Our present invention relates generally to a load elevating mechanism, and, more particularly, is directed to a lift dump attachment particularly adapted for emptying a dump-bottom type hopper.

A dump-bottom type hopper of the character to which we refer, comprises a substantially rectangular body portion pivotally mounted at its rear end, about a horizontal axis, to a platform portion. The platform portion is supported at its rear end on a pair of spaced legs, and at its forward end is supported on a transversely extending I-beam. A suitable bracket member is secured to the body portion of the hopper, adjacent the rear end thereof. When the hopper is in a normal position, that is, with the platform portion horizontal and the sides of the body portion vertical, a container is defined for storing articles, such as metal castings and the like.

Our present invention is concerned with an attachment for an industrial truck, which is adapted to engage the bracket member of the hopper for raising the latter whereby the forward end of the body portion of the hopper is swung upwardly and away from the forward end of the platform portion. With the hopper in the position last described, the platform portion defines an inclined chute, the lower end of which may be directed to another container or pile for conveying articles from the hopper to the said container or pile.

It is a primary object of our present invention to provide a lift dump attachment, as described, having a minimum overall height.

It has been determined that a considerable force is required to initially break open the hopper. For this reason, it has been found preferable to provide a lift dump attachment having a 1 to 1 lift wherein the load or hopper engaging means is moved upwardly conjointly with the piston rod of the elevating hydraulic assembly. This 1-1 lift, however, if continuous through the entire range of travel of the load engaging means, would require the attachment to be of considerable height.

It is a primary feature of our present invention that the load engaging means initially moves upwardly at the same rate of speed as the piston rod of the elevating hydraulic assembly, and after the load engaging means has been raised a predetermined distance, the latter moves upwardly twice as fast as the piston rod of the elevating hydraulic assembly.

After the hopper has been initially broken open, the force required to move the hopper to a full open position is less than the initial opening force required. Thus, a 2-1 lift provides sufficient force to complete the opening of the hopper after the latter has been initially broken open. By providing a sequentially operable 1-1 and 2-1 lift, the overall vertical height of the attachment may be maintained at a minimum without sacrifice of operating efficiency.

The lift dump attachment of our present invention, which has a sequentially operable 1-1 and 2-1 lift, comprises first frame means which is adapted to be secured to the load supporting carriage of an industrial truck. Slidably mounted in the first frame means is second frame means. A hydraulic assembly is provided for effecting vertical movement of the second frame means. A carriage assembly is mounted for movement within the second frame means and suitable stop means is provided for engaging the carriage assembly during initial upward movement of the second frame means for causing the carriage assembly to move upwardly conjointly with the second frame means. In addition, sprockets are rotatably mounted to the second frame means and chains are trained over the sprockets. The chains are secured at their one ends to the carriage assembly, and at their other ends to means slidably mounted along the actuating cylinder, which means in the embodiment of our invention to be disclosed hereinafter comprises a collar member. In the specific form of our invention to be disclosed, the collar member is adapted to engage the upper cap of the cylinder of the elevating hydraulic assembly after the second frame means has been raised a predetermined height for providing a reaction point, whereby upon continued upward movement of the second frame means, the chains will cause the carriage assembly to move upwardly at twice the speed that the second frame means moves.

Now, in order to acquaint those skilled in the art with the manner of constructing and using devices in accordance with the principles of our present invention, we shall describe in connection with the accompanying drawings, a preferred embodiment of our present invention.

In the drawings:

Figure 1 is a perspective view of an industrial truck to which is secured, at the forward end thereof, the lift dump attachment of our present invention;

Figure 2 is a front elevational view of the lift dump attachment of Figure 1;

Figure 3 is a plan view of the lift dump attachment of Figure 2:
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Figure 4 is a side elevational view of the lift dump attachment of Figure 2; and
Figure 5 is a perspective view of the industrial truck of Figure 1 with the lift dump attachment in an elevated position.

Referring now to Figure 1, there is shown an industrial truck, indicated generally by the reference numeral 10, having a pair of drive wheels 11 disposed at the forward end thereof, and a pair of steering wheels 12 disposed at the rear end thereof. The truck 10 is provided with a conventional prime mover and drive means for effecting driving of the forward wheels 11. Mounted on the truck 10 is an operator's seat 13, and disposed forwardly thereof is a hand steering wheel 14 mounted on a steering column 15 which is operatively connected in a conventional manner to the rear steering wheels 12. Pivottly mounted at the forward end of the truck 10 is a conventional generally vertically extending mast, indicated generally by the reference numeral 16, which comprises a pair of opposed facing, vertically extending, outer channel members 17, in which are slidably mounted a pair of vertically extending opposed facing channel members 18. The outer channel members 17, adjacent their upper ends, are maintained in spaced relation by means of a brace 19. The inner slidable channel members 18, adjacent their upper ends, are interconnected by means of a cross head 20, which has suitable connection to the upper end of the piston rod 21 of a hydraulic piston and cylinder assembly, indicated generally by the reference numeral 22. The assembly 22 is secured, at its lower end, to the outer channel members 17. Rotatably mounted on the cross head 20, about a horizontal axis, are a pair of sprocket gears 23 over which a pair of chains 24 are trained. The chains 24, adjacent their one ends, have connection to a brace member, not shown, secured to the outer fixed channel members 17, intermediate of the ends thereof. The chains 24, adjacent their other ends, are suitably connected to a load supporting carriage which is mounted for upward and downward movement within the inner channel members 18. Detachably secured to the forward surface of the load supporting carriage are a pair of vertically spaced, transversely extending, frame members or fork bars 25 and 26.

Movement of the load supporting carriage within the inner channel members 18 is effected by selectively admitting fluid under pressure to the lower end of the cylinder of the hydraulic piston and cylinder assembly 22. In this instance, the flow of fluid under pressure to the lower end of the cylinder causes the piston rod 21 to be urged upwardly, which, in turn, causes upward movement of the inner channel members 18, cross head 20, and sprocket gears 23. As the sprocket gears 23 are moved upwardly the chains 24, which are afixed, are fixed at their one ends, rotate about the sprocket gears 23 thus urging the load supporting carriage upwardly. When it is desired to lower the load supporting carriage, fluid under pressure is bled from the lower end of the cylinder of the assembly 22 thus permitting the piston rod 21 to move downwardly under the weight of gravity.

Brackets 27 are secured to the outer sides of the outer channel members 17, intermediate of the ends thereof, and pivotally mounted to the brackets 27 are hydraulic piston and cylinder assemblies indicated generally at 28 which are carried by the truck 10. By the selective admis-
horizontal plate 50 which is secured between the inner channel braces 46 and 47 intermediate of the ends thereof.

The hydraulic piston and cylinder assembly 50 is of the double acting type, and, thus, when fluid is admitted to the lower end of cylinder 51, the piston rod 58 is urged upwardly, thereby moving the inner slide top braces 45 and 47, together with the inner channel members 44 and 45, upwardly. When fluid under pressure is admitted to the upper end of the cylinder 51 and fluid is simultaneously bled from the lower end of the cylinder 51 the piston rod 58 is urged downwardly thereby causing the inner channel top brace members 46 and 47, together with the inner channels 44 and 45, to move downwardly within the outer channel members 41 and 42.

Mounted for upward and downward movement within the inner slideable channel members 44 and 45 is a carriage assembly indicated generally by the reference numeral 71. The carriage 71 comprises end plates 72 and 73 which are disposed respectively adjacent the inner channel members 44 and 45. Lateral extending pin members 74 are fixed in the carriage end plate 72 and project into the inner channel member 44. Rotatably mounted on the outer ends of the pin members 74 are rollers 75 which engage the inner surfaces of the leg portions of the inner channel member 44. Lateral extending pin members 76 are fixed in the carriage end plate 73. The outer ends of the pin members 76 project into the inner channel member 45 and rotatably mounted on the projecting ends of the pin members 76 are rollers 77 which engage the inner surfaces of the leg portions of the inner channel member 45.

Thrust roller blocks 78 and 79 are secured respectively to the carriage end plates 72 and 73. The blocks 78 and 79 extend into the inner channel members 44 and 45 and provide support for rollers 80 and 81 which respectively engage the eight portions of the inner channel members 44 and 45.

Secured to the forward edges of the carriage end plates 72 and 73, respectively, are lift brackets 82 and 83 which extend toward each other. Interconnecting the lift brackets 82 and 83 is a transversely extending main carriage plate 84 which is secured to the lift brackets 82 and 83 respectively by bolts 85 and 86.

The junction of the carriage end plate 72 and the lift bracket 82 is reinforced at the upper and lower ends thereof by gusset plates 87. The junction of the carriage end plate 73 and the lift bracket 82 is reinforced at the upper and lower ends thereof by gusset plates 88. Welded to the inner channel members 44 and 45, adjacent the lower ends thereof, are carriage bumber plates 90 and 91. The bumper plates 90 and 91 act as stops for limiting downward movement of the carriage 71 relative to the inner channel members 44 and 45.

Movement of the carriage 71 within the inner channel members 44 and 45 is accomplished by chain means which shall now be described in detail. Mounted intermediate of the inner channel braces 48 and 47, on spaced apart shafts 53 and 94, are compound sprockets 95 and 96.

Trained over the sprockets 95 and 96, respectively, are compound chains 97 and 98. The chains 97 and 98, at their one ends, are riveted to chain anchor pins 99 and 100. The chain anchor pins 99 and 100 are respectively bolted to blocks 101 and 102 fixed to horizontal plates 103 and 104 which are suitably secured to the rear surface of the main carriage plate 84. The mountings of the plates 103 and 104 to the main carriage plate 84 are reinforced by gusset plates 105 and 106.

The other ends of the chains 97 and 98 are riveted to chain anchor pins 114 and 115 which are suitably bolted to opposite sides of a collar member 116 slidably mounted on the cylinder 51 of the hydraulic assembly 50.

The upper edge of the main carriage plate 84 has secured to its upper edge a pair of spaced block members 125 and 127 which provide a journal support for a transverse shaft 128. Secured to the shaft 128, adjacent the block members 125 and 127, are a pair of J-shaped hook members 129 and 130.

A pair of L-shaped horizontally spaced load supporting fork frames 131 and 132 are detachably secured along their vertical legs to the above described fork bars 25 and 26 immediately inwardly of the outer channel members 41 and 42.

The operation of the lift dump attachment of our present invention is as follows. When it is desired to dump the contents of a loaded hopper, the industrial truck 10 is aligned with the hopper, and the load supporting forks 131 and 132 are inserted below the platform 33 between the legs 35. The hopper 31 is then raised to an elevated position by selectively admitting fluid under pressure to the lower end of the cylinder of the hydraulic assembly 22 of the truck mast 15. After the hopper 31 has been elevated to the desired height, fluid under pressure is admitted to the cylinder 51 of the hydraulic assembly 50 of the lift dump attachment which causes the inner channel top braces 46 and 47 to be raised together with the inner channel members 44 and 45. The carriage assembly 71 of the lift dump attachment is also raised by virtue of the stop members 90 and 91 engaging the lower end of the carriage end plates 72 and 73. Through the initial range of movement of the inner slides 44 and 45, there is no relative movement between the carriages 71 and the piston rod 58 and what we term a 1 to 1 lift is provided.

Now, during initial upward movement of the carriage 71, the hook members 129 and 130 engage the bracket 37 of the hopper 31 causing the rear end of the latter to be moved upwardly. During upward movement of the rear end of the body portion 32 of the hopper 31, the forward end of the body portion 32 pivots upwardly away from the platform portion 33. It has been determined that a considerable force is required to break open the hopper 31. For this reason, we have provided a lift dump attachment, as described, wherein the carriage 71 carrying the lift hooks 129 and 130 moves initially at the same speed as the piston rod 58. This 1 to 1 lift, however, if continued through the entire range of travel of the carriage 71, would require the attachment to be of considerable height. To overcome the latter objection, the above described chain and collar means are provided, which cause the carriage 71 and lift hooks 129 and 130 to move upwardly twice as fast as the piston rod 58, after the latter has been actuated through a predetermined range.

As the piston rod 58 of the hydraulic assembly 50 is urged upwardly, the collar member 116 moves upwardly until the latter engages the underside of the cylinder cap 55. At this point,
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the collar member 116 is prevented from moving further upwardly and a reaction or anchor point is provided for the chains 97 and 98.

Upon further upward movement of the piston rod 58, the inner-channel top braces 46 and 47 continue upwardly, and since the chains 97 and 98 are anchored at their one ends, the latter will travel over the sprockets 55 and 56 causing the ends of the chains 97 and 98, secured to the carriage 11, to move upwardly relative to the inner-channel 44 and 46. Thus, through the final range of upward movement of the inner-channels 44 and 45, the carriage 11 is caused to move upwardly twice as fast as the piston rod 58 providing what we term a 2 to 1 lift.

From the aforesaid operation of the lift dump attachment of our present invention, it will be readily apparent to those skilled in the art that the attachment provides for initial high force or power and subsequent high speed hook travel. After the hopper 31 has been initially opened, the force required to move the hopper from a full open position is less than the initial opening force required. Thus, the 2 to 1 lift provides sufficient force to complete the opening of the hopper 31 after the latter has been initially broken open. By providing a sequentially operable 1 to 1 and 2 to 1 lift, the overall vertical height of the attachment may be maintained at a minimum without sacrifice of operating efficiency. The point at which the 2 to 1 lift becomes effective may be varied by altering the lengths of the chains 97 and 98 which are secured to the collar member 116.

After the hopper 31 has been initially broken open, upward movement of the rear end of the body portion 52 causes the forward end of the platform portion 53 to be drawn toward the industrial truck until the 1-beam 36 engages the forward ends of the load supporting forks 131 and 132. At this point, the 1-beam 36 acts to stop further movement of the platform 33 toward the industrial truck and the hopper 31 will assume the position shown in Figure 5. With the hopper 31 in this position, the contents thereof will slide downwardly from the body portion 52 along the inclined platform 53 which acts as a chute for directing the goods where desired.

The hopper 31 may be emptied at any predetermined height within the capacity of the mast 15 of the industrial truck 10. After the hopper 31 has been emptied, fluid under pressure is selectively admitted to the upper end of the cylinder 51 and fluid is simultaneously bled from the lower end thereof permitting the piston rod 58 to move downwardly at which time the hopper 31 will return to the position shown in Figure 1.

Now, while we have shown and described what we believe to be a preferred embodiment of our present invention, it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of our invention.

We claim:
1. For use with an industrial truck having an upwardly and downwardly movable load supporting carriage, the combination of a load elevating mechanism comprising, a first pair of spaced vertically extending channel members secured to said load supporting carriage, a second pair of channel members slidably mounted, in said first channel members, a crosshead interconnecting said second channel members, a hydraulic assembly having a cylinder secured to said carriage and a piston rod secured to said crosshead, said cylinder having a cap, a carriage assembly mounted for movement within said second channel members, stop members secured to the lower ends of said second channel members which engage said carriage assembly during initial upward movement of said second channel members for causing said carriage assembly to move upwardly in conjunction with said second channel members, sprockets rotatably carried by said crosshead, chains trained over said sprockets and secured at one end to said carriage, means associated with and carried by the other ends of said chains which means is engaged to engage the cylinder cap after said second channel members have been raised a predetermined height for providing a reaction point whereby upon continued upward movement of said second channel members said chains will cause said carriage assembly to move upwardly at a higher speed than said second channel members move.

2. For use with an industrial truck having an upwardly and downwardly movable load supporting carriage, the combination of a load elevating mechanism comprising, a first pair of spaced vertically extending channel members secured to said load supporting carriage, second frame means slidably mounted in said first frame means, a hydraulic assembly having a cylinder secured to said carriage and a piston rod secured to said second frame means, said cylinder having a cap, a carriage assembly mounted for movement within said second frame means, stop members secured to the lower ends of said second frame means which engage said carriage assembly during initial upward movement of said second frame means for causing said carriage assembly to move upwardly in conjunction with said second frame means, carrying the chains over said sprockets and secured at one end to said carriage assembly and at their other ends to said second frame means, stop members being adapted to engage said cylinder cap after said second frame means have been raised a predetermined height for providing a reaction point whereby upon continued upward movement of said second frame means said chains will cause said carriage assembly to move upwardly at twice the speed that said second frame means moves.

3. For use with an industrial truck having an upwardly and downwardly movable load supporting carriage, the combination of a load elevating mechanism comprising, a first pair of spaced vertically extending channel members secured to said load supporting carriage, a second pair of channel members slidably mounted in said first channel members, a crosshead interconnecting said second channel members, a hydraulic assembly having a cylinder secured to said carriage and a piston rod secured to said crosshead, said cylinder having a cap, a carriage assembly mounted for movement within said second channel members, stop members secured to the lower ends of said second channel members which engage said carriage assembly during initial upward movement of said second channel members for causing said carriage assembly to move upwardly in conjunction with said second channel members, a collar member slidably mounted on said cylinder, sprockets rotatably carried by said crosshead, chains trained over said sprockets and secured at one end to said carriage assembly and at their other ends to said second channel members, stop members being adapted to engage said cylinder cap after said second frame means have been raised a predetermined height for providing a reaction point whereby upon continued upward movement of said second frame means said chains will cause said carriage assembly to move upwardly at twice the speed that said second frame means moves.
ends to said carriage assembly and at their other ends to said collar member, and said collar member being adapted to engage said cylinder cap after said second channel members have been raised a predetermined height for providing a reaction point whereby upon continued upward movement of said second channel members said chains will cause said carriage assembly to move upwardly at twice the speed that said second channel members move.

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