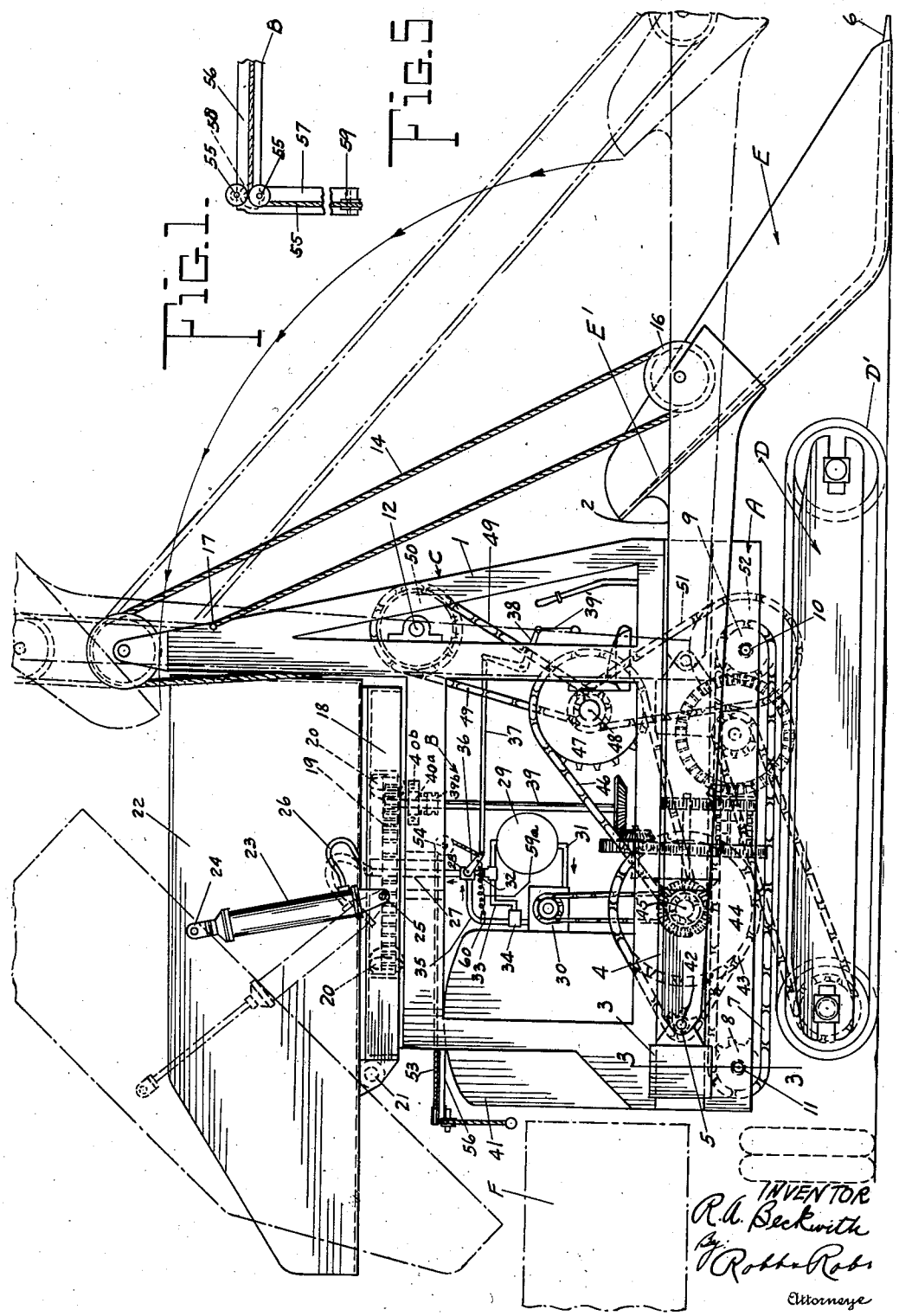
April 25, 1944. R. A. BECKWITH 2,347,455

EXCAVATING AND TRUCK LOADING MACHINE

Filed Feb. 1, 1943 3 Sheets-Sheet 1



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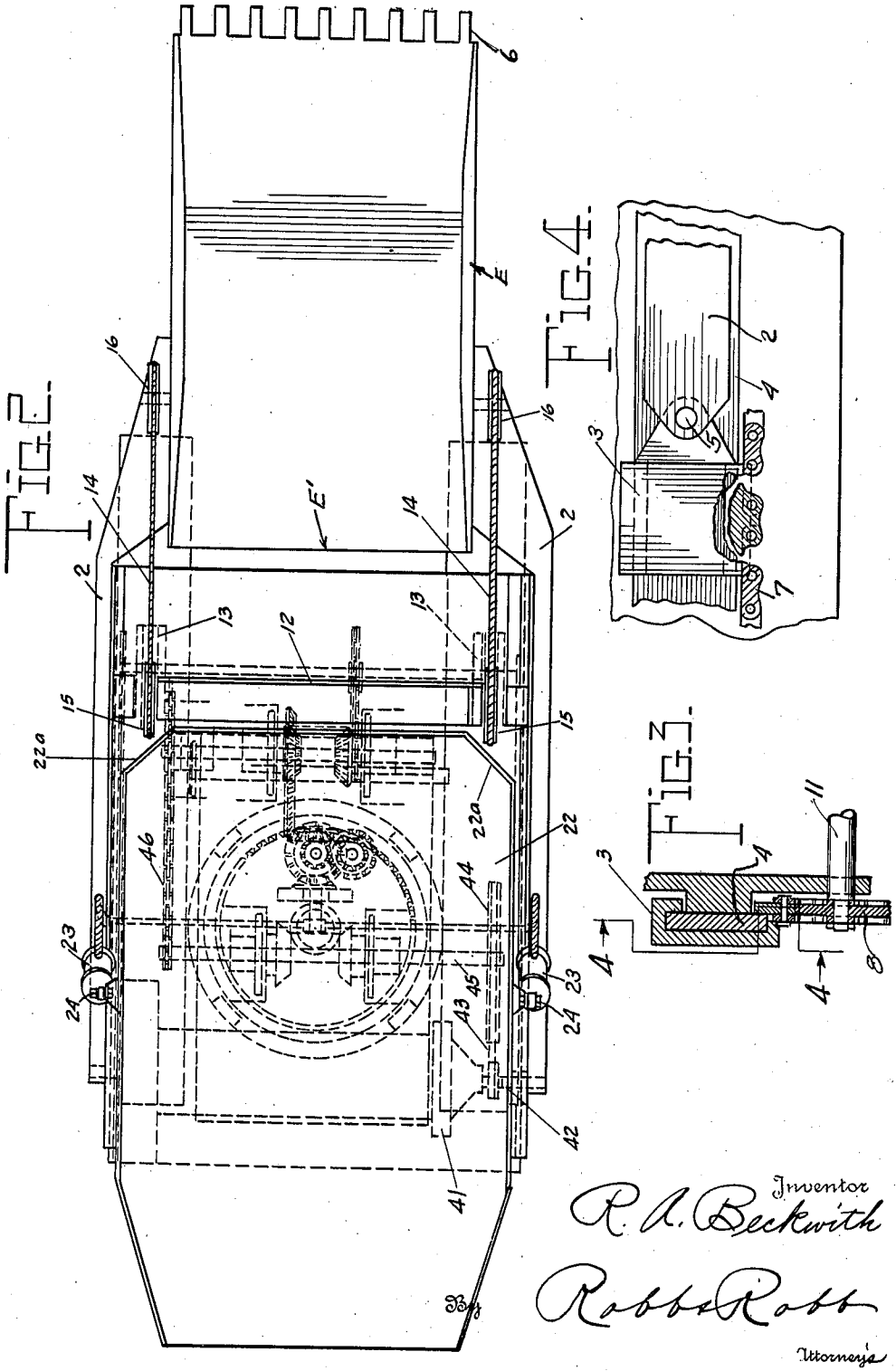

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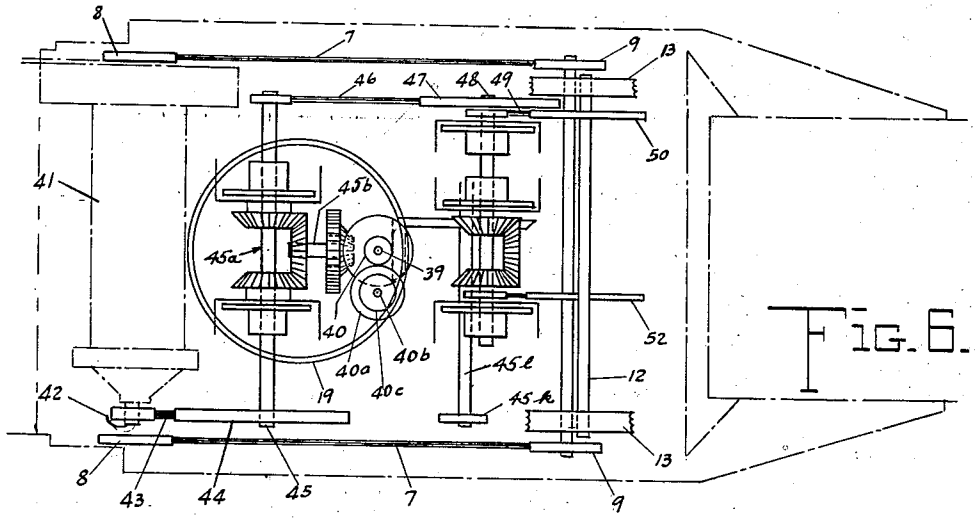

Fig. 6.

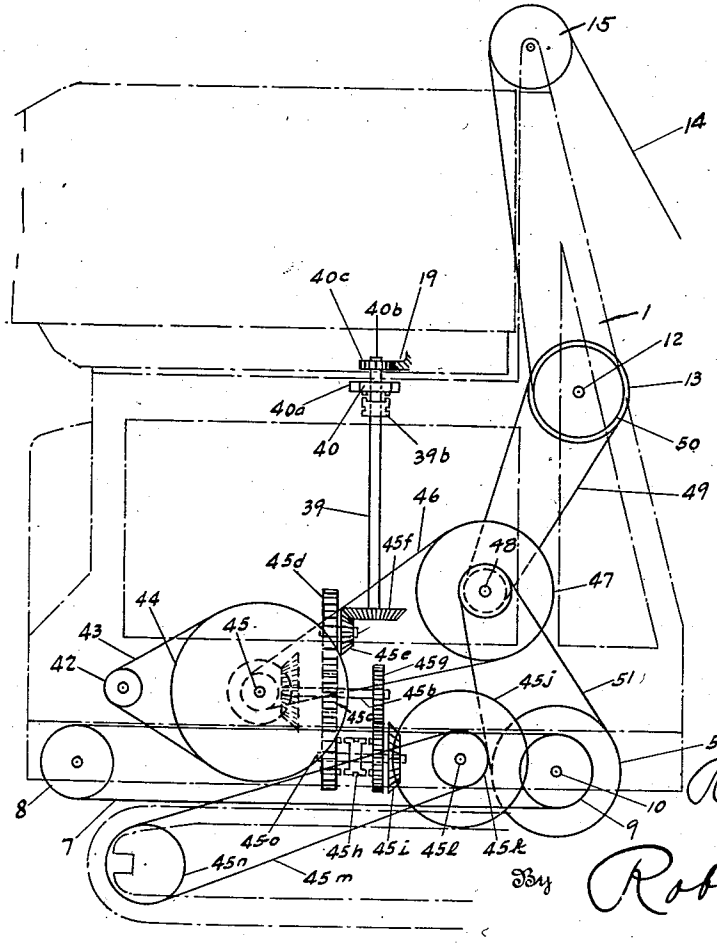

Fig. 7.

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EXCAVATING AND TRUCK LOADING MACHINE

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Application February 1, 1943, Serial No. 474,334

6 Claims. (Cl. 214—78)

The purpose of this invention has been to devise a special type of excavating and loading machine utilizing the principle of digging or excavating incident to the employment of commonly known power shovels, but capable of loading the excavated materials into a reservoir bin or body, which, when filled with a sufficient quantity of the materials, may be dumped in one operation to fill a truck or other vehicle brought alongside the machine for carrying off the dirt or excavated material to a place of use, such as a fill, or the like.

As is well known in the operation of ordinary shovel excavators of the dipper type for loading dirt carrying-off trucks or vehicles, it is required that the truck remain alongside the excavator until the dipper of the latter has been operated a number of times to dig into and deliver to the truck a number of dipper loads for filling the latter.

When the truck is filled, the dipper may be idle for a short period, while the truck is driven away, and a second truck is brought into position to receive the material to be excavated by the dipper. The foregoing mode of operation obviously creates time losses that reduce the operating efficiency of both the excavating machine and the truck vehicles that cooperate with the latter, in the manner stated.

By the improvements of the present invention availing of the dipper to crowd into and thus excavate and elevate the earth materials, along with a reservoir or storage bin, it will be apparent that the excavating dipper may operate practically continuously in loading the bin carried by the excavator itself, and means are availed of for tilting or dumping the bin very quickly into a truck brought alongside of the machine or positioned at the rear thereof, so that practically the only lag in the digging operation of the machine is when the storage bin is filled enough to deliver its contents in one batch sufficiently to fill the truck. Indeed, under certain conditions of operation of the machine, the dumping of the storage bin may be performed so quickly, while the excavating shovel or dipper is working with its excavating function, that the above mentioned lag may be almost reduced as to the time factor as to be practically negligible.

Another feature of the improvements of the invention comprises means for mounting of the storage bin and for effecting the dumping action thereof, such that the said bin may direct its contents into a truck disposed at either of the sides of the excavating machine, or in the rear thereof.

It is contemplated that the storage bin, furthermore, may be of sufficient size that it may contain enough excavated materials to be loaded into more than one truck, so that if the trucks are moved up to the excavator fast enough, they can be loaded with great frequency, and the excavator shovel or dipper kept working practically continuuously in replenishing the materials in the storage bin.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of an excavating and truck loading machine, embodying the general principles of construction and operation of the invention.

Figure 2 is a top plan view thereof.

Figure 3 is a vertical sectional view taken about on the line 3—3 of Figure 1.

Figure 4 is a fragmentary sectional view taken about on the line 4—4 of Figure 3, looking in the direction of the arrows.

Figure 5 is a fragmentary top plan view of certain control means.

Figures 6 and 7 are diagrammatic views of the various drives whereby the various instrumentalities comprising the machine are operated.

Describing my machine specifically, and referring particularly to Figure 1 of the drawings, said machine comprises a body, including a base frame A and superstructure B having at one end and supported upon the base A, and A-frame generally designated C, and composed of spaced sides 1.

The body of the machine is supported upon any conventional type of crawlers, generally designated D, providing the necessary traction and moving support for the machine.

Carried by the base A of the body are spaced dipper sticks or arms 2, one at each side of the base A, both mounted to be simultaneously moved forwardly and rearwardly by means of slide members 3 mounted on guides 4 at opposite sides of the base A. The slide members 3 may be of channel formation in cross section, as seen in Figure 3, and have pivotal connections at their front ends, as shown at 5, with the dipper sticks or arms 2, so that as the latter are moved forwardly carrying with them the excavating dipper and loading skip E, the forward edge of the dipper E will perform a digging function upon the earth in its excavating action, said forward edge being equipped with digging teeth 6, or a

solid blade digging member, as desired, within the purview of the invention.

The dipper E is rigid with the arms 2, the connection between the parts being effected by welding or any suitable fastening means desired.

For moving the dipper arms 2 forwardly and rearwardly, there are provided at opposite sides of the base A, sprocket chains 7 passing about rear sprockets 8, and front sprockets 9, the front sprockets 9 being carried on front sprocket shafts 10 and the rear sprockets 8 upon rear sprocket shafts 11.

Suitable mechanism to be later described is availed of for reversibly actuating the sprocket chains 7, and the said sprocket chains are connected at their upper laps to the lower portions of the actuating members or slides 3 so that back and forth movements of the upper laps of the chains 7 will impart corresponding back and forth movements to the dipper E, a forward movement, usually known as crowding or digging in the art of excavating machines, and a rearward or retractive movement often referred to as a racking-in movement in respect to ordinary dipper excavators.

The dipper E, for performing its loading function, is intended to be raised and lowered, raised in order to be elevated a sufficient distance such that the rear end of the dipper designated E' and which is open, may form a chute for enabling the discharge of materials loaded into the dipper, rearwardly therefrom into a suitable storage bin to be later described.

It will thus be seen that the dipper E partakes of a function of a loading skip, as known in the art of concrete mixing machines for instance, wherein aggregate materials are emplaced in a skip when disposed on the ground level and the latter is raised so as to discharge its contents from the end opposite the receiving end into a suitable receptacle, such as a mixing drum.

For the elevating of the excavating dipper E, I provide any suitable means, that illustrated including a drum shaft 12 mounted on the sides 1 of the A-frame C, at a point opposite approximately the uppermost portion of the superstructure B of the machine body. The drum shaft 12 carries cable drums 13 near its opposite ends, about which drums cables 14 are adapted to wind, said cables passing from the drums 13 upwardly over sheaves 15 at the top of the side members 1 of the said A-frame. From the sheaves 15, the cables 14 pass downwardly around sheaves 16 disposed in recesses in the front ends of the arms 2, and thence upwardly to dead-ending members 17 located near the upper portions of the A-frame side members 1.

Suitable operating mechanism to be hereinafter described is employed for turning the shaft 12 carrying said drums 13.

On top of the superstructure B of the body of the machine, I provide a turntable 18 equipped on its underside with a ring gear 19, somewhat after the manner of construction of certain types of turntables used on excavating cranes. The turntable 18 is supported by rollers 20 adapted to roll upon a suitable ring plate or track on top of the superstructure B. Carried by the turntable 18 and pivotally attached thereto at 21 is the storage or reservoir bin 22 designed to receive and hold a quantity of excavated materials, at least sufficient to completely fill an ordinary dirt hauling truck, by which the materials will be carried out to a place of deposit, after excavation by my machine. If desired, the bin 22 may be large enough to carry a quantity of materials to fill one or more trucks, within the purview of my invention.

The bin 22 has angular rear corners, as shown at 22a, see Figure 2, and is closed at its inner end, pivoted near its outer end, and open at its outer end, so that materials may be discharged from or through the open end of the bin when the latter is tilted upon its pivots 21 into the dotted line position generally illustrated in Figure 1 of the drawings.

For the purpose of tilting or dumping the bin 22, hydraulic jacks or any mechanical moving instrumentalities may be employed. Hydraulic jacks 23 are shown as used preferably being pivotally connected at their upper ends at 24 to the side portions of the bin inwardly of the pivots 21, and being pivotally connected at their lower ends at 25 to the turntable 18, which supports the bin and with which the bin moves rotatably when the turntable itself is rotated.

For supplying a pressure fluid to the lower ends of the hydraulic jacks 23, flexible conduits 26 may be used, leading to a conduit or pipe 27, in the lower portion of which is located a control valve 28 of any suitable rotary type. Pressure fluid is supplied to the conduit or pipe 27, and thereby to the conduits 26 from a pressure tank or reservoir 29, which in turn is supplied with the pressure fluid by means of a pump 30. The pump 30 is connected to the tank 29 by the pipe 31, and the tank 29 connected to the control valve casing 28 by the pipe 32 leading from a branch pipe 33 that extends from the tank 29 to a relief valve 34, the casing of which in turn is connected to the control valve 28 by a pipe 35.

An operating lever 36 is connected by a link 37 to an actuating lever 38 having a handle 39 at the operator's station, or seat, provided on the machine body. By pulling or pushing the handle 39', the operator of the machine may at will cause the pressure fluid or medium to pass from the tank 29 to the hydraulic jacks 23, and thereby effect dumping action of the bin 22; also, manipulation of said handle 39' may be resorted to to cut off supply of the pressure fluid or medium to the jacks 23 and then the bin 22 will gravitate to its normal horizontal position, from its inclined dumping position shown in dotted lines in Figure 1. Obviously, the jacks 23 may be hydraulic or air jacks dependent upon the kind of pressure fluid desired to be used.

As seen in Figure 1, in dotted lines, a portion of the load receiving truck is designated F and located at the rear end of the machine. When the bin is in the full line position of Figure 1, it may be dumped into the truck F thus located. If, however, the terrain is such or the facilities for disposing the trucks to be loaded by the machine so require, the trucks may be driven up to the machine at either side thereof, under which conditions, the bin 22 may be turned within a ninety degree angle sidewise of the machine, so that it will dump into side located trucks instead of rear located trucks. For this purpose, there is employed a vertical swing shaft 39 mounted in the superstructure or body of the machine. This swing shaft carries at its upper end, above a jaw clutch 39b, an intermediate swing pinion 40, meshing with a second swing pinion 40a, which in turn is connected by a shaft 40b to a swing pinion 40c, meshing with the ring gear 19. This and other of the drive gearing will be explained more fully hereinafter in reference to Figures 6 and 7.

The operating mechanism for the swing shaft 39 by which the turntable 18 is rotated with the bin 22, will be described hereinafter.

Near the rear end of the body of the machine, or at the rear of the superstructure B, is mounted a suitable power plant or engine 41, comprising a drive shaft 42 connected by a sprocket chain 43, with a large sprocket gear 44 upon a drive shaft 45, extending crosswise of the machine. In this manner, the shaft 45 may be operated from the engine and said shaft carries at the end opposite that having the sprocket 44 a sprocket gear connected by a chain 46 with a relatively large sprocket gear 47 on a countershaft 48. In turn, the countershaft 48 has a small sprocket connected by a chain 49 with a sprocket gear 50 on the drum shaft 12, whereby through the various sprocket chains just described, power may be carried to the shaft 12 for driving the same in one direction, namely, for the winding action of the drums 13 for elevating the dipper E. Said dipper is adapted to be returned from its elevating position by gravitation, facilitated, if desired, by the simultaneous retraction of the arms 2, to the lowered position under the control of suitable brake means, conventional in the art.

Suitable clutch means may be employed on the shaft 48 to carry the drive from said shaft 48 to the drums 13. The shaft 48 is connected by a sprocket chain 51 to a sprocket gear 52 on the shaft 10, which is connected with the sprocket chains 7 that move the dipper arms 2 back and forth in their excavating and retracting operations.

The means for driving the crawler chains D' of the crawlers D will next be described.

The diagrammatic showing of the various gear trains and driving means represented by Figures 6 and 7 are referred to in order to set forth the manner in which the drives form the engine to the hopper body and to the endless traction means are accomplished.

In Figure 6, drive shaft 45 is provided with a well known type of reversing gear train 45*a*, the said gear train being provided with friction clutches adapted to be operated in any well known manner. It will be noted that this drive shaft 45 is the same shaft which provides power for the raising and lowering of the dipper E as well as the thrust and retraction thereof.

However, describing more particularly the means for rotating the hopper body, it will be noted that the gear train 45*a* is adapted to operate a shaft 45*b* on which a pinion 45*c* engages a gear 45*d* to operate a bevel gear 45*e* and thereby effect rotation of the shaft 39 through a second bevel gear 45*f*. The shaft 39 is provided adjacent its upper end, as previously mentioned, with a jaw clutch 39*b* adapted to selectively engage a mating member on a gear 40, the said gear 40 in turn meshing with a second gear 40*a* on a shaft 40*b*, the shaft carrying adjacent its upper end a gear 40*c* adapted to engage the ring gear 19, whereby the hopper body is rotated.

Passing now to the means for driving the endless traction supporting means, it will be noted that the same gear train 45*a* is availed of, whereby the shaft 45*b* is adapted to rotate a gear 45*g* engaging one of a pair of gears on a shaft 45*o*. as determined by movement of a jaw clutch member 45*h*, in order to provide high and low speed drive to the traction supporting means. The shaft 45*o* is provided at one end with a beveled gear 45*i* adapted to mesh with a large bevel gear 45*j* whereby a sprocket 45*k* may impart movement through the sprocket chain 45*m* to additional sprockets 45*n* connected in well known manner with the traction supporting means. The gears 45*j* and 45*k* are mounted on a cross shaft 45—1, so as to effect a drive to both of the traction supporting means in accordance with well known practise.

The shaft 45—1 may be provided with brake and clutch mechanism for steering, such as is shown in the Brey Patent No. 1,947,823, issued February 20, 1934. This mechanism is not illustrated, since it is well known and suitable for incorporation into this machine by those skilled in the art.

General operation of machine

It is contemplated that the machine of my invention shall be advanced under power and steered by the operation of any suitable mechanism, an exemplification of which has been presented hereinbefore.

The power used will be that of an engine or motor carried by the base A of the body of the machine, and indicated at 41, as before described.

When the machine is at the point of excavation, the dipper or scoop E will be operated forwardly in engagement with the earth at the ground level or in advance of the machine, or in engagement with the face of a bank which is to be dug out.

The operator, by actuation of suitable control levers, will cause actuation of the chains 7 to move the arms 2 forwardly, and at the same time, the operator may effect the desired upward or elevating movement of the skip E through the operation of the cable drums 13. In this manner, the dipper E will be crowded to its work and elevated, and when a sufficient load has been received therein, the raising movement of the dipper will be compelled sufficiently to carry it to an approximately vertical position so that its load will be discharged through its rear open end E' into the bin 22 which bin may be disposed longitudinally of the machine laterally or intermediate positions dependent upon the locations where the truck or trucks to receive the loads of material in the bins are to be disposed.

Obviously, owing to the large capacity of the bin 22, the excavating dipper E may be kept working filling up the bin 22 and creating therein a sufficiently large load of materials so that when a truck is located adjacent to the bin to receive the materials, said bin may be tilted to its dumping position to discharge its contents into the truck sufficiently to completely load the latter in one operation of bin dumping.

Thereupon, after the bin 22 has been dumped, it will be restored to its load receiving position. Having in view the foregoing, it will be clear that the dipper E may be kept practically continuously in operation. The only time the dipper can not discharge its contents into the bin is when the latter is in dumping position, but since this last mentioned position is assumed only momentarily, there will be practically little or no interruption of digging and loading operations of the dipper or shovel E.

The foregoing method of operation is especially advantageous for reasons previously suggested in that the machine can keep supplying trucks with full loads by single dumping operations of the bin 22, and the operation of the dipper E does not have to be discontinued to any material extent so far as its excavating and dumping functions are concerned by reason of

the absence of the truck or trucks from the site adjacent to the machine, while the trucks are traveling up to the machine and traveling away from same.

If the capacity of the bin **22** is sufficiently large to supply more than one truck by consecutive single dumping operations, the said dumping operations will not materially interfere with the continuation of the excavating and elevating actions of the dipper E and the carrying-off operations of the trucks will be facilitated, accordingly.

In addition to the dumping control handle **39** adjacent the operator's station, there may be provided control means susceptible of being operated from the rear of the machine by the truck driver or other person stationed there.

This means comprises a cable or other flexible member **53** suitably fastened at the outer end of the valve lever **36** and extending upwardly so as to be reeved over a pulley **54** and thence rearwardly between pulleys **55**, see Figure 5, supported on an arm **56** fastened to the superstructure B. A second arm **57** is pivotally attached at **58** so as to swing in a horizontal plane to either side of the machine, or longitudinally thereof. The arm **57** carries at its outer end a pulley **59** over which the cable **53** passes, and from which it depends so as to be readily grasped by a truck driver, whereby a pull on the cable will actuate the valve **28** and cause the bin **22** to be tilted. In order to facilitate the return of the valve lever **36** to its normal inactive position, as shown in Figure 1, in full lines, a spring **59***a* is provided, attached at one end to the said lever and at the other at any suitable place such as the clamp member **60** on the pipe **35**.

The bin and excavating instrumentalities are so constructed as to enable their attachment to some known forms of crawler shovels in a manner apparent to those skilled in the art of dirt hauling and excavating machinery.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a machine of the class described, in combination, a portable support, a body thereon, means for propelling the same, an excavating dipper carried by the supporting means for operating said dipper to crowd the same to its work in excavating, means for elevating said dipper to discharge the contents thereof, a truck loading bin carried by the body of the machine, and means rotatably and tiltably mounting said bin on the body for discharging when tilted in a direction at angles to the direction of movement of the dipper in performing its excavating work.

2. A machine as claimed in claim 1, comprising an operator's station, and manual means at said operator's station for operating the bin to discharge the same, for rotating the bin to dischage the same in different directions and for operating the dipper.

3. In an excavating and loading machine of the class described, in combination, a portable support, a body mounted thereon, an excavating dipper mounted on the body, operating means for effecting excavating action of the dipper, means for elevating the dipper to discharge its contents, a bin carried by the body and arranged to receive the contents of the dipper when discharged, means for rotating the bin to assume different discharging positions, and means for effecting dumping action of the bin to discharge materials received therein from the dipper.

4. A machine as claimed in claim 3, in which the means for rotating the bin comprises a turntable mounted upon the body and mechanism for rotating the turntable to shift the bin to different positions for discharge thereof in different directions.

5. In an excavating and loading machine of the class described, in combination, a portable support, means for propelling the same, an excavating dipper carried by said support, comprising a front excavating portion and an open rear discharge portion, means for elevating the dipper to a discharge position wherein its rear discharge portion is effective for discharging, a bin carried by said portable support to receive materials discharged from the excavating dipper, means for turning the bin in to different positions longitudinally and angularly in relation to the portable support, and means for causing dumping action of the bin in any of its adjusted positions.

6. A machine as claimed in claim 5, wherein the turning means for the bin comprises a turntable rotatively mounted upon the support, and mechanism for driving the turntable in a rotative manner to cause the bin to assume different positions for dumping.

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