Nov. 4, 1958 H. A. TOULMIN, JR 2,858,626

EXCAVATING APPARATUS

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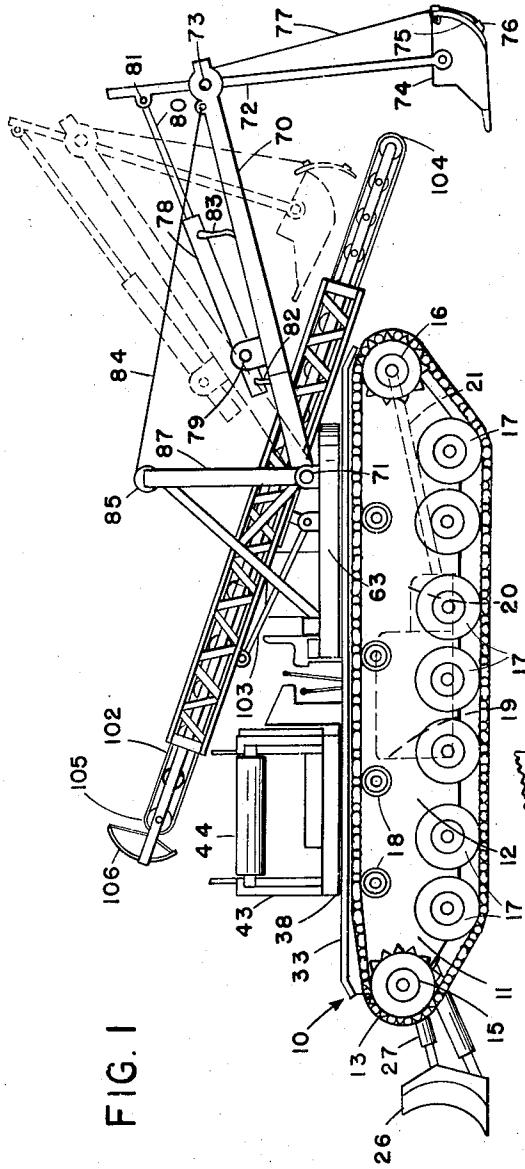

FIG. 1

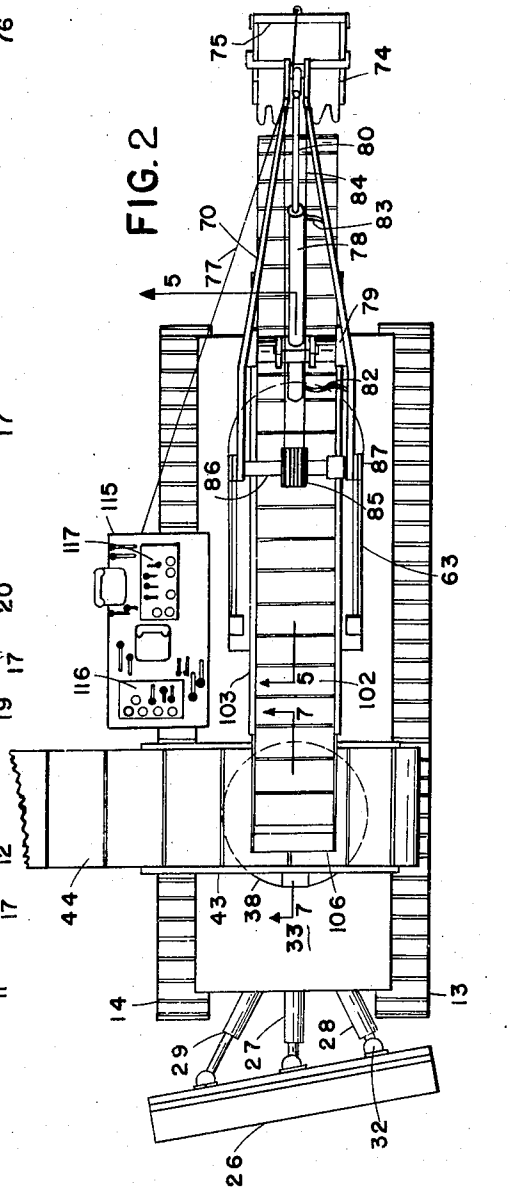

FIG. 2

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FIG. 3

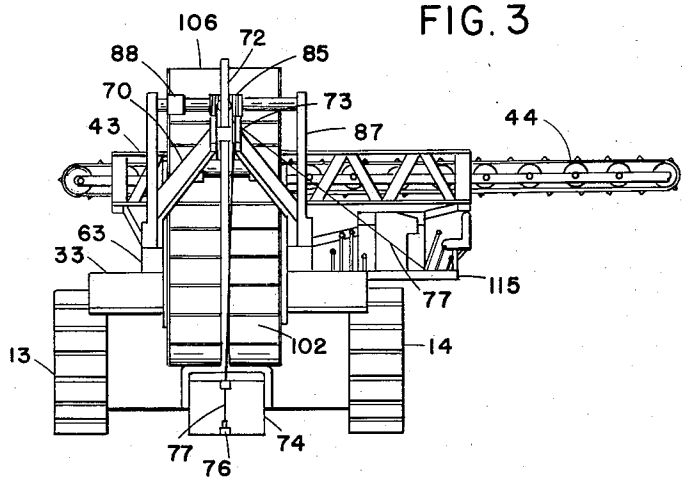

FIG. 4

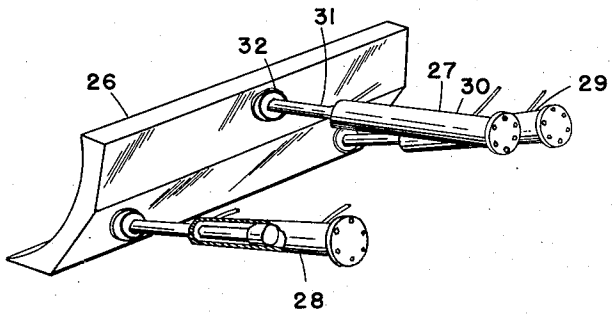

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FIG. 5

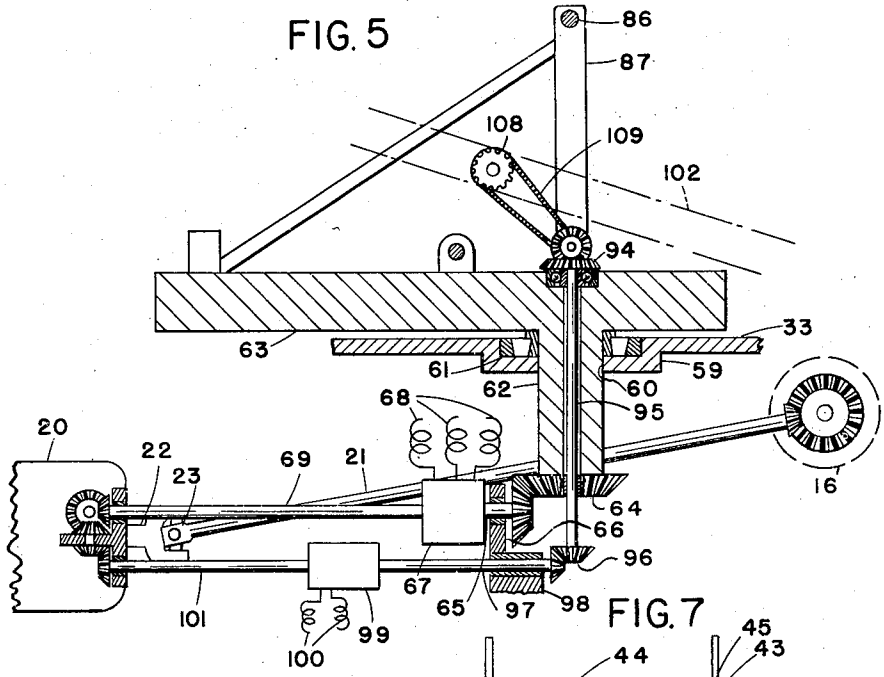


FIG. 6

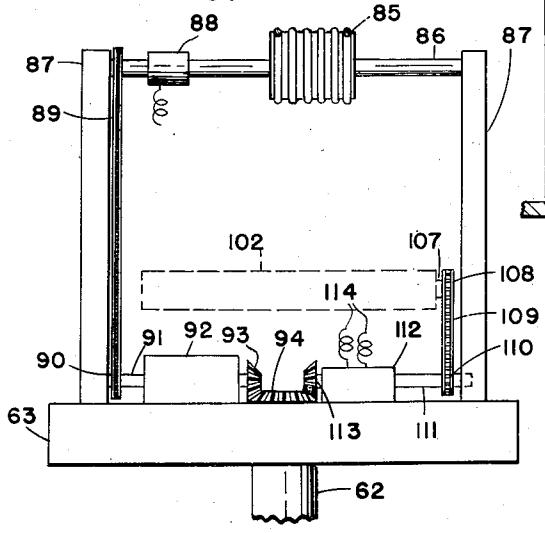
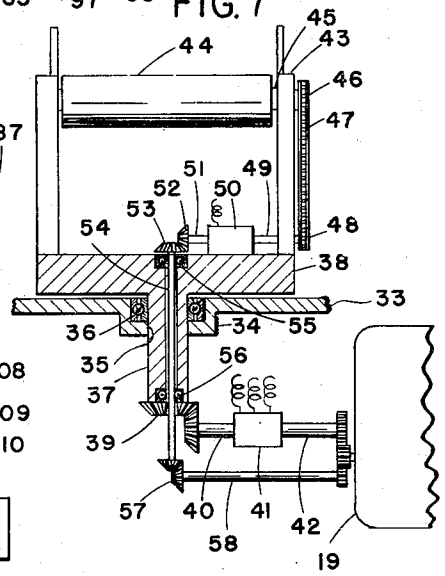


FIG. 7



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2,858,626

EXCAVATING APPARATUS

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Application November 24, 1954, Serial No. 470,866

12 Claims. (Cl. 37—117.5)

The present invention relates to excavating apparatus, more particularly, to a self-propelled vehicle which combines the functions of a bulldozer, a power shovel and a belt loader.

The operation referred to as excavating may be defined as that process wherein earth is removed from its natural location, and in most instances, subsequently conveyed to a different location. In order to accomplish the various excavating operations more efficiently numerous types of specialized equipment have been devised. Today many specialized machines exist to dig various types of soil. Other machines are employed for collecting the soil and still other machines may be utilized for loading soil onto trucks or other forms of conveyances.

In scraping or leveling operations it is desired to scrape the earth by a bulldozer or the like in order to achieve a desired grade or level. The scraped dirt is then picked up by means of power shovels to be loaded into conveyances. In this operation it can be seen that as the bulldozer proceeds along the earth to scrape the dirt, the shovel must follow closely therebehind in order to collect the accumulated earth. In addition, the conveyances, which are usually trucks, must follow the shovel in order that they may be loaded with the dirt. If the operation is not of sufficient size to warrant the use of power equipment, workmen are used to manually load the trucks with the accumulated dirt.

In order to attain an efficient removal of this earth, it can be seen that a close coordination is required between the bulldozer, the power shovel and any loading equipment which may be used. Because of the use of these separate pieces of equipment, the cost of excavating operations may sometimes be considerable. In addition, skilled manpower is necessary in order to operate the machinery.

The present invention discloses a novel and inventive form of excavating apparatus which is especially adapted to scraping and leveling operations. This apparatus comprises a self-propelled vehicle having endless track in order to enable the apparatus to operate on any kind of terrain. In essence, this apparatus is a combined bulldozer, power shovel and loader. There is a bulldozer blade adjustably mounted on the front end of the vehicle. A pair of platforms are rotatably mounted on the top of the vehicle. On one of these platforms is a conveyor belt which is normally used transversely of the vehicle. On the other platform there is mounted a belt loader and a power shovel which is aligned with the loader. A control platform is mounted on one side of the vehicle. It is preferable that two men be employed to control the apparatus: one man to operate the bulldozer and the second man to operate the shovel and loader.

The power shovel is of the drag or pull type. It is adapted to load the earth on the lower end of the belt loader. When the dirt has been deposited on the first

belt loader, it is conveyed to the transverse belt which, in turn, transports the dirt to a truck or the like positioned beneath the end of the transverse loader.

This excavating apparatus considerably decreases the time of excavating as it eliminates the necessity for the power shovel to dig the dirt, swing around to deposit the dirt upon a belt or in a truck, and then to return to the accumulation of dirt. In addition, the three functions of scraping, collecting and loading are combined in a single apparatus which is easily controlled on rough ground. Moreover, as a single apparatus accomplishes these three functions, there is no necessity for employing several pieces of specialized machinery.

It is, therefore, the principal object of this invention to provide a novel and improved form of excavating apparatus.

It is another object of this invention to provide an apparatus for decreasing the time of excavating.

It is a further object of this invention to provide an apparatus whereby all of the excavated dirt is rapidly loaded into suitable conveyances, such as trucks or the like.

It is an additional object of this invention to provide excavating apparatus wherein the functions of scraping dirt, collecting the scraped dirt, and subsequently loading the dirt into conveyances are combined in a single piece of equipment.

Other objects and advantages of this invention will become apparent upon reference to the following description when taken in conjunction with the accompanying drawings wherein:

Figure 1 is a side elevational view of the excavating apparatus of this invention;

Figure 2 is a top plan view of the apparatus illustrated in Figure 1;

Figure 3 is a rear elevational view of the apparatus illustrated in Figure 1;

Figure 4 is a perspective view of the bulldozer blade and the hydraulic cylinders employed to adjust the blade;

Figure 5 is a partial sectional view taken along the lines 5—5 of Figure 2 and showing the power transmission means drivingly connecting the engine, the endless tracks and the power shovel rotatable platform;

Figure 6 is a detailed view in enlarged scale of the power transmission means drivingly connecting the longitudinal belt conveyor and the cable drum for the power shovel; and

Figure 7 is a sectional view taken along the lines 7—7 of Figure 2 showing the construction employed in transmitting power from the engine to the rotatable platform carrying the transverse conveyor belt.

Referring now to the drawings, more particularly to Figure 1, wherein like reference symbols indicate the same parts throughout the various views, **10** indicates generally an excavating apparatus constructed in accordance with this invention. The excavating apparatus **10** comprises a vehicle **11** which has a body portion **12** and endless or caterpillar tracks **13** and **14** on each side thereof. The endless track **13** is mounted upon a front sprocket wheel **15** and a rear sprocket wheel **16**. The weight of the vehicle is distributed upon the endless track **13** by means of the bogie wheels **17**. The top portion of the endless track **13** is carried upon idlers **18**. The endless track **14** is similarly mounted on the other side of the vehicle **11**.

The vehicle **11** is powered by a suitable engine **19** which is mounted within the body portion **12**. The engine **19** has a transmission **20** from which power is taken off by means of the shaft **21** to drive the rear sprocket wheel **16**. A drive shaft **22** is secured by means of a universal joint **23** to the shaft **21**. The

other end of the drive shaft 22 is connected by suitable means to the transmission 20.

Mounted on the front of the vehicle 11 is a bulldozer blade 26. The bulldozer blade 26 is supported by means of three hydraulic motors 27, 28 and 29 which are secured to the front of the vehicle. The hydraulic motor 27 combines a cylinder 30 from which extends a piston rod 31 which is connected by means of a ball joint 32 to a point on the vertical center line of the bulldozer blade 26. The hydraulic motors 28 and 29 are similarly connected by ball joints to points spaced laterally from the ball joint 32 and proximate to the bottom edge of the bulldozer blade 26. Suitable hydraulic pumps and circuits are located within the body portion 12 in order to power the hydraulic motors 27, 28 and 29 to adjust the bulldozer blade 26. The controls for the bulldozer blade 26 are located on the control panel in a manner to be later described.

On the upper side of the body portion 12 there is fastened a top plate 33. The top plate 33 consists of a substantial steel plate. In the forward portion of the top plate 33 there is located a recess 34 having a circular opening 35 therein. This structure is illustrated in Figure 7. Positioned within the recess 34 is a bearing 36 within which is received a shaft 37 having one end thereof rigidly secured to a substantially circular platform 38. The other end of the shaft 37 is connected by means of suitable gearing indicated at 39 to a drive shaft 40 which extends into a solenoid operated clutch and transmission 41. The clutch 41 is drivingly connected by means of drive shaft 42 to the engine 19. Suitable power take-off means are provided on the engine 19 in order to power the rotatable platform 38.

Mounted on the rotatable platform 38 is a suitable frame 43 which supports a belt conveyor 44. The normal position of the belt conveyor 44 is transversely to the vehicle 11, as indicated at Figure 2. The belt conveyor 44 is powered by a transmission system which drivingly connects the belt conveyor to the engine 19. The belt conveyor 44 is geared to a drive sprocket (not shown) having a shaft 45 on the end of which is secured a gear 46. The gear 46 is drivingly connected by means of a chain drive 47 to a gear 48 which is fastened upon the end of a shaft 49. The shaft 49 is rotatably journalled in a portion of the frame 43. Suitable clutch means 50 receive one end of the shaft 49. Extending from the other side of the clutch 50 is a shaft 51 having a bevel gear 52 secured on the end thereof. The bevel gear 52 is in mesh with a bevel gear 53 which is fastened upon one end of a shaft 54 which is journalled by means of bearings 55 and 56 within the platform shaft 37. The lower end of the shaft 54 is drivingly connected by means of gearing 57 to a drive shaft 58 which, in turn, is drivingly connected to a suitable power take-off from the engine 19.

Located in the top plate 33 rearwardly of the first rotatable platform 38 is a second recess 59 having a central opening 60 therethrough, as illustrated in Figure 5. A bearing 61 is located within the recess 59 and closely receives a shaft 62 whose upper end is integral with a second rotatable platform 63. The lower end of the shaft 62 is connected by means of suitable gearing 64 to a shaft 65 which is rotatably journalled in a support 66 secured to the body portion 12 of the vehicle. The shaft 65 extends into a clutch and transmission 67 which is solenoid operated and the solenoids are controlled by leads 68 which are connected to a control panel. A drive shaft 69 extends from the other side of the clutch 67 and is drivingly connected to the transmission 20 of the engine 19.

The rotatable platform 63 is substantially rectangular in shape and is mounted eccentrically upon the shaft 62. The rotatable platform 63 serves as a base for both a conveyor belt and a pull power shovel, each of which will be presently described.

The pull or drag power shovel comprises a main boom 70 which is pivotally connected to the rotatable platform 63 at a pivot point 71. At the free end of the main boom 70 there is connected a dipper boom 72 at the pivot point 73. Rigidly secured on the lower end of the dipper boom 72 is a suitable bucket 74. If desired, mechanism may be provided in order that the bucket 74 is pivotable upon the end of the dipper boom 72. The bucket illustrated in the drawings is of the dump type and has a door 75 which is closed by suitable latch means 76. A cable 77 leads to the control platform for the power shovel and serves to release latch means 76 in order to open the bucket door 75.

The dipper boom 72 is hydraulically operated by means of a mechanism comprising a hydraulic cylinder 78 which is pivotally mounted at one end 79 to the main boom 70. The hydraulic cylinder 78 houses a piston to which is connected a piston shaft 80 which is pivotally connected by suitable means 81 to the upper end of the upper boom 72. The hydraulic cylinder 78 is actuated by means of hydraulic fluid under pressure introduced through hydraulic lines 82 and 83, which are connected to a suitable hydraulic system located within the body portion 12 of the excavating apparatus.

In order that the main boom 70 may be pivoted in a vertical plane, the upper end of the main boom is connected by means of a cable 84 to a drum 85 which is mounted upon a shaft 86 journalled between spaced uprights 87 fastened to the rotatable platform 63. This structure is depicted in Figure 6. One end of the shaft 86 is connected to a suitable clutch 88 which, in turn, is drivingly connected by a chain drive 89 to a gear 90 which is secured upon the end of a shaft 91 which is journalled within a support 92. The other end of the shaft 91 carries a bevel gear 93 which is enmeshed with a second bevel gear 94 on the end of a drive shaft 95 which is journalled within the platform shaft 62. The lower end of the drive shaft 95 is connected by suitable gearing 96 to a connecting shaft 97, rotatably journalled in a support 98 mounted in the body portion 12 of the excavating apparatus. The connecting shaft 97 extends into a solenoid operated clutch 99 which is actuated through the leads 100 which lead to the control panel of the excavating apparatus. Another drive shaft 101 is drivingly connected to the transmission 20 of the excavating apparatus engine.

The drive shaft 95 also serves to power a belt conveyor 102 which is mounted by means of a suitable frame 103 to the rotatable platform 63. The belt conveyor 102 is mounted on an incline on the rotatable platform 63 so that a lower end 104 of the belt conveyor extends rearwardly of the excavating apparatus 10 and in close proximity to the surface over which the excavating apparatus is travelling. The upper end of the belt conveyor 102 indicated at 105 carries a deflector plate 106 and is positioned over the transverse conveyor belt 44. It is pointed out that both conveyor 102 and the power shovel mechanism described above are rigidly connected to the rotatable platform 63. Furthermore, the belt conveyor 102 is aligned with the power shovel mechanism so that by suitable manipulation of the power shovel controls the bucket 74 may be raised to a position over the lower end 104 of the belt conveyor 102 in order to deposit a load of dirt on the belt conveyor 102.

The belt conveyor 102 is driven by a suitable sprocket (not shown) from which extends a sprocket shaft 107 with a sprocket gear 108 secured on its end. Sprocket gear 108 is drivingly connected by means of the conveyor chain drive 109 to a second sprocket gear 110 which is mounted upon a shaft 111, one end of which extends into a solenoid operated clutch 112. Power is transmitted into the clutch 112 by means of the drive shaft 113 which is geared to the bevel gear 94 mounted upon the end of the drive shaft 95 as has been previously de-

scribed. Leads **114** to control the solenoid clutch **112** extend to the control panel.

The control mechanism for the excavating apparatus **10** is mounted upon a control platform **115** which is secured to the top plate of the vehicle **11** to one side thereof in a manner so as to overhang the caterpillar tread **14**. The controls comprise a bulldozer control position **116** and a power shovel control position **117**. While the controls may be consolidated into a set of controls operated by a single individual, it is preferable that two control positions, as described, be employed with this excavating apparatus. The controls for both the bulldozer and the power shovel are conventional in nature and need not be described in detail. The controls for both conveyor belts are preferably consolidated with the power shovel control position **117**.

Because of the combined functions of the excavating apparatus, it is capable of being employed in several different ways. The excavating apparatus may be used solely as a bulldozer or solely as a power shovel with combined loading equipment. In a scraping or leveling operation, the bulldozer may be lowered and angled so that the forward motion of the apparatus results in dirt being scraped and pushed to one side due to the angled position of the bulldozer blade. The rotatable platform carrying the power shovel is then rotated to the position whereby the bucket is able to engage the pile of dirt pushed aside by the bulldozer blade. By suitable manipulation of the power shovel controls, the power shovel will load the dirt upon the lower end of the belt conveyor, which dirt will be subsequently conveyed to the transverse conveyor and then deposited into a truck or the like which is positioned underneath the overhanging end of the transverse conveyor.

When the excavating apparatus is used in a purely excavating function, such as digging a hole, the excavated dirt is then similarly deposited upon the lower end of the belt conveyor and conveyed to trucks or any other form of conveyance which may be positioned underneath the overhanging end of the transverse belt conveyor. When employing a power shovel of the pull or drag type, it can be seen that the earth is deposited upon the conveyor belt for loading without any unnecessary pivoting action of the power shovel mechanism. As pointed out above, this is due to the construction which positions the conveyor belt loader in alignment with the dipper boom of the power shovel.

It is pointed out that various forms of shovel equipment may be mounted upon the shovel rotatable platform to cooperate with the belt conveyor loader. If desired, conventional power shovel mechanism may be employed. For other specialized operations a drag line type shovel or a shovel employing a clam shell bucket may be employed to remove the earth and to deposit it upon the lower end of the belt conveyor. Regardless of which particular type of power shovel is employed, the method of operation of this excavating apparatus is in all instances similar.

It, therefore, can be seen that this invention provides a novel form of excavating apparatus which embodies many advantages. By combining the functions of scraping, digging dirt and loading the dirt into a single piece of equipment, savings in both time and manpower may be obtained. Suitable electrical equipment and circuits are mounted within the body portion **12** of the excavating apparatus in order to operate the various hydraulic pumps and to operate the solenoid clutches. Conventional circuits usually used in the hydraulic and electrical controls may be employed in this excavating apparatus.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. In combination, a self-propelled vehicle, a bulldozer blade mounted on one end thereof, a pull power shovel mounted on said vehicle on the other end thereof, and belt conveyor means on said vehicle cooperating with said power shovel.

2. In combination, a self-propelled vehicle, a bulldozer blade mounted on one end thereof, a rotatable platform carried upon the other end of said vehicle, loading means mounted upon said platform, and pull power shovel means mounted upon said platform to unload upon said loading means.

3. In combination, a self-propelled vehicle, a bulldozer blade mounted on one end thereof, a belt conveyor mounted substantially transversely on said vehicle, a rotatable platform upon said vehicle, second belt conveyor means mounted upon said rotatable platform and adapted to unload on said first belt conveyor, and pull power shovel means upon said platform for unloading its contents upon said second belt conveyor means.

4. In combination, a self-propelled vehicle, a bulldozer blade mounted on one end thereof, belt conveyor means mounted substantially transversely on said vehicle, second belt conveyor means mounted substantially longitudinally upon said vehicle and having one end thereof positioned above said first belt for unloading upon the same, and pull power shovel means on the other end of said vehicle adapted to load on the other end of said second belt means.

5. In combination, a vehicle, engine means to propel said vehicle, a bulldozer blade mounted on one end thereof, means for independently operating said blade, belt conveyor means mounted substantially transversely on said vehicle, second belt conveyor means mounted substantially longitudinally upon said vehicle and having one end thereof positioned above said first belt to unload on said first belt, a pair of rotatable platforms on said vehicle with each carrying one of said conveyor belts, pull power shovel means mounted on the other end of said vehicle to load on the other end of said second belt, and means for selectively transmitting power from said engine to each of said rotatable platforms, belt conveyors and power shovel.

6. In combination, a self-propelled vehicle, a bulldozer blade mounted on one end thereof, a first platform mounted rotatably on said vehicle, first belt conveyor means carried on said first platform and normally extending substantially transversely of said vehicle, a second platform rotatably mounted on said vehicle, second belt conveyor means carried on said second platform and normally extending substantially longitudinally of said vehicle, and pull power shovel means on said second platform for loading on the lower end of said second belt conveyor.

7. An excavating apparatus comprising a self-propelled vehicle, a bulldozer blade mounted on one end thereof, belt conveyor means mounted substantially transversely on said vehicle, a rotatable platform carried on said vehicle, second belt conveyor means mounted on said rotatable platform and having one end extending beyond said vehicle and pull power shovel means mounted upon said rotatable platform for loading on said extended belt end.

8. An excavating apparatus comprising a vehicle, engine means to propel said vehicle, a bulldozer blade mounted on one end thereof, means for operating said blade, belt conveyor means mounted substantially transversely upon said vehicle, second belt conveyor means mounted substantially longitudinally upon said vehicle and having one end thereof positioned above said first belt and the other end extending beyond said vehicle, a pair of rotatable platforms on said vehicle with each carrying one of said belt conveyors, pull power shovel means on the other end of said vehicle to load on said other end of said second belt, and means for selectively transmitting power from

said engine to each of said rotatable platforms and power shovel means, said bulldozer blade being operated independently of said power shovel means.

9. An excavating apparatus comprising a self-propelled vehicle, a bulldozer blade mounted on one end thereof, a first platform rotatably mounted on said vehicle, first belt conveyor means carried on said first platform and normally extending substantially transversely of said vehicle, a second platform rotatably carried on said vehicle, second belt conveyor means mounted inclinedly on said second platform, the upper end of said second belt conveyor means positioned over said first belt conveyor means and its lower end extending beyond said vehicle, and pull power shovel means mounted on said second platform and adapted to load on the lower end of said second belt conveyor means.

10. An excavating apparatus comprising endless tracks on a vehicle, an engine to drive said endless tracks, a bulldozer blade mounted on one end of said vehicle, a first platform rotatably mounted on said vehicle, first belt conveyor means carried on said first platform and normally extending substantially transversely of said vehicle, a second platform rotatably mounted on said vehicle, second belt conveyor means mounted inclinedly on said second platform, the upper end of said second belt conveyor means being positioned over said first belt conveyor means and having its lower end extending beyond said vehicle, pull power shovel means mounted on said second platform and adapted to load on the lower end of said second belt, and control means positioned laterally on said vehicle.

11. In an excavating apparatus, a rotatable platform, belt conveyor means mounted on said platform, frame means secured to said platform straddling said belt conveyor means, and pull power shovel means mounted on said frame means and aligned with said belt means for loading on one end thereof

12. In a self-propelled vehicle, a platform rotatably mounted thereon, an inclined belt conveyor mounted on said platform and having each end thereof extending outwardly of said platform, pull power shovel means mounted on said platform and aligned with said belt means, said pull power shovel means being adapted to load onto the extended lower end of said belt means.

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