May 7, 1929. G. E. WEBB 1,711,510

SKIP ELEVATING MECHANISM

Filed June 14, 1923 4 Sheets-Sheet 1

Fig. 1.

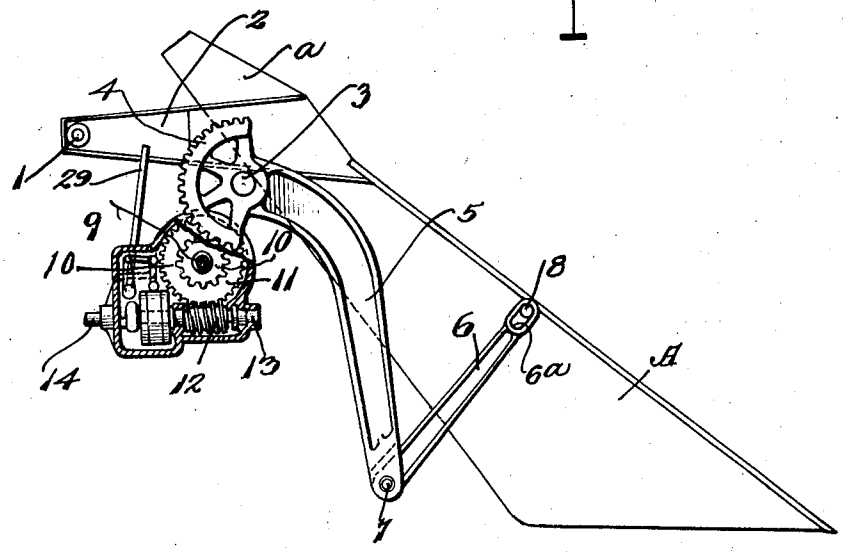
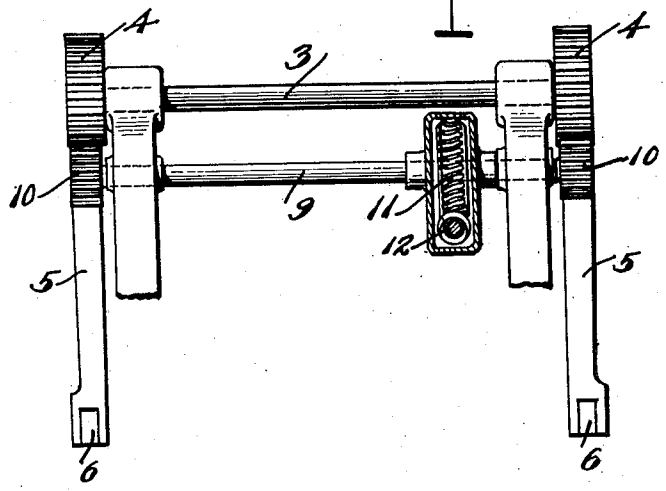


Fig. 2.



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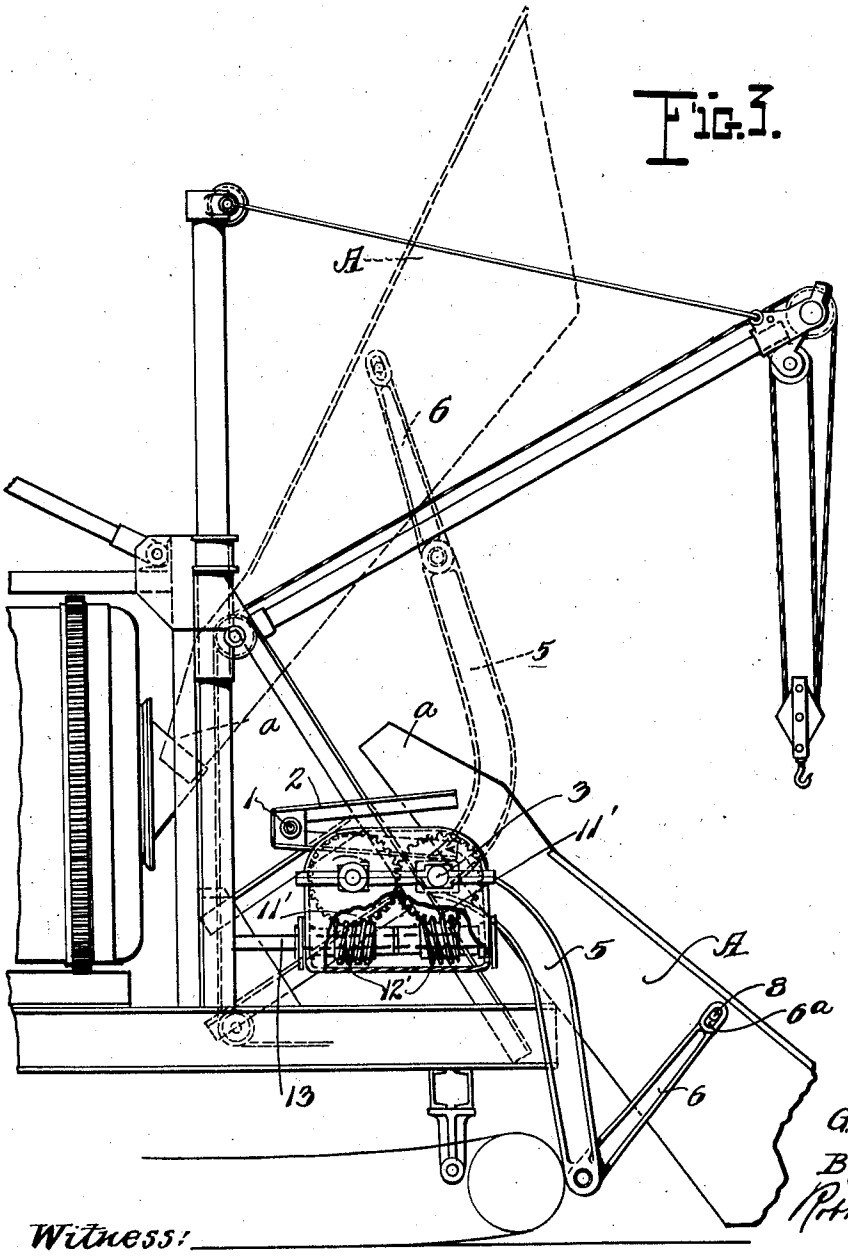
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SKIP ELEVATING MECHANISM

Filed June 14, 1923 4 Sheets-Sheet 2

Fig. 1.



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SKIP ELEVATING MECHANISM

Filed June 14, 1923 4 Sheets-Sheet 3

Fig. 4.

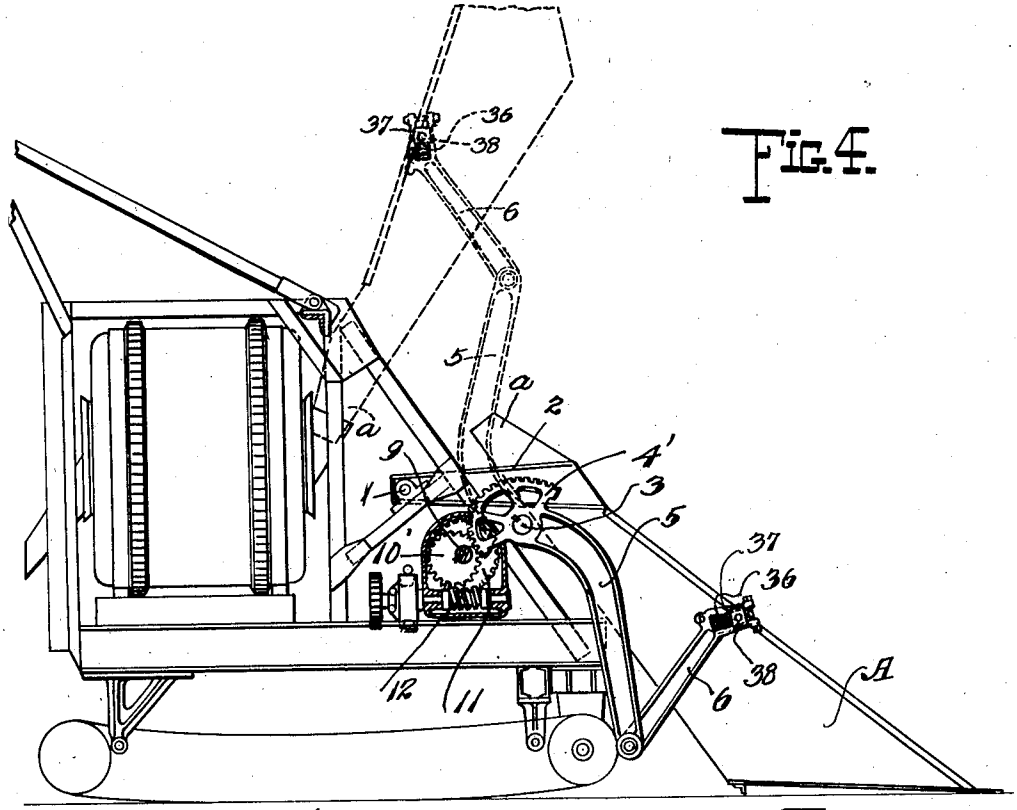
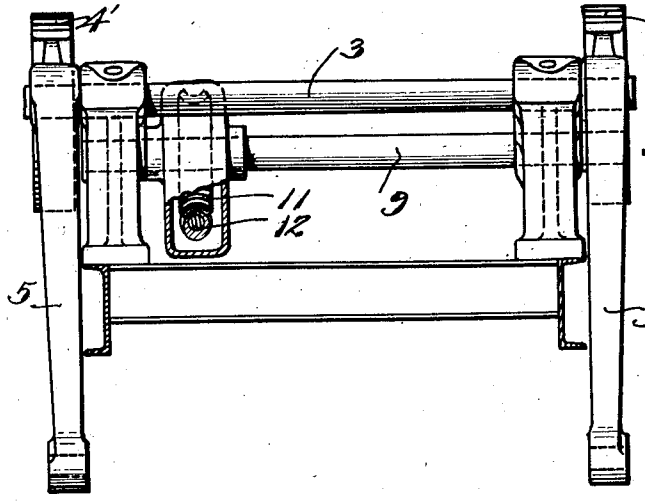


Fig. 5.



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SKIP ELEVATING MECHANISM

Filed June 14, 1923 4 Sheets-Sheet 4

Fig. 6.

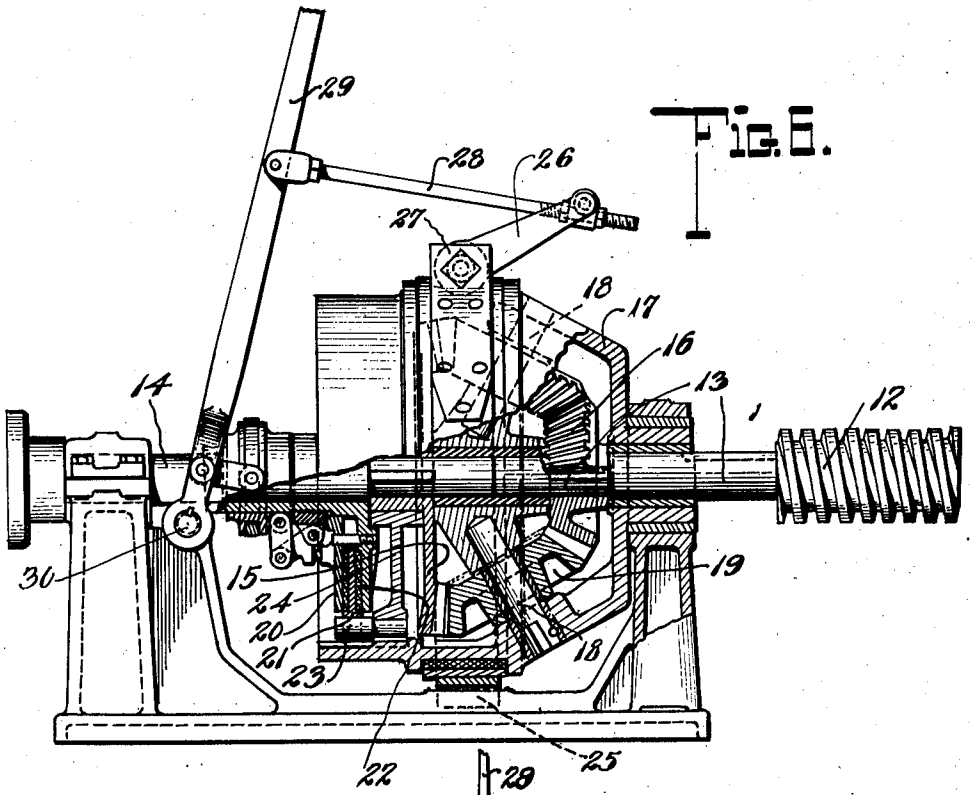
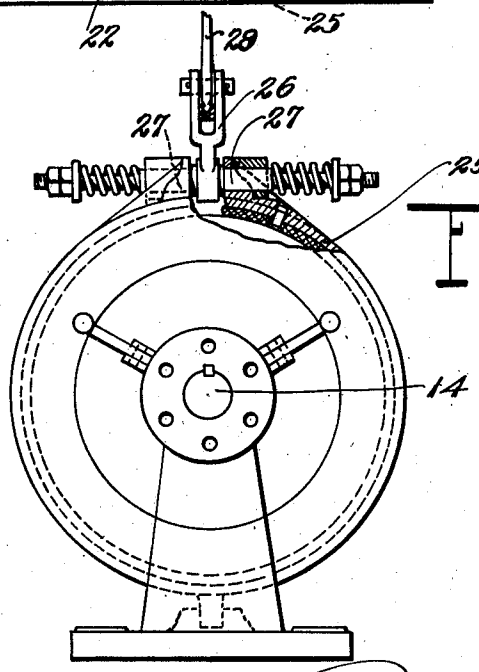


Fig. 7.



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Patented May 7, 1929. 1,711,510

UNITED STATES PATENT OFFICE.

GEORGE E. WEBB, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO KOEHRING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION.

SKIP-ELEVATING MECHANISM.

Application filed June 14, 1923. Serial No. 645,415.

For the loading of receptacles or machines disposed in an elevated position, as for instance a concrete mixer, it is customary to use a loading skip or hopper. This hopper is pivotally mounted at one end and in commercial practice today the common method of raising and lowering the same involves the employment of cables connected with the hopper or skip and adapted to be wound about suitable winding drums which are driven or released as required, to elevate and lower the skip, respectively. My invention has to do primarily with loading skips such as used on large or small concrete mixers, a primary object in view being to devise gearing for controlling the raising and lowering movements of the skip so as to do away with the elevating cables and drum mechanism heretofore employed. The cable winding means breaks at times, requires the use of safety appliances to protect against such breakage where the uttermost safety is desired, and the cables wear out in time necessitating their renewal. There are other disadvantages in the cable and drum hoisting means for skips of which those skilled in the art are advised.

I have designed special drive gearing with which to raise and lower a loading skip in conjunction with a novel and advantageous arrangement of lever and link lifting devices which when substituted for the old cable and drum mechanism enable the elimination of a considerable portion of the superstructure of the machine needed to properly train cables for the application of the lifting power. By the use of my gearing in practice I am thus enabled to do away with the expense and trouble of removing the superstructure aforesaid, which is done temporarily to facilitate the shipment of these larger machines with cable and drum lifting devices, and obviously the time and trouble of replacement of the superstructure when a machine arrives at the site where it will be used is avoided.

In the carrying out of my invention my gear driving devices are additionally advantageously designed so that I not only obtain a more reliable, durable and safer construction than those commonly now used, but I eliminate operations involving shocks due to the sudden application of the lifting power. I obtain through the design of my lever and linkage contrivances operated from my gearing, a peculiar preliminary slow lifting movement at the beginning of the elevating action of the skip, a subsequent acceleration for the larger portion of the raising movement, and, finally, a slowing down of the movement which at the last is synchronized with the movement of the material as it passes from the skip into the drum or receptacle to be charged by the latter. This synchronizing action is necessary where skips are used which embody relatively narrow or gradually tapering discharge ends that would otherwise tend to result in a choking of the skip were not provision made against such contingency.

By the use of my special gearing types of construction more fully presented hereinafter, there is a positive control of the lowering of the skip not obtained in the usual types of cable and drum apparatus, thus avoiding an element of danger or risk found in the operation of skips with the raising and lowering means at present so commonly utilized. With my invention the lowering movement of the skip is positively controlled at a uniform speed.

In my drawings I illustrate a number of variations of construction of my invention as I do not wish to be limited to any one specific construction within the purview of my broader claims. According to the illustrations in the drawings:

Figure 1 is a side view of a loading skip embodying one construction of my raising and lowering gear contrivances;

Figure 2 is a rear view of the same with the gear box shown in section;

Figure 3 is a view illustrating a gear mechanism corresponding somewhat with that of Figures 1 and 2 but wherein I employ intermeshing actuating gears and a plurality of actuating worms for said gears carried by a common driving shaft whereby special thrust bearings are avoided, the thrusts of the worms being self-contained, so to speak, or counter-balancing;

Figures 4 and 5 are side and sectional views somewhat like Figure 1 save that I utilize a modified form of gear mechanism involving an elliptic lifting gear member or operated by an eccentric gear and producing variable power ratios and speeds of the skip supplemental to the variable speeds obtained by the utilization of the peculiar lifting arm arrangement;

Figure 6 is a side view, certain parts broken away and shown in section, illustrating a planetary gear unit with controlling clutch and brake devices such as may be used with certain of my skip raising devices for obtaining the required power ratios and variable speeds in lifting and lowering the skip;

Figure 7 is a side view which shows somewhat more clearly the type of brake used in the construction of Figure 8.

Referring to the drawings for a full explanation of the various constructions of my invention, and first with reference to Figures 1 and 2, there is illustrated the skip A which is pivoted on the suitable fulcrum 1 by means of brackets 2 suitably affixed to the discharging end *a* of the skip A. At a point somewhat below the discharging end *a* of the skip A and intermediate the opposite extremities of the skip A is located a lifting gear shaft 3 on which are preferably mounted a pair of lifting gears 4 which are virtually gear sectors forming integral parts of lifting levers 5. The lifting levers 5 curve off laterally and downwardly from the gears 4 of which they are a part, and said levers 5 are of very substantial construction, as are the lifting links or arms 6 which are pivotally attached to their outer or free ends, the pivotal point of connection being designated 7. The lifting arms or links 6 are disposed at a somewhat acute angle to the levers 5 when the skip A is at rest or in its lowered position, and said arms 6 are attached in any substantial way, as at 8, by studs entering slots 6^a of the arms, to the skip A. The relative disposition of the levers 5 and their arms 6 is such that as the arms 5 are raised by outward movement the arms 6 tend to straighten in a manner which is more fully shown in Figure 3 where practically the same construction of these particular parts is utilized. On account of the disposition of the parts 5 and 6, a set of which will be located at opposite sides of the skip, to raise the latter in a substantially balanced condition and to facilitate, of course, the application of power in so doing there is a resulting initial slow movement of the skip A in elevating, an accelerated movement at the middle portion of the upward cycle of movement of the skip, and a retardation of movement as it approaches its final uppermost limit of movement.

Various means may be employed to operate the skip in raising and lowering and I have illustrated several such means, that shown generally in Figure 1 involving a driven shaft 9 which carries spur gears 10 in mesh with the lifting gears or gear sectors 4. The driven shaft 9 is operated by suitable gearing preferably involving a worm gear 11 engaged by the worm 12, the latter being fixed to a worm shaft 13.

Suitable clutch and brake mechanism are used to transmit the driving forces of a drive shaft 14 to the worm shaft 13 and this mechanism may be of the type best illustrated by Figures 6 and 7 wherein the drive shaft 14 and the worm shaft 13 are coaxial and adapted to be connected for operation at the same speed, and for operation of the shaft 13 at reduced speed, the slower speed being employed for the raising of the skip and the faster speed for the lowering of said skip. For practical purposes it is proposed by the gearing to raise the skip in a period approximating ten seconds and lower it in about five seconds, or half the time.

The clutch and brake mechanism intermediate the shafts 13 and 14 involves gearing of the reverse gear type and comprises a crown gear 15 keyed to the shaft 14, a bevel gear 16 keyed to the shaft 13 and spaced from the crown gear, a gear casing or carrier 17 having a plurality of studs or axes 18 supporting transmitting bevel gears 19 meshing with the gears 15 and 16 and disposed intermediate of them. The casing 17 is supported by the shaft 13 and by clutch mechanism involving a series of clutch disks or plates 20, 21 and 22, the member 21 being intermediate the other two plates and being connected at its outer end by clutch pins 23 with a closing plate 24 disposed between the crown gear 15 and the series of clutch plates 20, 21 and 22.

At its left end portion the casing 17 forms a housing for the parts 20 to 24 inclusive and the middle portion of the casing virtually constitutes a brake drum because encircling the same is a brake band 25, seen best in Figures 6 and 7, an actuating arm 26 with cams 27 being designed to be operated to apply the brake band 25 to the casing 17 and stop the casing from rotation. As the brake means is of a conventional type its action will be readily understood by any versed in the art of brakes. The actuating arm 26 for the brake is connected by a rod 28 to the hand lever 29 which is pivoted at 30. Said lever 29 is likewise connected by commonly used parts which are conventionally illustrated to shift the clutch mechanism to apply and disengage the clutch devices, comprising the several clutch plates previously mentioned.

When the lever 29 is in its vertical position at neutral the clutch parts are released and the drive from the shaft 14 to the shaft 13 is discontinued. By carrying the lever 29 to the left from its neutral position the brake means is applied by a tightening of the band 25 on the casing or carrier 17 and in this way the carrier is prevented from rotating. Under these conditions, since the crown gear 15 is keyed to the shaft 14 and the carrier 17 is held stationary, the rotation of the crown gear rotates the gears 19

and through them transmits the driving forces to the gear 16 keyed on the shaft 13. The shaft 13 and the worm 12 are thus driven at twice the speed of the shaft 14 owing to the gear ratios of the crown gear 15 and the bevel gear 16. The foregoing is the lowering speed for the skip so that the latter may be carried to its receiving or normal lowered position at twice the speed at which it is raised. To raise the skip the lever 29 is carried to the right from its neutral position, which results in a releasing of the brake band 25 from the casing or carrier 17 and throwing in of the clutch mechanism so that the casing or carrier 17 is clutched to the shaft 14, is thus driven at the same speed as the crown gear 15 is driven, wherefore the floating bevel gears 19 are turned with the carrier 17 and the gears 15 and 16 are practically locked together as one so that the shaft 13 is driven at a speed which corresponds with the speed of the shaft 14. Under these conditions, of course, the worm 12 transmits to the driven gear 11 the driving forces which will raise the skip at a uniform speed of the gearing, though the movement of the skip itself begins slowly, becomes accelerated, and then decreases at the final upward limit of movement, owing to the action of the parts 5 and 6 previously referred to.

In Figure 3 which illustrates a concrete mixer of the type of machine to be charged by the loading skip A, the operating gearing for controlling the raising and lowering of the skip is in a sense duplicative of the type of gearing shown in Figure 1, that is to say in the modification of Figure 3 I utilize a pair of the actuating gears 11′ intermeshing with one another and operated by worms 12′ on a common shaft 13′. I have omitted any illustration of control mechanism such as may be seen in Figures 6 and 7 to be applied to the gearing illustrated in Figure 3. My object in the arrangement of the worms and worm gears of Figure 3 construction is to eliminate any special thrust bearings as required in my other types of construction to resist the thrust of the worm and its supporting shaft. In other words, the thrusts of the worms 12′ of Figure 3 construction counterbalance one another and the tooth pressures on the gears 11′ are equally distributed.

Passing now to Figures 4 and 5, another construction of gearing is employed having novel functions. In this instance the levers 5 and links or arms 6 are like those previously described excepting that the lifting gears 4′ are practically segments of elliptic gears, are operated by the eccentric gears 10′ carried by the shaft 9. The shaft 9 is equipped with a gear 11 substantially like that previously described in the construction of Figure 1. The driving through the worm 12 is practically as heretofore set forth. With this special type of eccentric gear and elliptic gear sector members wherein the eccentric gears drive the gear members 4′ with a speed reduction of substantially eight to one, a number of desirable features of operation are attained, notably, a corresponding increase of torque in starting and a gradual increase in the raising speed of the skip. As the skip approaches its upper limit of movement the combined action of the gears and the linkage including the levers 5 and members 6 effects a retardation of the movement of the skip which is necessary for highest efficiency in order to synchronize the movement of the skip with the movement of the materials being discharged therefrom. Choking of the materials in the skip as they are discharged is thus prevented, as previously suggested. It will therefore be understood that with the elliptic and eccentric gear members as described, a decided variation in the speed of the skip from initial slow speed, to intermediate fast speed, and final slow speed, is achieved, all through a uniform actuating movement of the main actuating gear 11.

The links or arms 6 may be connected with the skip by special means illustrated in Figure 4, including shock absorbing springs 36 bearing against blocks 37 having bearings receiving the studs or pins 38 which project from opposite sides of the skip A. The purpose of this spring or resilient construction is to absorb the shock incident to starting upward movement of the skip, whether loaded or unloaded, it being borne in mind that the skip is lowered under control always to the extent that the power is always connected for the positive driving or movement of the skip.

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

1. In skip operating means, a loading skip, means supporting said skip for pivotal movement, levers pivoted between their ends, means connecting corresponding ends of the levers with the skip, means cooperating with the other corresponding ends of the levers to actuate the levers and raise the skip, the last mentioned means including a drive shaft, gears on said shaft cooperating with the levers, other drive gears on said shaft, and a driving worm mechanism for the last mentioned gears, the said gears between the shaft and levers being so formed as to impart to the levers initial slow, subsequent accelerated movements.

2. In skip operating means of the class described, in combination, a skip fulcrumed near one end thereof, means for raising the skip comprising levers pivoted near corresponding ends thereof and equipped at

such ends with gear sectors, means connecting the opposite corresponding ends of the levers with the skip, gear elements engaging the gear sectors of the levers at the first mentioned corresponding ends thereof, actuating gearing engaging said gear elements, the said gear sectors and gear elements being of varying gear ratios to impart to said skip initial and final slow with intermediate accelerated movements, and means for controlling the operation of said gearing for transmitting movement of the skip through the levers and other connections referred to.

3. In skip operating means of the class described, in combination, a skip, raising and lowering means therefor including levers, means for moving said levers, arms connecting the levers with the skip, and shock absorbing means intermediate said arms and the skip.

4. In skip operating means, a loading skip pivoted at one end, a support to which the skip is pivoted, lifting levers connected at one end with the skip, and operating means for the other ends of said levers comprising a gear set composed of a driven element for actuating the skip in one direction at a certain speed and gear elements cooperative with said driven element to actuate the skip in an opposite direction at a different speed, and means for controlling said gear set.

5. In skip operating means, in combination, a support, a skip pivoted at one end thereto, lifting levers pivoted between their ends to the support, means connecting corresponding outer ends of said levers with the skip, the other ends of said levers being provided with gear sectors, gears meshing with said gear sectors, and means for driving said gears including a worm and a gear set having means to actuate the worm at a relatively low speed for lifting the skip and other means for actuating the worm at a higher speed for lowering the skip.

6. In skip operating means, in combination, a support, a skip pivoted thereto, and means for elevating said skip comprising a pair of lifting levers, means cooperating with said levers to impart pivotal movement thereto, arms connecting corresponding ends of the levers with the skip and having movable connections with the latter, said movable connections comprising shock absorbing springs substantially as described.

7. In skip operating means, a support, a loading skip pivoted thereto, raising and lowering means for said skip comprising lifting levers, arms pivoted to said lifting levers, and connections between said arms and the skip including bearing blocks movably mounted on the arms, springs interposed between said bearing blocks and said arms and journaled pins projecting from the skip and having bearings in said bearing blocks substantially as set forth.

8. In combination, a support, a charging device mounted thereon for up and down movement, and actuating means including an element for moving said device at a predetermined speed in one of said movements and another element for moving the device at a different speed in the other of said movements and means for rendering one or the other of said elements operative.

9. In combination, a support, a charging device mounted thereon for up and down movement, and actuating means including operating means for moving said device at a relatively low speed in the upward movement and other means for moving said device at an increased speed in the downward movement, and means for making the respective operating means effective.

10. In combination, a support, a charging device mounted thereon for up and down movement, actuating means including an element for moving said device at a predetermined speed in one of said movements and an element for moving said device at a different speed in the other of said movements, means for rendering said elements operative, and separate means for periodically varying the speed during one of said movements.

11. In combination, a support, a charging device mounted thereon for up and down movement, actuating means including a low speed element for moving said device at a predetermined relative speed in one of said movements and a higher speed element for moving said device at a different speed in the other of said movements, and separate means for periodically varying the speed during both of said movements.

12. In combination, a support, a charging device mounted thereon, a source of supply of power, lifting devices for the charging device, transmission mechanism intermediate the power supply source and said lifting devices and comprising direction reversing means and speed changing means, and a mechanical speed changing gear unit intermediate said transmission mechanism and the lifting devices including a low speed element and a high speed element and means for rendering either of said elements operative.

In testimony whereof I affix my signature.

GEORGE E. WEBB.