Jan. 2, 1945. R. A. BECKWITH 2,366,480

DIPPER SHOVEL LOADER

Filed July 15, 1943 5 Sheets-Sheet 1

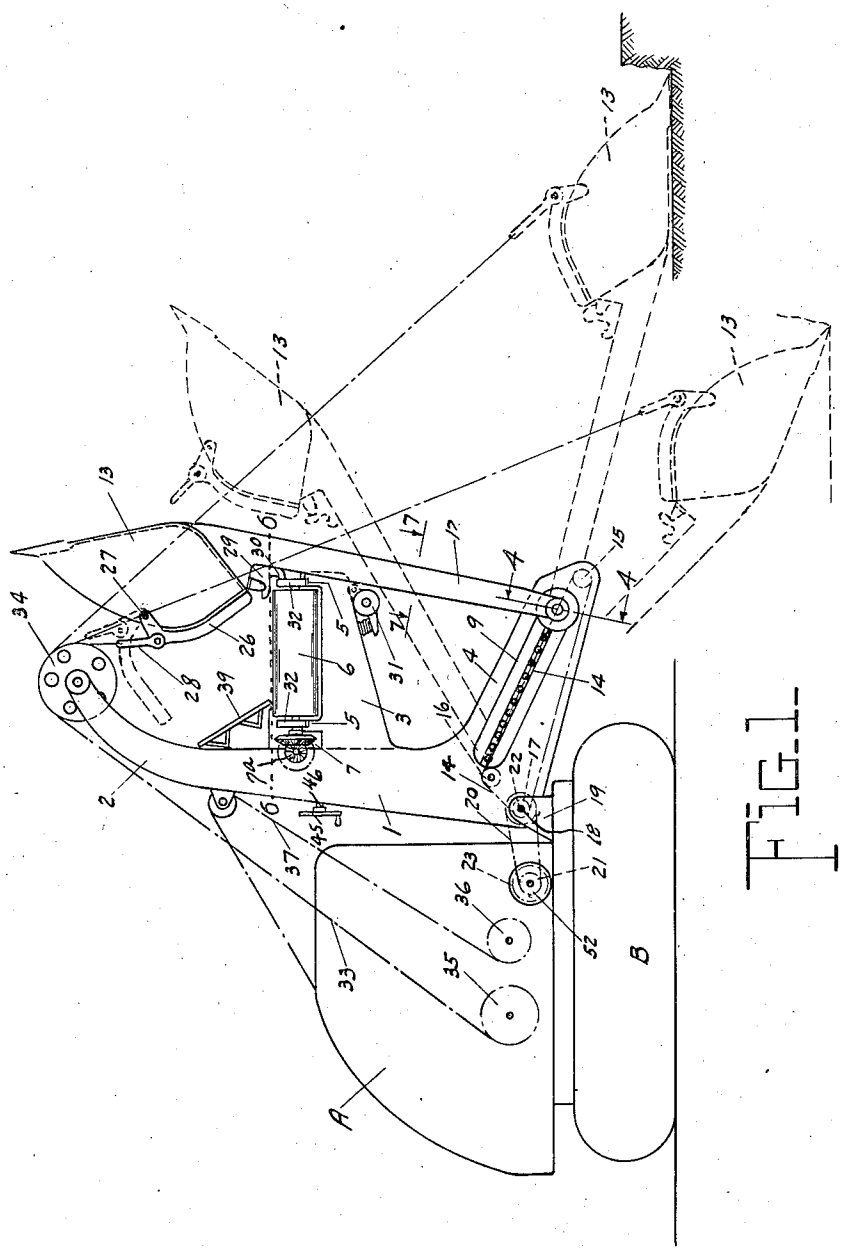


FIG. 1

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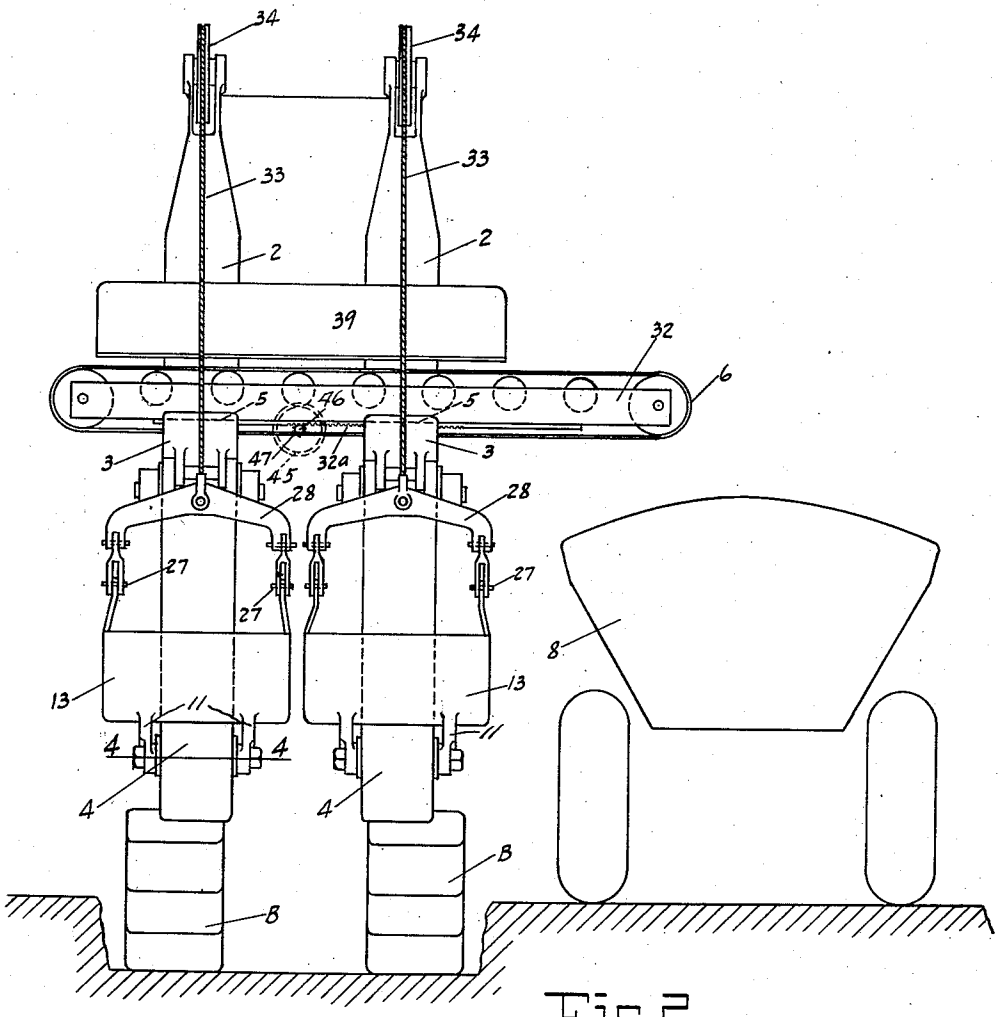


Fig. 2.

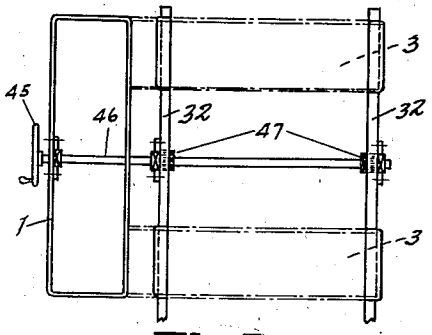


Fig. 6.

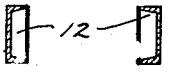


Fig. 7.

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DIPPER SHOVEL LOADER

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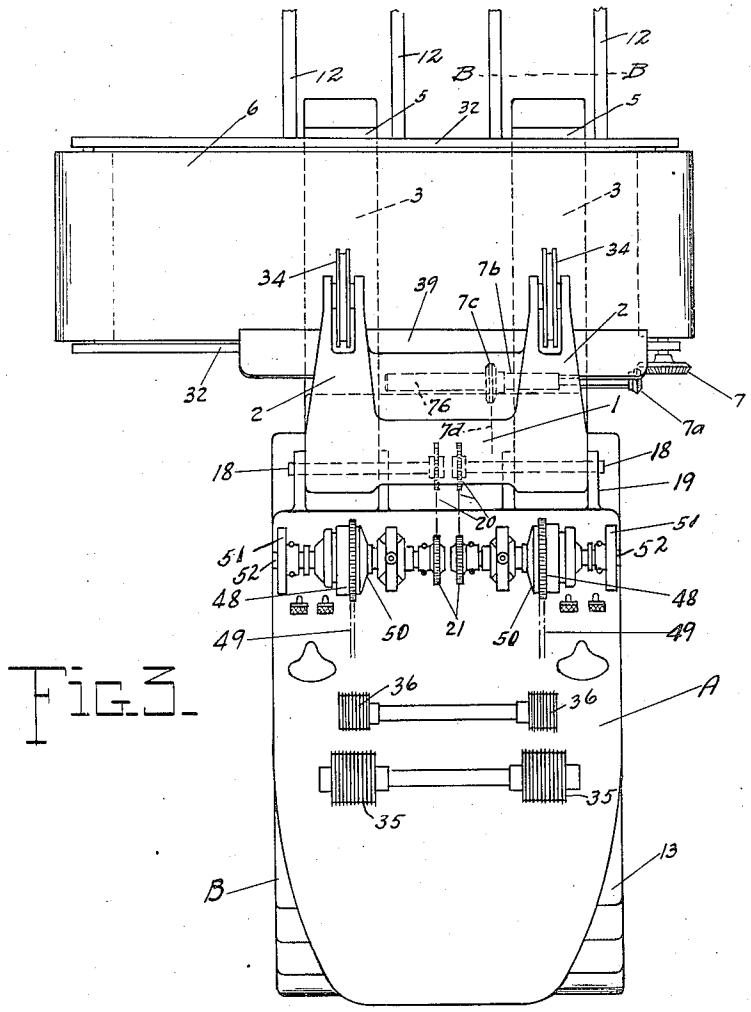


Fig. 3.

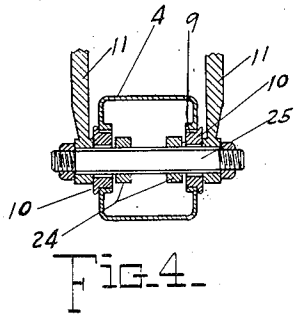


Fig. 4.

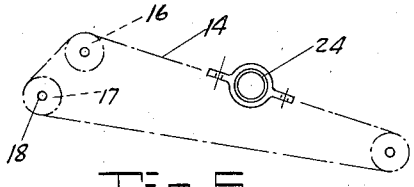


Fig. 5.

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DIPPER SHOVEL LOADER

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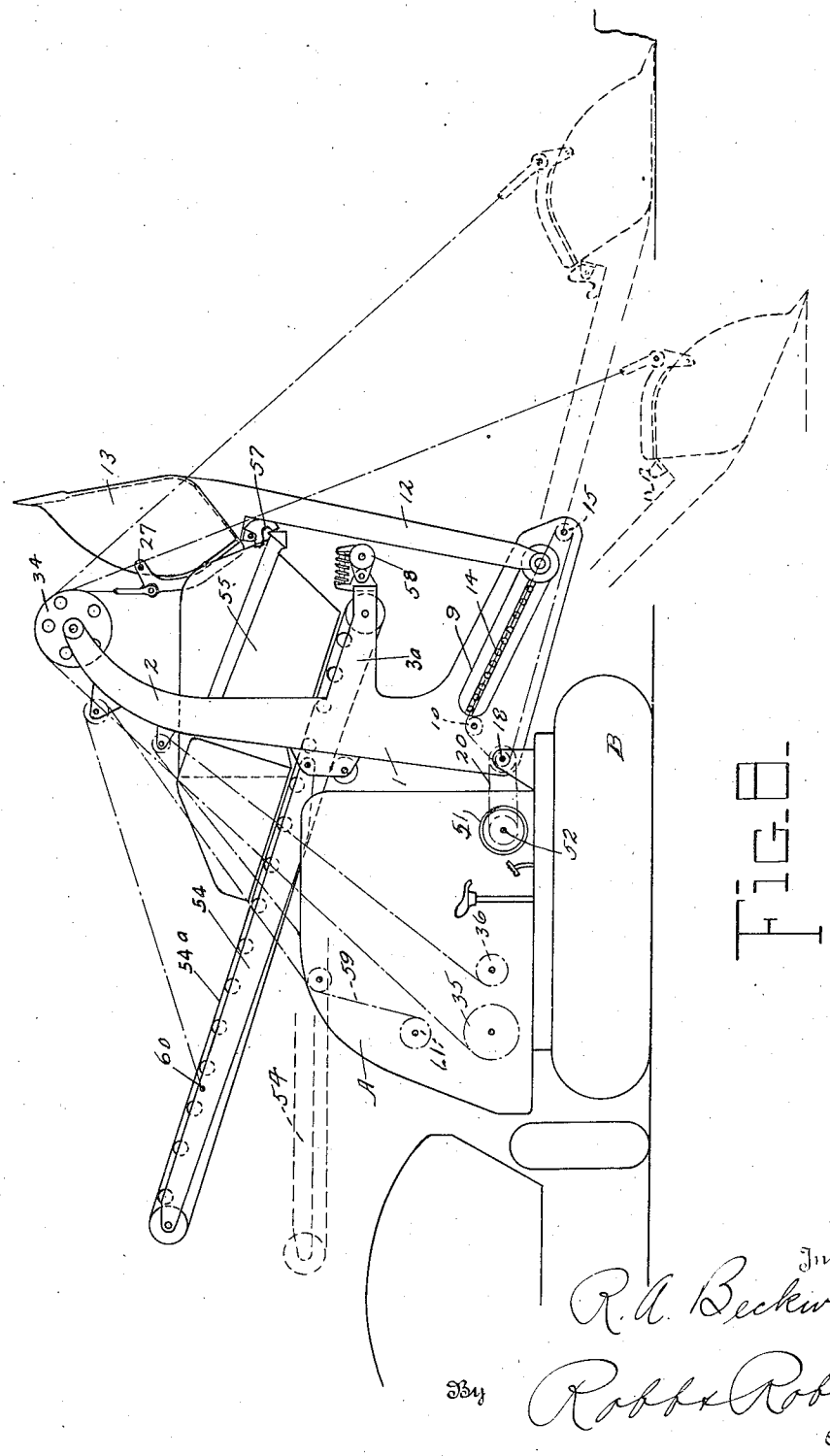


FIG. 1

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DIPPER SHOVEL LOADER

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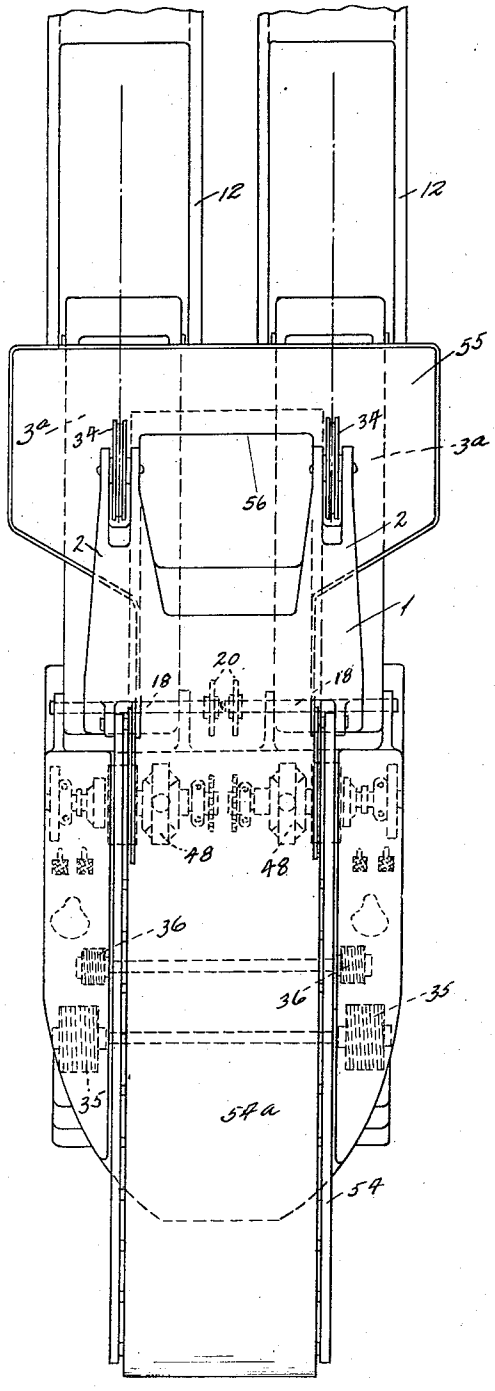


Fig. 9.

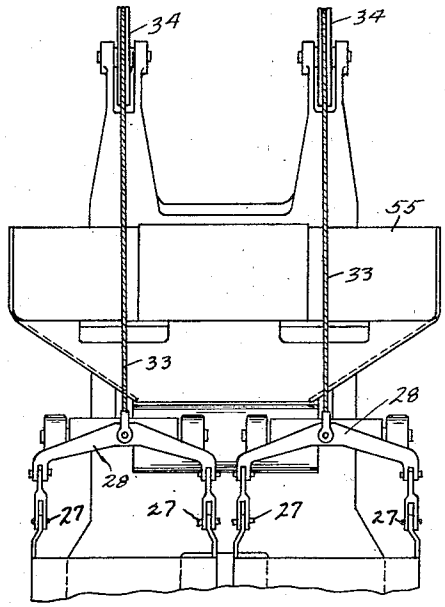


Fig. 10.

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UNITED STATES PATENT OFFICE

2,366,480

DIPPER SHOVEL LOADER

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Application July 15, 1943, Serial No. 494,813

9 Claims. (Cl. 214—91)

The purpose of this invention has been to devise a novel form of shovel dirt loading machine with a special view to obtaining highly efficient and fast operations of excavating and loading.

The common machines and method employed heretofore very largely in respect to utilizing shovel type machines for loading dirt from a place of excavation into a vehicle or onto a soil bank or the like involve the employment of what is ordinarily known as a power dipper shovel. These shovels comprise a traction base, a revolving body mounted upon the base, an offstanding boom carried by the body, and a dipper shovel carried by a dipper stick or handle. In the use of such shovel excavating machine the dipper is ordinarily lowered to the excavating position by pivotal movement on its supporting boom, thereupon thrust into the earth to load the same, thereafter elevated from the excavation, and swung by rotation of the shovel crane body to bring the boom and dipper to a lateral position whereupon the bottom door of the dipper is opened to drop the excavated materials into a truck or vehicle to carry them off or to drop said materials onto a soil bank, so to speak, dependent upon the condition of excavation.

Now in the use of the ordinary dipper shovel in the manner above described, a very considerable portion of the time of the excavating and dumping operations of the dipper is involved in the non-excavating functions thereof incident to the elevation, swinging laterally, spotting the load for dumping, and dumping or discharging the dipper finally.

It has therefore been a primary object of the present invention to avail of a dipper type excavating crane or shovel in which the operation of swinging the dipper to spot the same for discharging the excavated materials is eliminated. In order to increase the efficiency of the machine, moreover, I contemplate using a plural number of dippers, each adapted to be lowered, thrust into the material to be excavated, and elevated to a position wherein the dipper load will be automatically deposited upon a carry-off conveyor. In this manner I avoid the necessity for swinging the body of the crane and by reason of the fact that I employ a plural number of dippers, a substantially continuous excavating operation may be performed in that while one dipper is being actuated to excavate the materials, the other dipper, previously filled, may be elevated to the discharge point. In this way the dippers need be worked up and down only and one of the dippers may practically always be occupied with its excavating function during the time the other dipper is being discharged, and vice versa.

The machine of the present invention embodies the features last referred to above in a simple type practically ccontinuous excavating and loading dipper shovel machine.

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

Figure 1 is a side elevation of a shovel crane embodying the principles of construction of the invention.

Figure 2 is an end view of the machine, looking in the direction of the dipper supporting boom end of the machine, the traction features and body being omitted.

Figure 3 is a top plan view, the dipper sticks and dippers omitted.

Figure 4 is a detail view taken about on the line 4—4 of Figure 1.

Figure 5 is an diagrammatic view showing the drive chain means for crowding out and for withdrawing the pivotal axis of each dipper stick, which axis is carried by the supporting boom.

Figure 6 is a sectional view, partly dotted, about on line 6—6 of Figure 1.

Figure 7 is a sectional view on the line 7—7 of Figure 3.

Figures 8, 9, and 10 show, respectively, side, top plan, and fragmentary front end views of a modified form of the machine.

In the preferred type of my machine as illustrated in the accompanying drawings, A denotes the body of the machine which comprises the usual cab or housing enclosing the operating machinery and power plant which is customarily a Diesel or other suitable motor. The said body A is preferably stationarily mounted upon the traction base B which may embody the customary spaced crawlers or endless traction belts commonly used for dipper shovel excavators today. Mounted on the body A at one end thereof is a double boom 1 which comprises the upwardly or approximately vertically extending boom members 2, each boom member having offstanding outwardly from its middle portion a supporting arm 3 and similarly having below said arm and standing outwardly from the boom, the lower arm 4. The two arms 3 of the boom members 2 are provided with track portions 5 on which is supported the transversely slidable endless conveyor belt unit 6. One of the roller shafts of said belt unit has a driving gear 7 adapted to be connected by sprocket chain means or any suitable gearing with the power plant on the body A.

whereby said unit 6 may be operated in either direction for causing dirt or like material deposited thereon to be discharged from either side of the machine.

Any suitable means, as shown, may be employed for shifting the unit 6 bodily transversely, and upon its mounting parts 5, so that one end of the unit may extend some distance laterally from either side of the machine and the materials received and conveyed off by said unit deposited in a truck body 8 as seen in Figure 2. Or, if desired, the materials carried off by the conveyor unit 6 may be dropped upon a spoils bank or deposited in any suitable place appropriate for the particular use of the machine in its excavating operation.

The lower arms 4 of the boom 1 are dipper carrying arms in that they are provided with elongated slotted portions 9 to receive a roller 10 mounted at the inner bifurcated end portions 11 of a dipper stick 12. The roller 10 supports the pivotal or axis end of the stick 12 for back and forth movement relatively to the slotted portion 9 of the boom arm 4, said back and forth movement being the retracting and thrusting movement, respectively, of the dipper 13 which is carried by the outer end of the dipper stick 12.

In order to shift the axis of the dipper 12 for said retracting and thrusting or crowding movements of the stick 12, I may employ any suitable drive means from the body of the cab or body A. As illustrated, I utilize an endless sprocket chain 14 operating around suitable sprockets 15, 16, and 17, the sprockets 15 and 16 being carried on the arm 4 and the sprocket 17 carried by the pivotal axis 18 of the boom, the said axis 18 being supported on suitable brackets 19 at the adjacent end of the body A. In turn, the sprocket 17 is driven by a sprocket chain 20 passing around sprockets 21 and 22 and driven by a drive carried to the shaft supporting the sprocket 21 as from an engine or any suitable means.

The retracting and crowding chain 14 carries a coupling 24 between said links thereof and fastened to the latter. The coupling involves bearing parts surrounding the axis shaft 25 of the dipper stick 12, see Figures 4 and 5.

Now it is to be understood that a dipper stick and driving means comprising the general structure just described is carried by each of the boom arms 4 and is operated from the machinery in the body A under driving connections leading from the motor in said body, so according to the construction of my loader as illustrated, there are two or twin dipper shovel members employed.

The dipper 13 of each dipper stick 12 instead of being a bottom dump dipper similar to the ones usually employed today in dipper shovels, has a top door 26 which is pivoted to the sides of the dipper as at 27. A short distance from the point of pivotal support of the dipper 27 a yoke or clevis member 28 has its ends connected with the opposite side portions of the door 26. The door 26 is pivoted near the middle of the top of the dipper at the sides thereof and the door closes against the back of the dipper as shown in Figure 1 and is normally retained closed by a latch 29 having a trip arm 30.

If desired, the under side of each arm 3 of the boom 1 may be equipped with a roller bumper 31 yieldably supported in any suitable manner to take the shock of stopping the dipper stick movement near the upper limit of the latter.

The trip arms 30 of the latches 29 are adapted to strike the outer frame member 32 of the supporting frame of the conveyor unit 6 when the dippers reach the upper limit of their movement, whereupon to disengage the latches 29 on the doors 26 and permit the doors to open incident to the upward pull thereon of cables 33 which are attached one to each of the yokes 28. The cables 33 lead over sheaves 34 on the upper ends of the boom members 2 and are connected with separate operating drums 35 in the cab or body A, which drums are actuated by the source of power in said cab, such as the engine.

Separate drums 35 are employed in order that the dippers 13 may be separately raised and lowered, preferably in alternation, so that while one dipper is down, being thrust out to excavate and retracted and elevated, the other dipper may be up in its dumping position and/or progressing backwardly and downwardly toward its excavating position. In this manner substantially continuous excavating operations may be carried on by the operator stationed in the cab 8 of the machine at the controls for the various operating parts used for the dipper operations.

If desired, a drum 36 may be employed in the cab and connected suitably by cable means 37 to the boom arms and for raising and lowering the peaks of the boom members 2 simultaneously, whereby to adjust the boom properly so that the dipper stick arms 4 may be positioned at different elevations and the extent of digging movement of the dippers regulated in a satisfactory manner.

It is notable that in so far as the boom 1 and the mounting of the dipper sticks 12 thereon is concerned, there is utilized the principle of boom and dipper supporting construction embodied in the patent of Kirkham No. 1,692,452 issued November 20, 1928, with the consequential advantages to be derived therefrom.

The operation of the machine of my invention is comparatively simple. When the machine is positioned at the site of excavation, the operator will adjust the boom 1 as may be desired or its then present adjustment utilized, as will be most customary. Thereupon, the operator will cause the alternate lowering of each dipper stick from the full line position of Figure 1 to the several excavating and crowding out positions illustrated in dotted lines in said figure. Then the excavating dipper will be elevated to its substantially full line position of Figure 1 and when it reaches its upper limit of movement it will be automatically discharged onto the conveyor unit 6 which will carry off the contents of the dipper deposited on the conveyor. While the operation above mentioned is performed with one dipper, the other dipper will in proper sequence be lowered and caused to go through such operation in alternation with the first dipper.

It is notable that on the upward pull of the cable means 33 on the dipper during the larger part of the raising of the dipper from its excavating position, the cable means acts with the tendency of maintaining the dipper door or doors 26 closed, though at about the upward limit of movement with the dipper stick 12 with the dipper 13 the angle of the cable as to its pulling force changes and tends to shift the door or doors to open positions immediately upon the release of the door or doors from the latches 29. A powerful thrusting or crowding out of the dipper sticks 12 is obtainable by the operating chain means 14 and the reversal of the direction of movement of the chain means will effectively and quickly re-

tract the dipper stick as required in the operation of the machine.

A deflector plate **39** attached to the boom members **2** is used to deflect materials discharged from the dippers **13**, onto the conveyor **6**.

Figures 1 and 2 show that drive gear **7** for the conveyor unit **6** engages gear **7a** on the inner section of a telescopic shaft **76**, the outer section of which carries sprocket **7c**. A sprocket chain **7d** leads from sprocket **7c** to any suitable driving source on the body A. Figures 2 and 6 show how by turning a hand wheel **45** carried by shaft **46** turning in bearings in boom **1**, pinions **47** may be rotated in either direction. The pinions **47** engage teeth racks **32a** on the undersides of the frame parts **32** of conveyor **6**, and turning of the shaft **46** enables shifting of the conveyor unit **6** to adjusted positions projecting laterally from either side of the machine.

Figure 3 illustrates certain operating mechanism of the machine including the drums **35** to actuate the cables **33** for raising and lowering the dippers **13**; also the drums **36** for moving boom **1**, and engine operated units for the crowding and retracting of the dipper sticks and dippers. There are two such units identically constructed. Each comprises a reversing planetary gear unit **48**, chain driven as at **49** from the engine, and includes a clutch **50** and brake **51**. The clutch controls the drive action and the brake holds the planetary gears to control reversing action of the driving shaft **52** of each unit, as well known in this and the general art of such planetary gearing. From the shaft **52** of each planetary unit the drive is transmitted by the sprocket **21** and chain **20**, previously described, to the associated boom axis or shaft **18** that carries the sprocket **22** before mentioned, and the sprocket **17** that operates the crowd and retract sprocket chain **14**. By the operation of the planetary gear units the thrust or crowd, and retract, actions of the chains **14** for the dipper sticks **12** and dippers **13** are effected.

In the modified form of my machine of Figures 8, 9, and 10 of the drawings I employ a longitudinal endless belt conveyor unit **54** carried by the boom arms **3a**, the material excavated by the dippers **13** being discharged automatically into the feed hopper **55** and through the bottom opening **56** thereof onto the conveyor belt **54a**, by abutting of latches **57** against said hopper **55**. Yieldable bumpers **58** limit movements of the dipper sticks **12** and absorb the shock of such movements. The remaining features of the modified machine are like those described in reference to the construction in Figures 1 to 7 inclusive, and like parts have corresponding reference characters applied thereto. A cable **59** connected at one end to the conveyor **54** at **60** winds and unwinds relatively to the hoist drum **61** to vary the elevation of the conveyor.

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 dipper shovel loader of the class described, in combination, a body, a traction base supporting said body, a boom supported by the base, a conveyor unit leading away from the machine and supported by said boom, a dipper stick pivotally mounted upon the boom, a dipper carried by said dipper stick, means for operating the dipper for effecting excavating action thereof and for elevating the same to discharge onto the said conveyor unit, combined with a second dipper and dipper stick unit corresponding with that set forth and disposed at one side of the latter upon the boom, and in which the moving means is alternatively operable for the actuation of the two dipper and dipper stick units.

2. In a dipper shovel loader of the class described, in combination, a supporting traction base, a body thereon, a pair of dipper sticks and dippers movably mounted on the base in side by side spaced relation, independent means for crowding out and retracting said dipper sticks, an adjustable boom supporting the dippers and sticks, and independent means for raising the dipper sticks from excavating positions to discharge positions.

3. A machine as claimed in claim 2, combined with a conveyor for carrying materials away from the machine carried by said boom to receive materials from the dippers when discharged.

4. A machine as claimed in claim 2, combined with a conveyor for carrying materials away from the machine carried by said boom to receive materials from the dippers when discharged, pivotal means supporting the said boom for permitting adjustment thereof, and means for moving the boom and holding the same in adjusted positions whereby to control the digging depth of the dippers.

5. A machine as claimed in claim 2, combined with a conveyor for carrying materials away from the machine carried by said boom to receive materials from the dippers when discharged, and means to shift the conveyor in opposite directions laterally of the machine.

6. A dipper shovel and loading machine of the class described, in combination, a portable base, a body mounted thereon to move therewith, a pair of side by side dipper stick and dipper units extending from one end of the body, a boom adjustably mounted on the body, mechanism operable from the body for reciprocating the dipper stick and shovel units toward and from the body for effecting excavating actions thereof, and means connected with the boom for varying its position of adjustment on the body.

7. A machine as claimed in claim 6, combined with a conveyor unit supported on the boom and onto which the dipper stick and dipper units discharge.

8. A machine as claimed in claim 6, combined with a conveyor unit supported on the boom and onto which the dipper stick and dipper units discharge, and means carried by the boom for varying the operative position of the conveyor thereon.

9. A machine as claimed in claim 6, characterized in that the boom comprises a vertically extending body portion and a laterally extending base portion, said base portion connected with the dipper stick and dipper units so as to permit the reciprocating movement of the latter, and further characterized in that the mechanism for reciprocating the dipper stick and dipper units is operable independently so as to enable alternating excavating operations of the separate units.

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