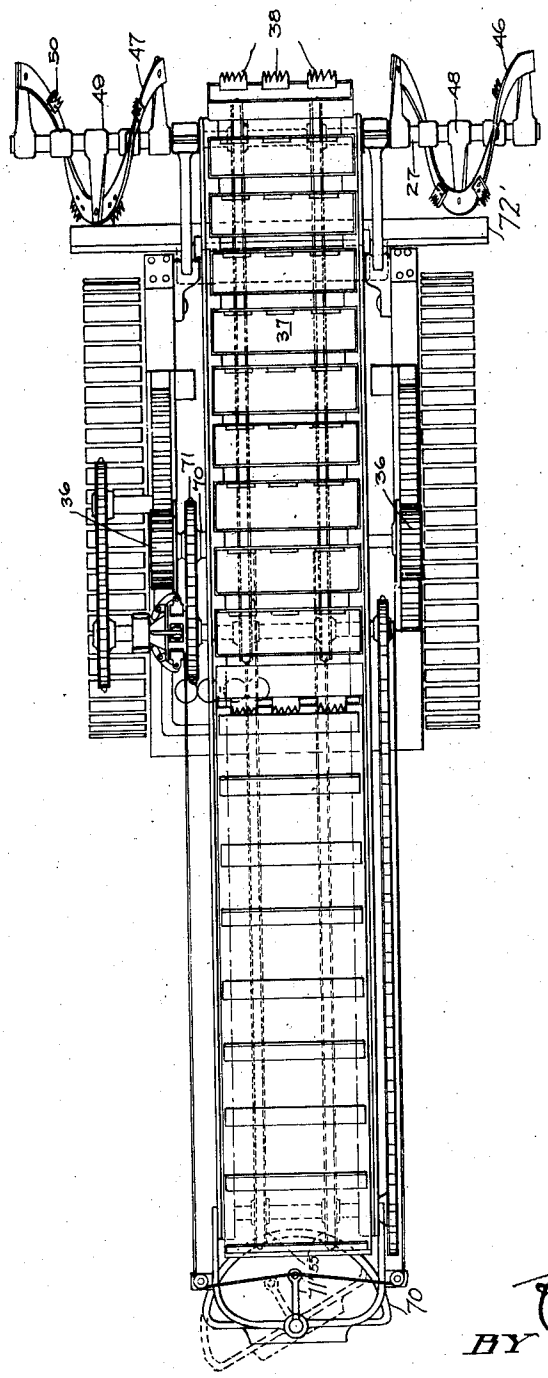



Fig. 2

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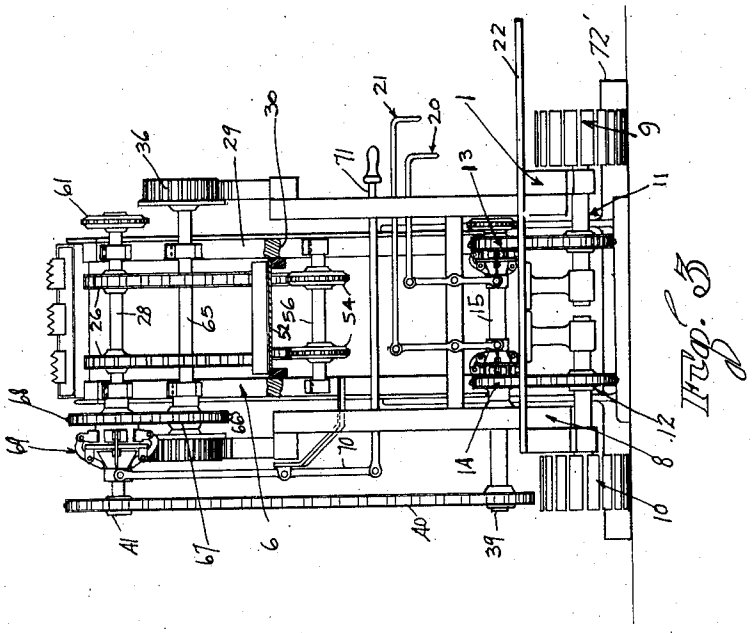



Fig. 5

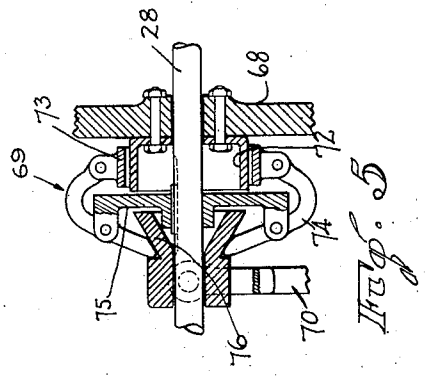



Fig. 5

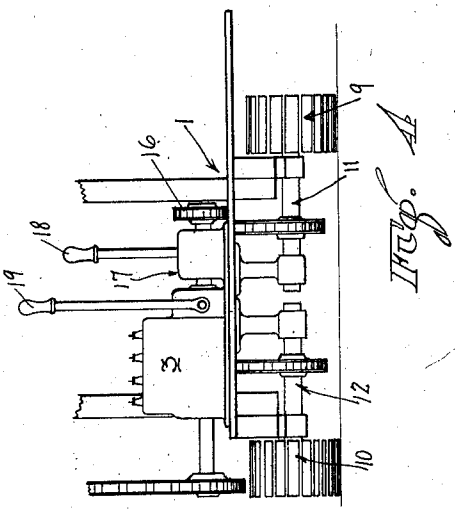



Fig. 4

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Patented Mar. 26, 1929. 1,706,689

# UNITED STATES PATENT OFFICE.

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## EXCAVATOR AND LOADER.

Application filed June 28, 1926. Serial No. 118,886.

This invention relates to an improved excavating and loading machine which is so constructed and arranged that it may be operated with greater ease, accuracy and economy than has been possible with excavating and loading machines such as heretofore constructed.

One of the purposes of the invention is to provide a machine of the character described which will be exceptionally mobile and which will have a lower center of gravity than machines such as are now commonly used.

Another purpose of the invention is to provide an excavating and loading machine of the character described which may be used for excavating and loading clay, hard ground and like materials as well as loose and soft materials.

A further purpose of the invention is to provide a machine of the character described which will be comparatively simple as to construction, strong and durable and which will have a greater capacity in proportion to its size and weight than other machines of this nature of which I am aware, said machine of this invention being arranged so that it will operate smoothly with less wear and strain on the mechanisms thereof than is the case in the ordinary excavating and loading machines.

With the above mentioned and other objects in view, the invention consists in the novel construction and combination of parts hereinafter described, illustrated in the accompanying drawing, and set forth in the claims hereto appended, it being understood that various changes in the form, proportion, size and minor details of construction with the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Referring to the drawings:

Fig. 1 represents a side elevation of the excavator and loader of my invention.

Fig. 2 is a top plan view of the machine.

Fig. 3 is a sectional view taken on the plane of line 3—3 of Fig. 1.

Fig. 4 represents a fragmentary end elevation of the vehicular part of the machine.

Fig. 5 represents a sectional view of one of the friction clutches.

The embodiment of the excavating and loading machine shown in detail in the accompanying drawings generally comprises a track laying type of motor vehicle 1, which serves as a base or support, a comparatively short endless bucket type elevator 2, supported in an upwardly inclined position on said vehicle and driven by the motor 3 thereof, a digging and elevator loading device 4, an endless loading conveyor 5 which receives the bucket loads and is adapted to discharge said loads into trucks, cars or like vehicles, an especially constructed frame 6 which serves as a common support for the elevator, the conveyor and the digger and loader, and is adjustable to suit various conditions of excavating and loading jobs, and a power driven means 7 for adjusting said frame.

These seven elements of the machine together with their associated elements which will be hereinafter more fully described are constructed and assembled to provide for compactness, simplicity, and reliability in a machine which is easier to operate, has more capacity for weight and size, and costs less to operate and maintain in working order than excavating and loading machines such as heretofore constructed.

### *Vehicular support.*

The track laying motor vehicle 1 is made up of a suitable frame 8 on which is mounted in the usual manner any suitable type of track laying driving devices 9 and 10. Separate drive devices 11 and 12 including friction clutches 13 and 14 are operatively connected with a main drive shaft 15 and with said track laying devices. This shaft is driven by a chain and sprocket drive connection 16 from a suitable compound speed changing transmission. Means 17 and engine clutch 17′ operatively associated in the usual manner with the motor 3 which latter is preferably of the internal combustion type. Control levers 18 and 19 provide for operation of the compound transmission and engine clutch. Similar controls 20 and 21 are associated with the friction clutches 13 and 14. All control levers are accessible from the operator's platform 22 extending from one side of the vehicle frame. By the drive arrangement, the track laying devices are subject to operation so as to move the entire machine as desired in various directions necessary to carry out a continuous operation of

the machine. The main drive shaft 15 is also subject to easy and minute control as to its speed and driving power through the transmission mechanism.

*Endless bucket elevator.*

The elevator 6 comprises two endless sprocket chains 23 mounted on pairs of sprockets 25 and 26 carried by shafts 27 and 28 which shafts are supported at the extremities of upwardly inclined frame pieces 29, comprising a part of the adjustable main frame. The frame pieces 29 are joined to similar frame pieces 30 of the frame 6 disposed below said pieces 29, by connecting plates 31. The frame 6 in its entirety is adjustably supported by arms 32 pivoted on the shaft 27 and which extend outward and upward from one end of the vehicle frame 8 at which point they are pivoted as at 33. Upright stationary frames 34 on the vehicle frame 8 carry curved racks 35 on their upper ends. Pinions 36 on the upper portions of the frame pieces 29 ride on the rack and in this way the frame 6 is adjustably supported.

Suitable buckets 37 are pivoted on the sprocket chains of the elevator in the usual manner. Sets of teeth 38 are removably secured to the digging or loading edges of the buckets. The buckets in being moved up and around the sprockets 25 dig or scoop up the dirt, aided in this action by the teeth thereon. As they begin their upward travel after being loaded, they assume a proper carrying position which is maintained until the upper end of the elevator is reached. At this point the buckets will drop their loads onto the endless conveyor 5 as they turn downward around the sprockets 26 at the beginning of their downward travel. The endless elevator is driven from a sprocket wheel 39 fixed upon the shaft 15 and operating a chain 40 which extends upward and around a sprocket 41 fixed to the outer end of a shaft 28 which drives the elevator 2.

*Bucket loading and digging mechanism.*

The bucket loading and digging mechanism 4 is carried on the shaft on opposite sides of the elevator. The length of this shaft is such that said means 4 may be arranged so as to cut into a bank of dirt to be removed sufficiently to enable the machine to move into the cut. This means 4 comprises helical blades 46 and 47 secured by arms 48 and 49 on the extended portions of the shaft 27 and disposed on opposite sides of the lower end of the elevator. On these blades at suitably spaced points are a plurality of sets of teeth 50 which aid in the digging and loading operation. The pitch of these horizontal blades is such as to cause the dirt or earth to be loosened or excavated and to be forced inwardly to a point over or adjacent the lower end of the elevator. In other words, these blades not only dig into the ground or dirt, for example, into the side of a bank to be removed, but also force the earth or dirt into a position so that it will fall into and load the buckets as the latter turn upward at the lower end of the elevator. Since the shaft 27 is driven with the elevator, this provides for operation of said blades to bring about the digging and loading action simultaneously with the elevating operation.

*Endless conveyor.*

The loads from the buckets 37 of the elevator which are discharged from the buckets at the upper end of the elevator drop onto deflecting plates 51 extending across the endless conveyor 5 are arranged to direct the dirt forwardly onto said conveyor. This member 51 serves to break the force of the falling dirt and eliminates wear and damage to the conveyor. The conveyor comprises a suitable endless belt 52 fixed upon sprocket chains 53, which latter are mounted on pairs of sprocket wheels 54 mounted on shafts 56 and 57, which shafts are secured to the lower and upper portions respectively, of the frame pieces 30. Extending transversely of the belt are risers or cleats 58 which support the dirt in the upward travel thereof to the outer end of the conveyor. Along the upper run of the conveyor are guard boards 59 to prevent dirt from falling off the sides of the conveyor. In this connection it will be noted that the elevator 2 is provided with similar guard boards 60 extending along opposite sides of the upper run thereof. The elevator is of sufficient length and outward and upward extension to provide for the movement of the outer end thereof into a position whereby the dirt or load on the conveyor may be properly delivered into a truck, car, dump cart, or in fact into the desired place. Ordinary motor trucks having a capacity of from one to five cubic yards are usually employed to carry away the excavated dirt. The conveyor of this machine is so arranged that the machine may be readily moved to dump the dirt off the conveyor into the front of a five yard capacity truck body, whereas with excavating and loading machines such as heretofore used, it has not been possible to dump the load into the forward end of a large capacity truck and has necessitated the shoveling of the load from the rear end of the truck to other parts thereof. This conveyor is driven from the shaft 28 on which is mounted a sprocket 61 around which the sprocket chain 62 is extended. This chain extends over a similar sprocket 63 on the shaft 57. Thus, when the shaft 28 is driven in order to operate the elevator 2, the conveyor 5 is likewise operated. To brace the structure, supporting bars 64 are fastened to the upper structure of the elevator

2 and extend downwardly and rearwardly to intermediate points on the frame pieces 30 for the conveyor 5.

*Adjustable supporting frame for the elevator and conveyor.*

The adjustable supporting frame 6 principally comprises as previously stated, frame pieces 29 and frame pieces 30 joined by the members 31 and 64. This main frame is so constructed that it is comparatively long but does not extend upwardly sufficiently to make the entire machine in anyway top heavy. The principal objection to machinery of this type such as heretofore used has been the too great upward extension thereof with a result that the machines become top heavy. In addition to this objection, a long bucket elevator must have a greater number of buckets than a short one and this adds to the weight of the structure and detracts from the efficiency thereof. In the present arrangement by combining the elevator and conveyor on one frame which is adjustably supported on the vehicular body, it is possible to use a very short elevator and but a few buckets, thus reducing the weight and making for reliability of operation without loss of and with a gain in efficiency. The conveyor having considerable of an outward extension provides for an easier loading of trucks, cars or the like.

*Bar operated frame adjusting means.*

The adjusting means for the frame 6 includes the pinions 36 which are mounted on a shaft 65 extending across the under side of and journaled on the frame pieces 29. On this shaft is a sprocket 66 around which a sprocket chain 67 is extended, said chain being also extended around a similar sprocket 68, loosely mounted on the shaft 28. A friction clutch 69 of any suitable type, preferably of the same type as the clutches 13 and 14, is associated with the shaft 28 and with the sprocket wheel 68 so that said sprocket wheel may be caused to rotate with the shaft or the shaft permitted to rotate relative to the sprocket wheel. This clutch 69 is controlled by levers 70 and 71, the latter lever being disposed adjacent the levers 20 and 21 so that it may be conveniently operated from the platform 22. On operating the clutch to cause the sprocket 68 to rotate with the shaft 28, the chain 67 drives the shaft 65 and turns the pinions 36 which are engaged with the racks 35. This causes the entire frame 6 to move and assuming that the frame moves forward, the forward end of the elevator will be lowered and the upper end of the conveyor lifted. By reversing the direction of the rotation of the shaft 15 as may be accomplished by properly manipulating the compound transmission 17, the frame 6 may be moved in the opposite direction. The rack and pinion arrangement act as a lock to maintain the frame in the position into which it is adjusted.

The type of friction clutch used throughout this machine is illustrated in Fig. 5. The clutch shown in this figure is the one mounted on the shaft 28 but the clutches 13 and 14 are constructed identically with this clutch. Fixed on the sprocket 68 is a clutch drum 72, surrounding which drum is a contractible band 73. This band is contracted by means of levers 74 pivoted on a member 75 which is splined on the shaft 28. A cam member 76 slidable on the shaft 28 operates against the ends of the lever 74 so as to cause contraction and expansion of the band 73. The lever 70 is connected with and operates the cam 76. However, I wish it understood that I may use any type of friction clutch that is suitable for use in this machine.

*Operation.*

With the motor 3 in operation the driver or operator on manipulating the control levers 20 and 21 may operate the track laying devices 9 and 10 so as to dispose the machine in proper position for operation. The speed of the movement of the track laying devices may be regulated by the transmission 17. Since the motor 3 drives the main shaft 15, this shaft through the sprocket 39, chain 40 and sprocket 41 rotates the shaft 28 on which the sprockets 26 for the elevator chains 23 are mounted, thereby putting into operation the elevator and also operating the conveyor 5 which is driven by the shaft 28, the chain 62 and its associated sprockets. The position of the lower end of the elevator and likewise the position of the digger and loader mechanism 4 may be changed to suit the conditions at hand as determined by the lay of the ground or the material to be excavated and removed. This adjustment of the elevator may be effected through the power driven adjusting means including the pinions 36, shafts 65, racks 35 and clutch 69, which latter locks the sprocket 68 with the shaft 28 and drives the chain 67 on the sprocket 66. This rotates the shaft 65 and the pinions 36 whereby the entire frame 6 is moved as previously described.

The excavator and loader 4 being mounted on the shaft 27 of the loader, operates simultaneously with the operation of the elevator. The spiral blades 46 are so arranged and pitched that they will cause an excavating or digging action and the dirt or material thus excavated to be forced inwardly and towards the lower end of the elevator thereby loading the buckets 37 as the latter move upwardly and around the lower end of the elevator. The buckets themselves assist in the digging and excavating operation, both the buckets and the horizontal blades being assisted by

the sets of teeth 38 and 50. The excavation made by the digger and buckets is of sufficient width to enable the machine to be moved directly into the path or bank of earth or other material being cut into. The dirt or material is carried upwardly in the buckets 37, is dumped from said buckets at the upper end of the elevator and falls onto the endless conveyor 5 striking first the deflector and guide plate 51 which breaks the force of the falling dirt. The risers or cleats 58 on the conveyor belt 52 carry the dirt to the outer end of the conveyor, the dirt being held on the conveyor by the guard plates 59. The dirt drops off the outer end of the conveyor beneath which a truck or car is disposed in order that the dirt may be hauled away. By manipulating the vehicular support, the outer end of the conveyor may be positioned to properly scatter or load the dirt into a truck, whether the truck be of large or of small capacity. A further adjustment facilitating the proper loading may be made by the power driven adjusting means 7 for the main frame 6 on which the conveyor 5 is mounted.

The comparatively short elevator and the conveyor arranged on the adjustable frame in accordance with this invention provide many advantages and overcome objections which are present in excavators and loaders such as heretofore constructed, for example, twenty buckets may be eliminated. The shortening of the elevator, together with the elimination of the extra buckets, etc. and the extra weight does away with the top heaviness which is an objection in excavating and loading machines. It also eliminates the use of long bucket chains and thereby prevents jerking and uneven operations due to slack in the long chains. By using less buckets the capacity of the buckets may be materially increased without detracting from the efficiency of the machine. The particular digging or excavating and loading means at the lower end of the elevator provides for working in solid ground or gravel and under other conditions in which the ordinary excavating and loading machine will not operate. This provision for operation in such hard materials is also made possible by the transmission mechanism which provides for proper controlling of the power applied to the machinery. An advantage of the machine is that the conveyor extends outwardly from the body of the machine in such manner that the front end of a twelve foot, five yard, truck may be easily loaded, whereas with machines such as heretofore used it has been necessary to shovel the material from the rear end to the front parts of the truck body.

To facilitate the dumping of the material or dirt being handled from the upper end of the conveyor 5, there is provided an adjustable spout 70′ having adjusting means 71′, a part of which is shown. This spout may be turned to direct the dirt as desired into the wagon, truck or other vehicle into which the dirt is to discharge.

Rearward of the forward end of the elevator 2 is a scraper plate 72′ which is slightly longer than the width of the vehicle and is adapted to engage the ground along its lower edge. This plate pushes the dirt ahead of it as the apparatus is advanced and thereby provides a smooth track for the vehicle to operate upon.

I claim:

1. An excavating and loading machine comprising a vehicular support, a substantially upright frame on said support, another frame mounted in upwardly and rearwardly inclined position, means for adjustably connecting the first and second named frames, and providing for bodily adjustment of the second named frame relative to the first named frame, dirt excavating means upon the lower end of the second named frame, an endless elevator mounted on and entirely supported by said second named frame and cooperating with the excavating means and an endless conveyor mounted on the second named frame with the upper run thereof disposed beneath the upper end of the said elevator.

2. An excavating and loading machine comprising a vehicular support, an upwardly and rearwardly inclined frame bodily adjustably mounted upon the support, excavating means mounted on the lower end of said frame, an elevator mounted on said frame and operatively associated with the excavating means, an endless conveyor mounted on said frame with the upper run thereof disposed beneath the upper end of the elevator, a motor on the vehicular support, means of driving connection between the motor, the excavating means, the elevator and said conveyor and means providing for bodily adjusting said frame to change the inclination thereof and to change the position of the excavating means and conveyor, which means may be operated to so adjust the frame during, and without affecting the operation of the excavating means, the elevator and said conveyor.

3. An excavating and loading machine comprising a vehicular support, an upright frame on said support, an elongated upwardly and rearwardly inclined frame, means pivotally connecting the lower portion of said frame with the forward portion of the vehicular support, racks mounted on said upright frame, pinions mounted on the second named frame and engaging said racks, means for rotating the pinions to change the inclination of said second named frame, an endless elevator mounted on said second named frame, means at the lower end of the second named frame for depositing dirt into the elevator and an endless conveyor mounted on

the second named frame with the lower end of the upper run disposed beneath the upper end of the elevator and the upper end disposed at the upper and outer end of the second named frame.

4. An excavating and loading machine comprising a vehicular support, an upright frame on said support, an elongated upwardly and rearwardly inclined frame, means pivotally connecting the lower portion of said frame with the forward portion of the vehicular support, racks mounted on said upright frame, pinions mounted on the second named frame and engaging said racks, means for rotating the pinions to change the inclination of said second named frame, an endless elevator mounted on said second named frame, means at the lower end of the second named frame for depositing dirt into the elevator, an endless conveyor mounted on the second named frame with the lower end of the upper run disposed beneath the upper end of the elevator and the upper end disposed at the upper and outer end of the second named frame, and an adjustable chute on the upper end of the second named frame and into which material is discharged from the upper end of said conveyor.

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