Oct. 11, 1966 R. L. DROLLINGER ETAL 3,278,057

HANDLE AND DIPPER ASSEMBLY FOR POWER SHOVELS

Filed April 23, 1964

4 Sheets-Sheet 1

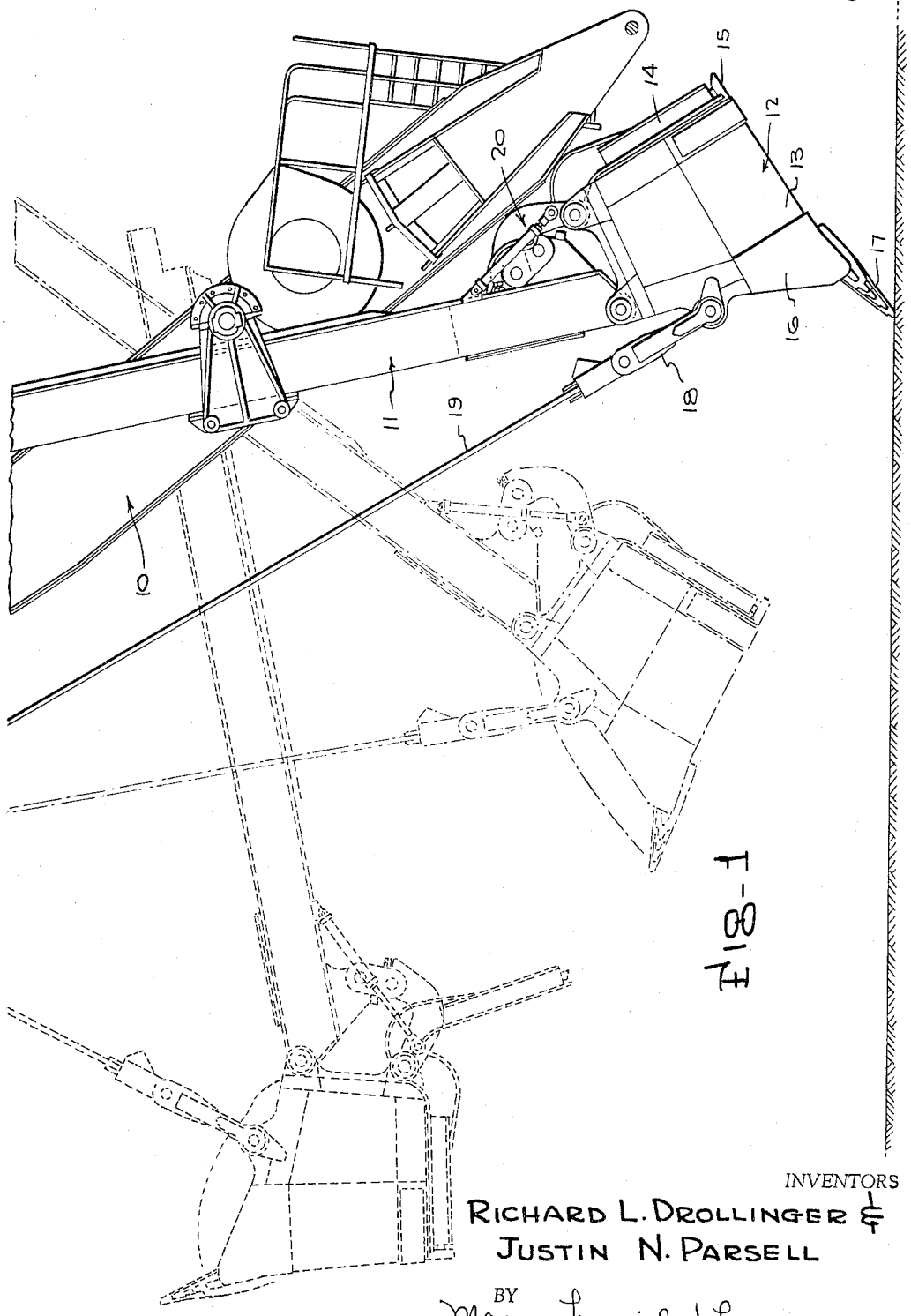


FIG. 1

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4 Sheets-Sheet 2

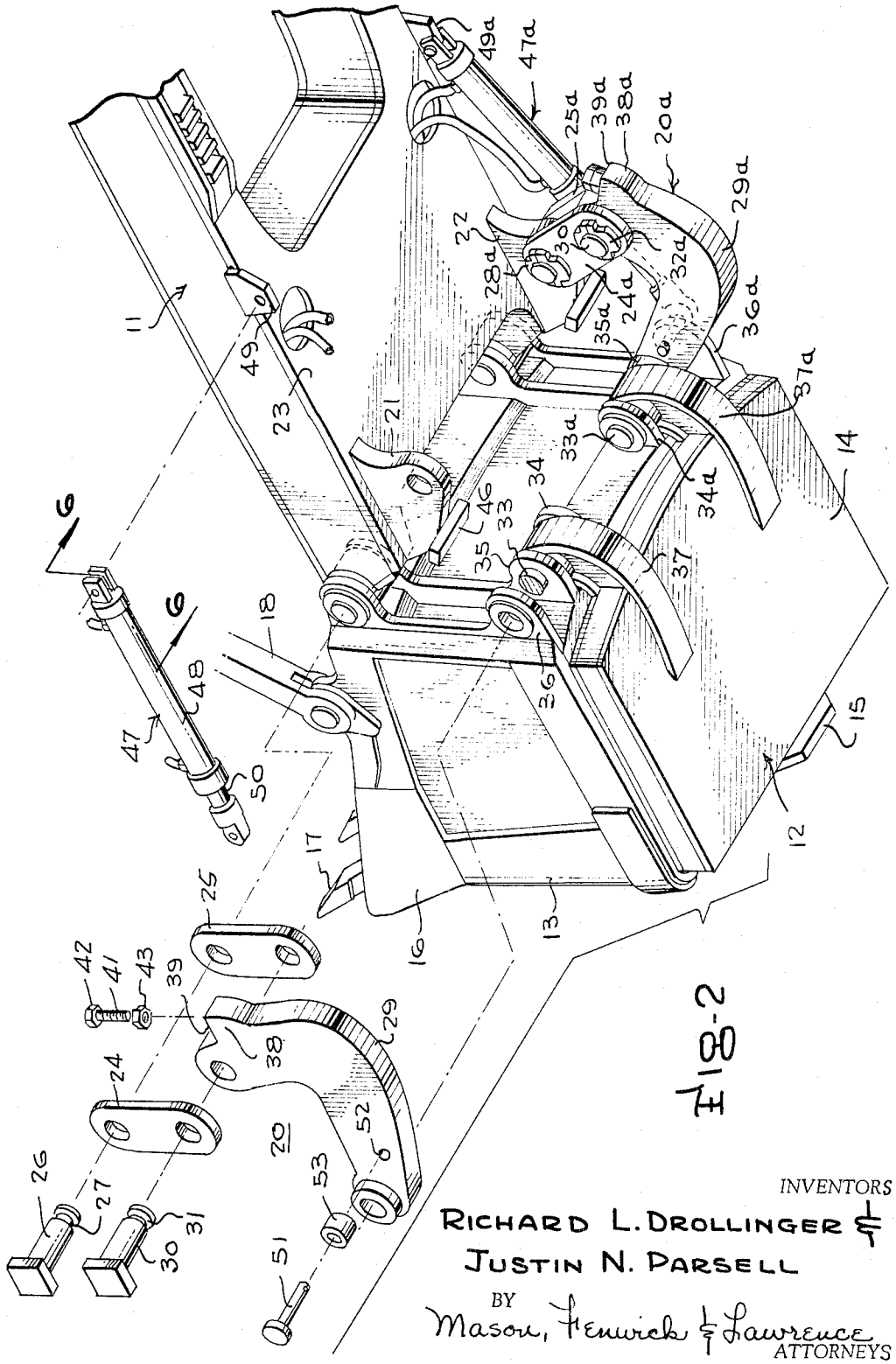


FIG. 2

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4 Sheets-Sheet 3

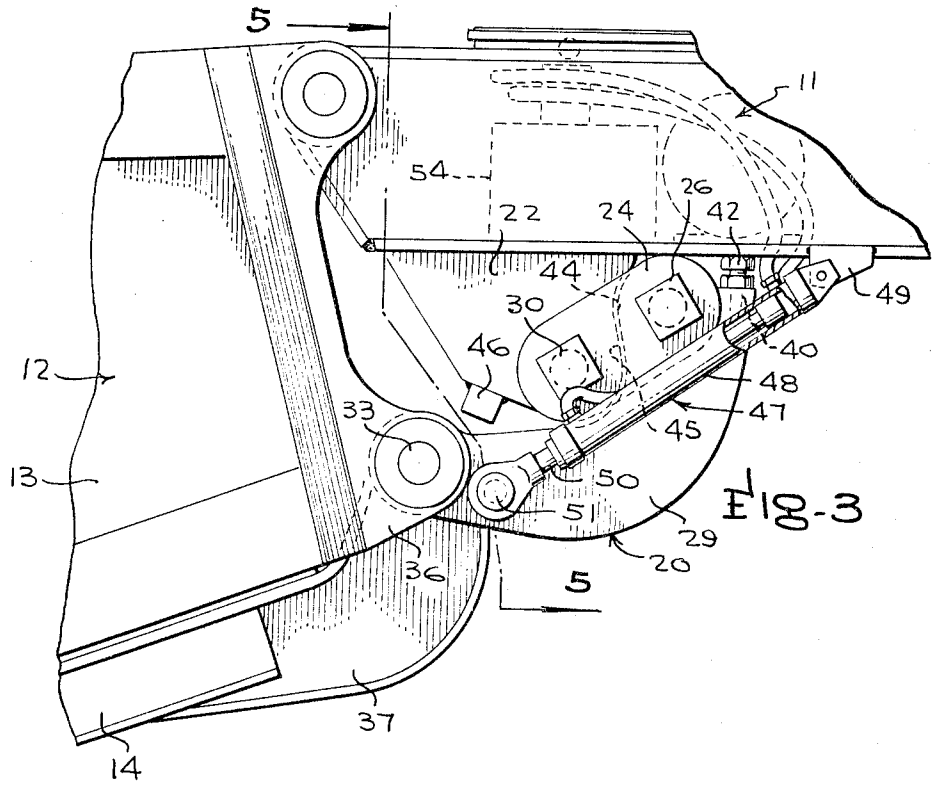


FIG-3

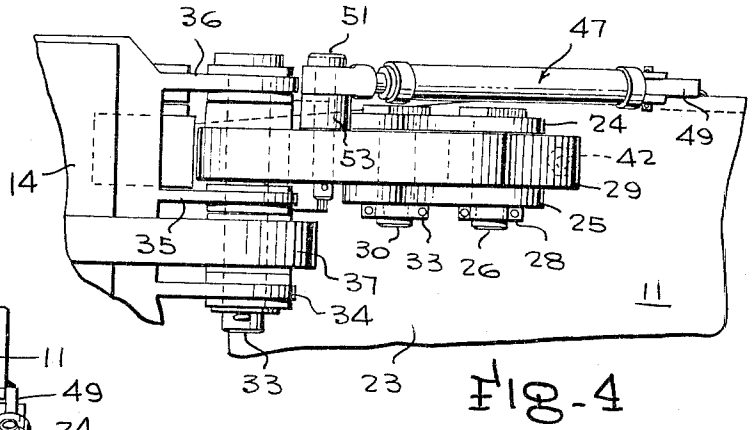


FIG-4

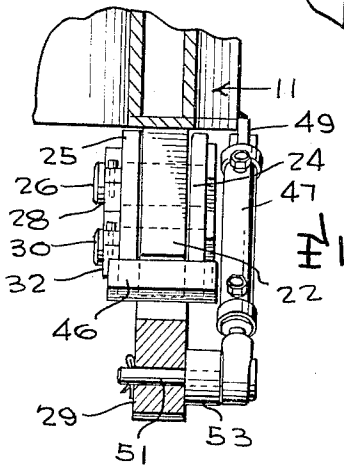


FIG-5

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HANDLE AND DIPPER ASSEMBLY FOR POWER SHOVELS

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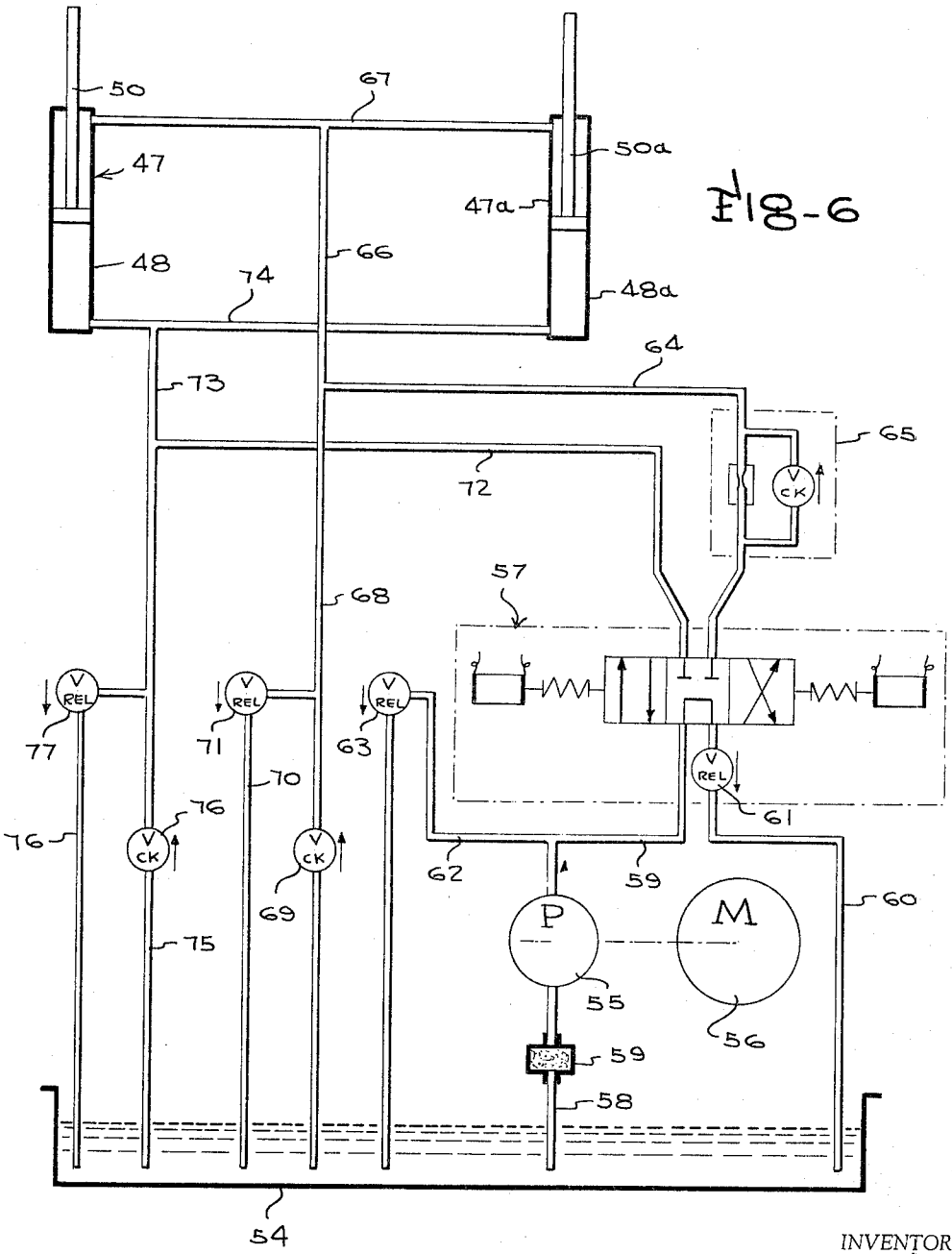


FIG-6

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HANDLE AND DIPPER ASSEMBLY FOR POWER SHOVELS

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7 Claims. (Cl. 214—146)

This invention relates to shovel apparatus and more particularly to a handle and dipper assembly for a shovel apparatus.

In most conventional power shovels there generally is provided an elongated handle carried by a boom, having a dipper connected to the end thereof. Usually, the dipper is provided with a bottom door for discharging material therethrough, and has the upper rear end thereof pinned to the end of the handle to permit pivotal movement of the dipper relative to the handle. When the dipper initially is connected to the handle, the dipper normally is positioned relative to the handle to provide the most efficient digging angle. A rigid link or pitch brace then is installed between the dipper and the handle to fix this relationship. It has been found, however, that by rigidly positioning the dipper relative to the handle to provide the most efficient digging angle, often, when the dipper is elevated to a height for dumping, considerable spillage of material occurs which results in reduced operating efficiency of the shovel.

Accordingly, the general object of the present invention is to provide an improved handle and dipper assembly for power shovels.

Another object of this invention is to provide an improved handle and dipper assembly which will reduce the amount of spillage of material carried by the dipper normally characteristic of conventional handle and dipper assemblies.

A further object of the present invention is to provide an improved handle and dipper assembly, wherein the dipper is adapted to be positioned at the most efficient digging and dumping angles relative to the handle.

A further object of this invention is to provide an improved handle and dipper assembly, wherein the dipper is adapted to be positioned at the most efficient digging and dumping angles relative to the handle and moved between such limits in a smooth motion, thereby preventing spillage caused by abrupt or sudden loads applied to the dipper.

Another object of this invention is to provide an improved handle and dipper assembly in which the dipper can be moved between the most efficient digging and dumping angles relative to the handle during normal digging and dumping operations.

A further object of this invention is to provide an improved handle and dipper assembly for a power shovel which has comparatively few parts, is simple to assemble and is relatively inexpensive to manufacture.

Other objects and advantages of the present invention will become more apparent to those persons skilled in the art, from the following description when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 illustrates a side elevational view of an embodiment of the invention illustrating the assembly in a sequence of positions passing through a digging and dumping cycle;

FIGURE 2 is an enlarged perspective view of the embodiment illustrated in FIGURE 1, having portions thereof shown in exploded relation;

FIGURE 3 is an enlarged fragmentary view of the embodiment illustrated in FIGURE 1, having portions thereof broken away;

FIGURE 4 is a bottom view of the interconnecting means illustrated in FIGURE 3;

FIGURE 5 is a cross-sectional view taken along line 5—5 in FIGURE 3; and

FIGURE 6 is a diagrammmatic schematic view of the actuating means of the embodiment illustrated in FIGURES 1 through 5.

Briefly described, the present invention provides a handle and dipper assembly for a shovel apparatus comprising a handle, a dipper pivotally connected to the handle and means interconnecting the handle and the dipper for limiting the angular movement of the dipper relative to the handle between predetermined limits. The predetermined limits of the angular movement of the dipper define the most efficient digging and dumping positions of the dipper relative to the handle. Actuating means operatively interconnecting the handle and the dipper preferably are provided to move the dipper in a smooth motion between the predetermined limits.

Referring to the drawings, there is illustrated a preferred embodiment of the invention. Specifically, FIGURE 1 illustrates a boom **10**, having a dipper handle **11** mounted thereon and a dipper **12** pivotally connected to the end of the dipper handle. The dipper **12** is of a conventional type generally comprising an open ended, substantially rectangularly shaped body portion **13**, a hinged door **14** mounted on the bottom of the body portion, a door latch **15** mounted on the lower front wall of the dipper body, a lip portion **16** formed at the upper end of the body portion having a plurality of teeth **17** formed along the upper front edge thereof and a dipper bail **18** pivotally connected to the side edges of the dipper body, which is operatively connected to a hoist cable **19**. The lower rear end of the dipper **12** is operatively connected to the handle **11** by interconnecting means **20** and **20***a* generally defining linking or toggle means which are substantially similar.

Referring particularly to FIGURES 2 and 3, the dipper handle **11** is provided with a pair of spaced lugs **21** and **22** which depend from the bottom wall **23** of the handle. Pivotally connected to depending lug **21** is a pair of short linking members **24** and **25** which are connected to the lug **21** by means of a pin **26** having an annular recessed end portion **27** for receiving a split retaining collar **28**. The opposite ends of the short linking members **24** and **25** are connected to the lower rear end of the dipper body **13** by means of a curved linking member **29** having a substantially gooseneck shape. The linking member **29** is curved outwardly relative to the dipper and handle and is pivotally connected to the ends of the short linking members **24** and **25** by means of a pin **30** having a recessed end portion **31** for receiving a split retaining collar **32** similar to the split retaining collar **28**. The opposite end of the linking member **29** is connected to the dipper body **13** by means of a pin **33** which is mounted in suitable aligned opeinings in a set of spaced lugs **34**, **35** and **36** provided on the lower rear wall of the dipper body **13**. As best illustrated in FIGURE 4, the linking member **29** is connected to the pin **33** between the spaced lugs **35** and **36**. Also connected to the pin **33** between the lugs **34** and **35** is a suitably apertured hinge member **37** of the bottom door **14** of the dipper.

The upper end of the linking member **29** has an outwardly projecting portion **38** providing a shoulder **39**, having a threaded hole **40**. The threaded hole **40** is adapted to receive a threaded adjustable stop bolt **41** having a head portion **42** and a set nut **43** which is threaded on the bolt **41** and is engageable with the shoulder **39** of the linking member **29**. As best illustrated in FIGURE 3, the rear edge **44** of the depending lug **22** is configured similar to the upper inner edge **45** of the link-

ing member 29 so that the edges 44 and 45 are disposed adjacent each other when the linking member 29 is moved rearwardly and upwardly so that the head portion 42 of the bolt 41 engages the bottom wall 23 of the dipper handle. It also will be noted that the distance between the pivotal connection between the linking members 24 and 25 and the depending lug 22 and the pivotal connection between the opposite ends of the linking members 24 and 25 and the linking member 29 is such as will enable the complementary edges 44 and 45 of the depending lug and the linking member 29, respectively, to be disposed adjacent each other when the head portion 42 of stop bolt 41 engages the bottom wall 23 of the dipper handle. In addition, the lower ends of the short linking members 24 and 25 are suitably configured so that they will not engage the bottom wall 23 of the dipper handle prior to the engagement of the adjustable bolt 41. The depending lug 22 also is provided with a rigidly mounted stop member 46 which is engaged by the side edges of the short linking members 24 and 25 to limit their movement in a clockwise direction relative to FIGURE 3.

Interconnecting the dipper handle 11 and the curved linking member 29 adjacent the pivotal connection of the curved linking member with the lower rear wall of the dipper is a hydraulic cylinder assembly 47 defining an actuating means for the dipper. The hydraulic cylinder assembly generally comprises a fluid cylinder 48 pivotally connected at its upper end to a depending lug 49 mounted on the bottom wall 23 of the dipper handle and a piston 50 slidably mounted within the fluid cylinder 48, having the lower end thereof pivotally connected to a pin 51 which is received within and retained in an opening 52 provided in the lower end of the linking member 29. The connecting end of the plunger 50 is spaced from the side of the linking member 29 by means of a spacer collar 53.

Referring to FIGURE 6 of the drawings, there is shown a schematic diagrammatic view of the hydraulic system utilized in the above described embodiment of the invention for moving the dipper between the predetermined digging and dumping positions. Specifically, there is provided a fluid reservoir 54 which is mounted within the forward end of the handle 11 adjacent the pivotal connection of the dipper with the handle, as shown in FIGURE 3. Also mounted within the handle are a pump 55 adapted to be driven by a suitable electric motor 56 and a remotely controlled, four-way solenoid valve 57.

The pump 55 is provided with a suction line 58, having a filter unit 59, which communicates with the fluid reservoir 54. The discharge side of the pump is connected to the valve 57 by means of a discharge line 59. The solenoid actuated valve 57 preferably is of the spring centered, sliding valve type and is illustrated in the centered, closed position whereby fluid pumped through discharge line 59 will be returned to the reservoir by means of a return line 60 having a relief valve 61 provided therein. The discharge line 59 also is provided with a return line 62, having a suitable relief valve 63. Fluid is delivered to the forward ends of the cylinders 48 and 48*a* by means of a line 64, including a flow control check valve 65, line 66 and line 67 intercommunicating with the forward ends of the cylinders. The line 66 also is connected to a return line 68, including a check valve 69, through which fluid is returned to the reservoir 54. A line 70 is connected to return line 68, which includes a relief valve 71. The rearward ends of cylinders 47 and 47*a* are connected to the valve 57 by means of lines 72, 73 and 74. Similar to return line 68, line 73 is provided with a return line 75 which includes a check valve 76. The return line 75 also is provided with a line 76 having a relief valve 77.

When the valve 57 is in the position as illustrated, the fluid being pumped will be returned to the fluid reservoir through the line 60. When it is desired to move the dipper in the rearward or digging position, the valve piston is moved to the left relative to FIGURE 6, so that

fluid under pressure will flow in lines 64, 66 and 67 to retract the pistons 50 and 50*a*. After the digging operation has been completed, the dipper can be moved into the desired dumping position by moving the valve piston to the right, so that fluid under pressure will flow through lines 72 73 and 74 into the opposite ends of the cylinders to extend the pistons 50 and 50*a*. The controls for the motor 56 and the solenoids of valve 57 preferably are located in the cab of the shovel with the other controls of the shovel.

It will be appreciated that the component parts of the interconnecting means 20 will be designed so that when the head portions 42 and 42*a* of the stop bolts engage the bottom wall of the dipper handle, the dipper will be at the most efficient digging angle relative to the dipper handle, and when the short linking members 24 and 25 of each assembly engage the stop members 46 and 46*a*, the angle of the dipper relative to the dipper handle will be the most efficient for dumping. In addition, the hydraulic cylinder assemblies are operable to move the dipper between the most efficient digging and dumping position.

In operation, at the beginning of a digging cycle, the dipper 12 is moved to the position as illustrated by the solid lines in FIGURE 1. This position is determined by the engagement of the adjustable stop bolts 41 and 41*a* with the bottom wall of the dipper handle. The dipper 12 is moved downwardly and forwardly to receive the material within the dipper, and then is elevated as illustrated in the second sequence illustrated in FIGURE 1. When a tensile load is applied to the cable 19 and the dipper has cleared the digging surface, the hydraulic system is actuated so that the pistons 50 and 50*a* are extended, causing the dipper to pivot relative to the handle. As load continues to be applied to the cable 19 and the dipper is elevated to a position as shown in the third sequential position in FIGURE 1, the short linking members 24 and 25 eventually engage the stop members 46 to restrict any further pivotal movement of the dipper relative to the dipper handle. The dipper is then in position for dumping, which is accomplished by tripping the latch mechanism 15 to release the bottom door 14.

Initially, in assembling the interconnecting means 20 and 20*a*, the stop bolts 41 and 41*a* are adjusted so that when the dipper is in the digging position, as illustrated in FIGURE 3, the stop bolts will engage the bottom wall of the handle before the pistons in the hydraulic cylinders engage the rearward cylinder walls. This, then, will permit the digging force to be transmitted through the linking members instead of the hydraulic cylinder assemblies.

From the foregoing detailed description it will be evident that there are a number of changes, adaptations and modifications of the present invention which come within the province of those skilled in the art. However, it is intended that all such variations not departing from the spirit of the invention be considered as within the scope thereof as limited solely by the appended claims.

What we claim is:

1. A handle and dipper assembly for a shovel apparatus comprising a handle, a dipper hingedly connected to said handle, at least a first linking member pivotally connected to said handle, at least a second curved linking member pivotally connected to said dipper and said first linking member, said curved linking member having means radially displaced from the axis of the pivotal connection between said first linking member and said curved linking member engageable with said handle to limit the angular displacement of said dipper relative to said handle in a first direction and said handle member having stop means engageable by at least one of said linking members for limiting the angular displacement of said dipper in a direction opposite from said first direction.

2. A handle and dipper assembly for a shovel apparatus comprising a handle, a dipper hingedly connected to said handle, at least a first linking member pivotally connected to said handle, at least a second curved linking member

pivotally connected to said dipper and said first linking member, said curved linking member having means radially displaced from the axis of the pivotal connection between said first linking member and said curved linking member engageable with said handle to limit the angular displacement of said dipper relative to said handle in a first direction, said handle member having stop means engageable by at least one of said linking members for limiting the angular displacement of said dipper in a direction opposite from said first direction and means operatively interconnecting said dipper and handle for moving said dipper between said predetermined limits.

3. A handle and dipper assembly for a shovel apparatus comprising a handle, a dipper hingedly connected to said handle, at least a first linking member pivotally connected to said handle, at least a second curved linking member pivotally connected to said dipper and said first linking member, said curved linking member having means radially displaced from the axis of the pivotal connection between said first linking member and said curved linking member engageable with said handle to limit the angular displacement of said dipper relative to said handle in a first direction, said handle member having stop means engageable by at least one of said linking members for limiting the angular displacement of said dipper in a direction opposite from said first direction and hydraulic actuating means operatively interconnecting said handle and said curved linking means for angularly displacing said dipper between said limits.

4. A handle and dipper assembly for a shovel apparatus comprising an elongated handle, a dipper having a bottom door hingedly connected at its upper rear end to an end of said handle, at least a first linking member pivotally connected to a bottom surface of said handle, at least a second linking member having a gooseneck shape pivotally connected to said dipper adjacent the lower rear end thereof and said first linking member, said second linking member being curved outwardly relative to said dipper and said handle, said second linking member having an outer edge including abutment means engageable with the bottom surface of said handle for limiting the angular displacement of said dipper in a first direction, and said handle having stop means disposed on the bottom surface thereof engageable by the said first linking member for

limiting the angular displacement of said dipper relative to said handle in a direction opposite from said first direction.

5. A handle and dipper assembly according to claim 4, including means operatively interconnecting said dipper and handle for moving said dipper relative to said handle.

6. A handle and dipper assembly according to claim 4, including hydraulic actuating means operatively interconnecting said handle and said curved linking means for angularly displacing said dipper.

7. A handle and dipper assembly for a shovel apparatus comprising an elongated handle, a dipper having a bottom door hingedly connected at its upper rear end to an end of said handle, at least a first linking member pivotally connected to a bottom surface of said handle, at least a second linking member having a gooseneck shape pivotally connected to said dipper adjacent the lower rear end thereof and said first linking member, said second linking member being curved outwardly relative to said dipper and said handle, said second linking member having an outer edge including an outwardly projecting means, adjustable means mounted on said outwardly projecting means engageable with the bottom surface of said handle for limiting the angular displacement of said dipper in a first direction, said handle having stop means disposed on the bottom surface thereof engageable by the said first linking member for limiting the angular displacement of said dipper relative to said handle in a direction opposite from said first direction and at least one hydraulic actuating means operatively connected to said handle and said second linking member adjacent the pivotal connection between said second linking member and said dipper.

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