Aug. 25, 1953 A. FINLAY ET AL 2,649,983

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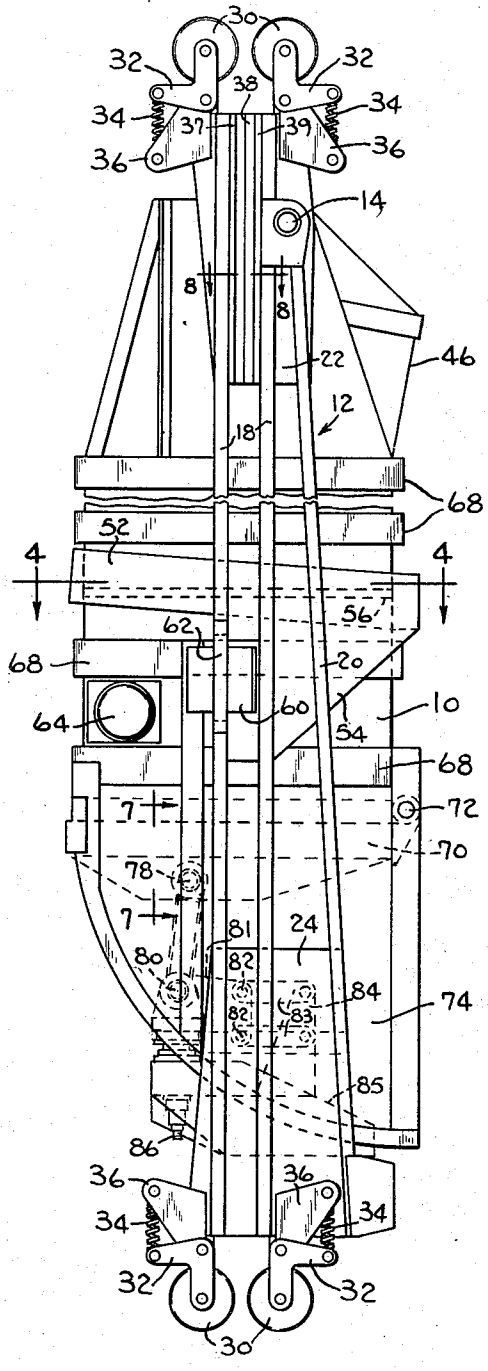


FIG. 1

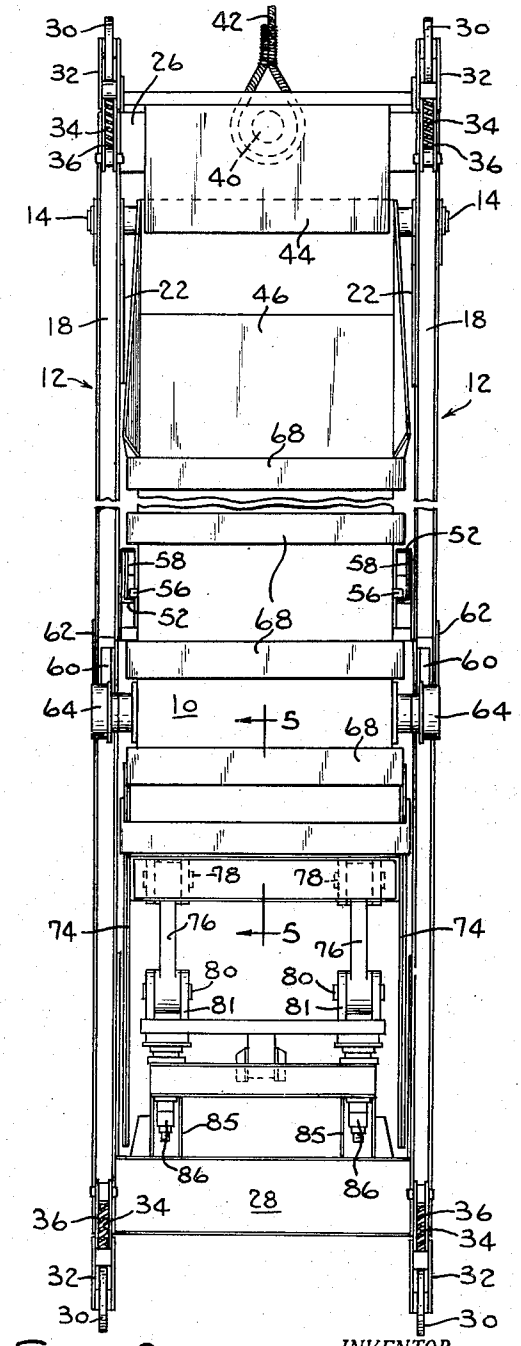


FIG. 2

INVENTOR.
ALEXANDER FINLAY
BY JAMES W. CLARK

John W. Michael

ATTORNEY

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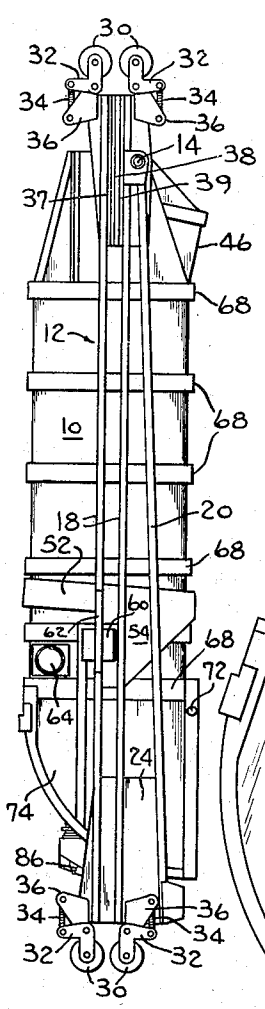


FIG. 9

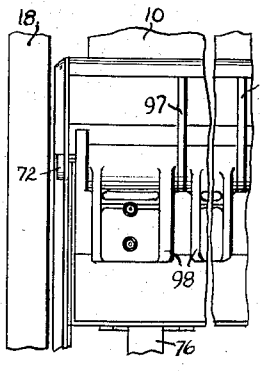
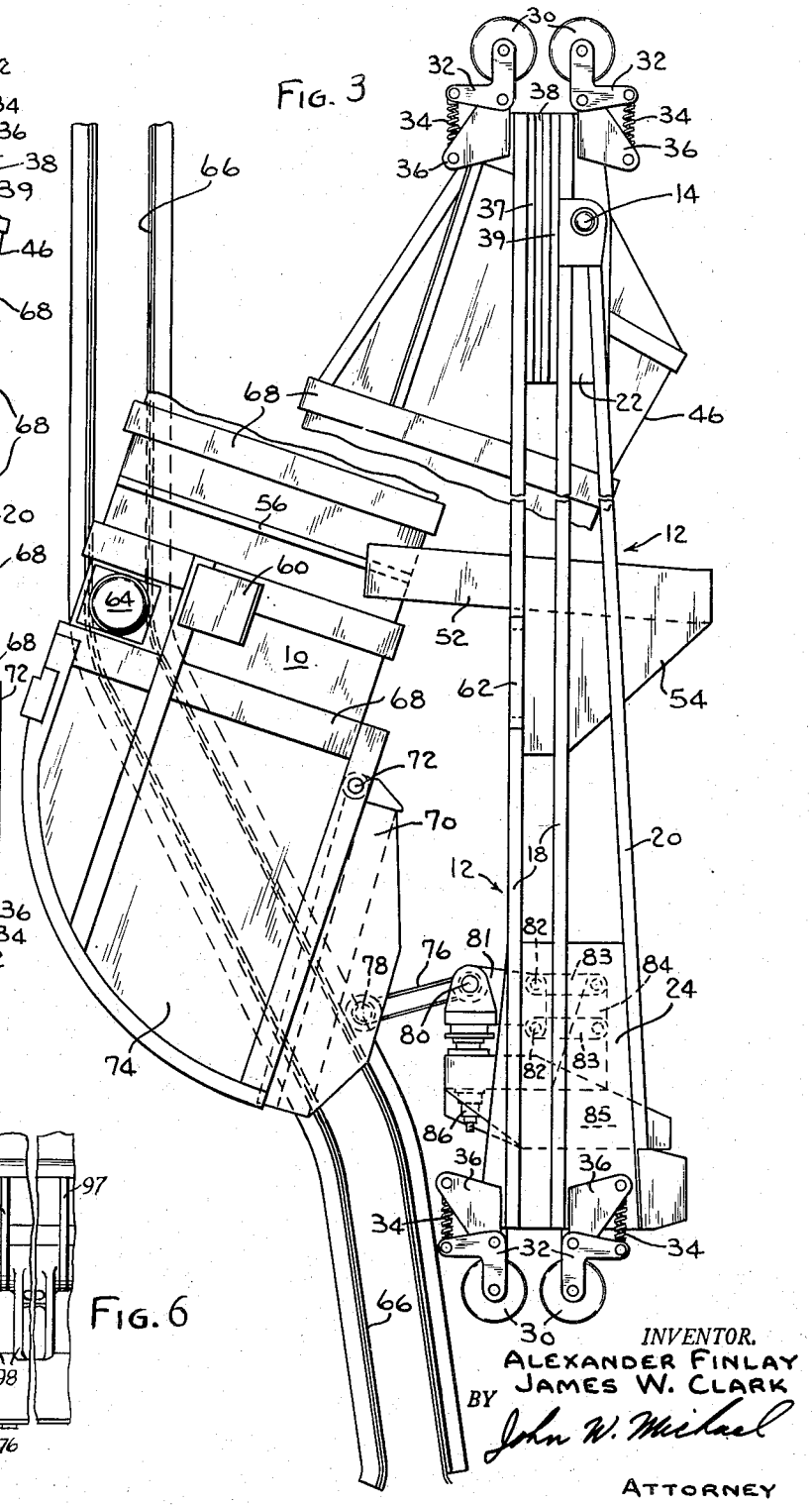


FIG. 6

FIG. 3



INVENTOR.
ALEXANDER FINLAY
JAMES W. CLARK
BY John W. Michael
ATTORNEY

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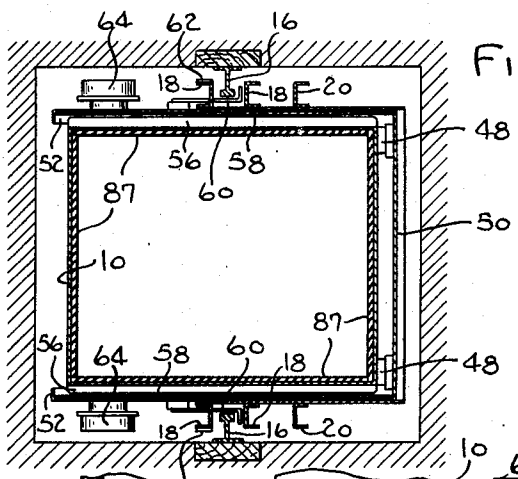


FIG. 4

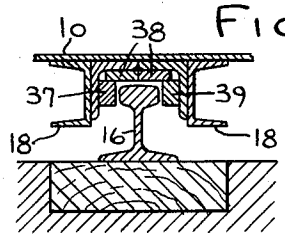


FIG. 8

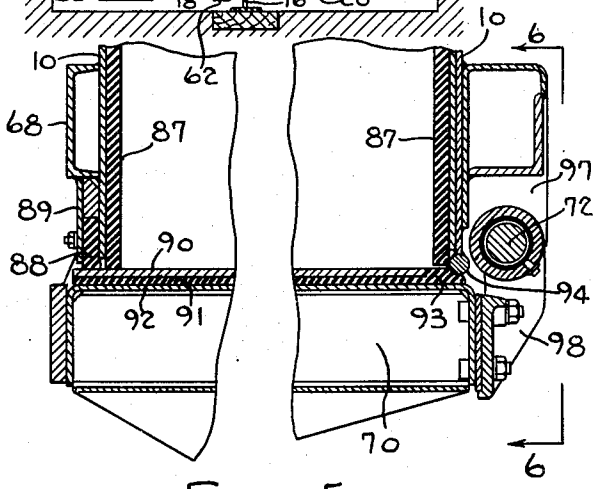


FIG. 5

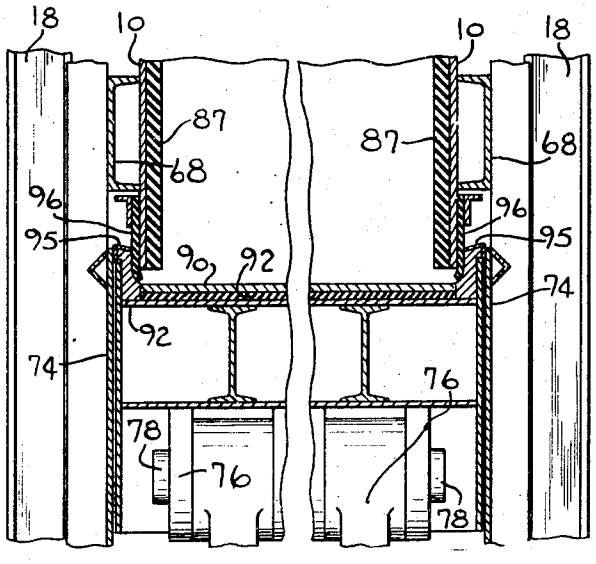


FIG. 7

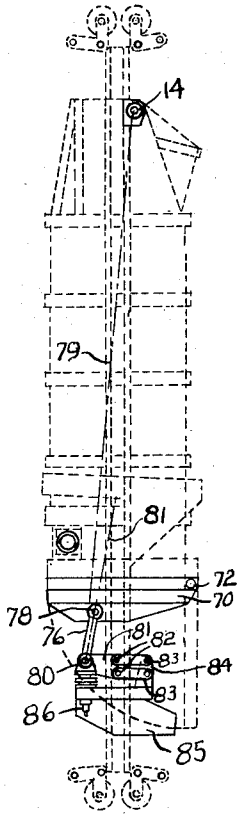


FIG. 10

INVENTOR.
ALEXANDER FINLAY
JAMES W. CLARK
BY John W. Michael
ATTORNEY

Patented Aug. 25, 1953

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SKIP

Alexander Finlay and James W. Clark, Marquette, Mich., assignors to Lake Shore Engineering Company, Iron Mountain, Mich., a corporation of Michigan

Application March 26, 1951, Serial No. 217,636

8 Claims. (Cl. 214—707)

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This invention relates to a skip which dumps from the bottom rather than the top.

The present skip is particularly advantageous in connection with shaft mines. The usual shaft mine employs two skips so reeved on the hoist mechanism that the weights of the skips offset each other. The conventional mine skip is overturned in the headframe to dump the ore into a bin over the crushers. Since the skip must be slowed down prior to entering the dump scrolls, which impart the overturn motion to the skip, and must be moved slowly while being overturned and returned to the guide timbers, the dump time of the duty cycle is quite long. When it is realized that under modern mining methods the output can easily exceed the capacity of the skips to hoist the ore to the surface, it is readily apparent that reducing the duty cycle time makes possible more cycles and increased production with little or no increase in labor.

An object of this invention is to provide a bottom dump skip which requires less dump time than the conventional skips. This reduced time has, in one case, indicated a possible 7½% increase in output by permitting the number of duty cycles per shift to be increased. The reduced time per duty cycle is also reflected in another situation. Thus it has been generally assumed that the limit of shaft depth was about 2500 feet since the time required to hoist ore to the surface from greater depths made operation uneconomical. Now, however, shafts may be sunk deeper and the mine still operated profitably. It is estimated that with the present skip the limit may be about 3500 feet. There are a number of mines in this country which have pretty well exhausted the ore to 2500 feet and which have high grade ore below that level.

Another object is to provide a skip which reduces the strains on the headframe and timbers and the necessary headframe height over the bins. Conventional skips severely stress the headframe and guide timbers going into and coming out of the dump position. Furthermore, the hoisting distance over the bin and, therefore, the headframe height over the bin is relatively great where the skip must be overturned. The present skip goes into and out of the dump position smoothly and the stresses on the headframe and guide timbers are greatly reduced. This means that new structures require less bracing, etc. with a consequent saving in steel and fabrication costs. In the case of old structures the existing headframe can now handle greater tonnage and the existing headframe height permits of larger skips which have such increased capacity.

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Another object is to provide a skip which maintains better counterbalancing on the hoist mechanism. Most of the weight of a conventional skip is carried by the dump scrolls in the dump position and the hoist is subjected to a greater load since the skips are not counterbalanced. Most of the weight of the present skip is carried by the hoist in the dump position and the hoist is, therefore, better counterbalanced.

A further object is to provide a skip which dumps clean and fast. This skip can handle wet, sticky ore without having the ore "hang up" on the sides of the skip when it is dumped.

Still a further object is to provide a bottom dump skip in which leakage and spillage is substantially non-existent.

Another object is to provide a bottom dump skip which has a simple, positive-acting door permitting compensation for wear and adjustment of its action.

Still another object is to provide a skip which travels smoothly in the timbers without whip or lash, thus making greater hoisting speeds feasible.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the single embodiment shown in the drawings, in which:

Fig. 1 is a side elevation of the skip with the middle portion broken away;

Fig. 2 is a front elevation of the skip shown in Fig. 1;

Fig. 3 is a fragmentary view of the skip in the dump scroll;

Fig. 4 is a section taken on line 4—4 of Fig. 1 and includes the guide timbers;

Fig. 5 is a fragmentary section on line 5—5 of Fig. 2;

Fig. 6 is a fragmentary view taken as indicated by line 6—6 on Fig. 5;

Fig. 7 is a fragmentary section on line 7—7 of Fig. 1;

Fig. 8 is a section on line 8—8 in Fig. 1 to show the wear bars cooperating with the timber;

Fig. 9 is a side elevation of the entire skip to give the relative proportions; and

Fig. 10 is a schematic view showing the skip pivot, door, and toggle mechanism in solid lines with the other parts of the skip in dotted line.

Referring to the drawings in detail, the skip comprises a body 10 pivotally supported by stringer 12 at pivot 14 to move from its normal position as shown in Figs. 1 and 9 to the dump position shown in Fig. 3 while the stringer remains engaged with the guide timbers or rails 16 fixed in the shaft. Stringer 12 is a framework com-

prising a pair of parallel spaced channels 18, 18 and a diagonal bracing channel 20 on each side of the body and interconnected at the top by means of a plate 22 welded to the channels and at the bottom by means of a plate 24. A transom channel 26 interconnects the side channels at the top of the frame and a similar transom 28 connects the bottoms. Wheels 30 are rotatably carried on bell cranks 32 at the top and bottom of the stringer frame to engage the guide timbers 16. Spring 34 is compressed between one end of crank 32 and support 36 to bias the wheels into contact with the timbers to yieldingly absorb shocks as the skip is hoisted in the shaft and reduce the strain on the timbers. Wear bars 37, 38, 39 may be mounted adjacent the top and bottom of each stringer frame to loosely engage the timbers as shown in Fig. 8. In large skips the wear bars may serve to limit movement of the stringer with respect to the timbers and in smaller skips the wear bars may be employed to the exclusion of wheels 30. These wear bars are preferably bolted or otherwise removably secured to permit their replacement when worn. Rope thimble 40 is mounted in the top transom 26 and receives wire rope 42 connected to the hoist mechanism.

The long skip body 10 is provided with an open top and front to permit rapid loading of the skip. Rubber deflector plate 44, hung from the transom, prevents ore from striking the thimble. Rearwardly and upwardly inclined plate 46 at the top opening prevents spillage during loading and catches falling ore, if any, in the shaft.

It will be noted that pivot 14 is positioned rearwardly of the vertical body axis. Therefore, the weight of body 10 biases the body into the stringer. A pair of stop blocks 48 are mounted on channel 50 extending across the rear of guide channels 52 welded to the inside of stringer channels 18 and 20 and suitably braced by means of plate 54, and limit rearward movement of the body. Guide channels 52, it will be noted, project upwardly at a slight angle and are adapted to cooperate with guide bar 56 welded to each side of body 10 to prevent uneven movement of the body out of the stringer frame as it moves to the dump position. Where desired, wear plate 58 may be removably mounted inside channel 52.

Immediately below guide channel 52 the front stringer 18 is partially cut out to permit angular latch plate 60 to pass through the channel to engage the back of the timber when the skip is in the shaft. The front stringer channel 18 is reinforced by plate 62 welded to the outside leg of the channel adjacent the cut-out portion. Since latch plate 60 normally co-acts with the guide timber as shown in Fig. 4 to prevent movement of the body toward the dump position, it will be appreciated that a portion of the guide timbers must be cut out in the proximity of the dump position to permit the latch plate to move through the opening as the body moves into its dump position. Thus when the dump rollers 64 at the lower front portion of each side of body 10 engage the dump scrolls 66 in the headframe, not shown, to start the movement of the body to its dump position, that portion of the guide timber adjacent latch plate 60 at the moment must be cut out to permit the latch plate to move through the opening. As the body returns to the stringers the latch plate again passes through the openings and latches the body with respect to the timbers.

The usual striker bars 68 are provided on body 10. Door 70 is mounted on pivot 72 positioned rearwardly and upwardly of the bottom edge of body 10 to allow the door 70 to move down and back from the opening when dumping, thus facilitating a "clean dump." In order to prevent spillage to the side as the door opens, the body is provided with depending, quadrant-like skirts 74.

The door opening and closing movement is regulated by means of links or levers 76 pivotally connected to the door at 78 and to adjustable supports 80 carried by plates 81 which are part of a parallel linkage. Thus pivots 82, 82 on each plate are connected to parallel links 83, 83 pivotally mounted on stationary uprights 84, 84. The uprights are welded or otherwise secured to stationary plates 85 mounted on bottom transom 28 and supporting adjustable pivot 80 on vertical adjustable jack screw apparatus 86 which permits vertical adjustment of the height of pivot 80 in a manner known in other machine arts. Actuation of the jack screw will move the pivot over a predetermined path to adjust the action of toggle lever 76 and compensate for wear. We have found that if the center of door pivot 78 is approximately one inch behind the imaginary line 79 connecting the centers of adjustable pivot 80 and body pivot 14 (see Fig. 10 where the upward divergence of imaginary line 79 and imaginary line 81 connecting the pivot 80 and door pivot 78 illustrates the rearward disposition of door pivot 78 when the door is closed) the desired toggle action will result to open the door slowly as the body starts toward the dump position and rapidly in later stages of the dumping action. Indeed, the toggle action keeps the door closed in the very early stage of movement. The toggle action allows the body to be moved over the lip of the bin before dumping starts. Furthermore, any body sway relative to the stringers in the shaft will not cause the door to crack open to spill ore down the shafts.

Fig. 3 illustrates the steep dumping angle of this skip which helps insure a clean dump with no ore hanging on the sides of the body. We have found that in the case of wet, sticky ore it may be beneficial to line the body with rubber sheets 87 secured at their upper edges and overlapping in the manner of clapboard siding to prevent ore hanging on the sides since they shake enough during the dumping action to dislodge all the ore therefrom.

The handling of wet ore raises another problem with respect to a skip of this type in that leakage from the bottom must be prevented. We employ various seals about the bottom opening dependent upon the location of the seal. The front of the bottom opening is provided with a rubber seal 88 bolted between body 10 and an auxiliary plate 89. This seal is adapted to be compressed by the steel plate 90 on the top surface of door 70 to seal the front edge of the opening. A piece of bar stock 94, welded bottom rear edge of the opening, compresses the thick portion 93 of rubber sheet 91 sandwiched between the top door plate 90 and the bottom plate 92 to seal the rear of the opening.

Referring now to Fig. 7, door 70 is wider than the body 10 and is provided with a scraper 95 at each side to clean ore from the inside of skirt 74 as the door closes. Rubber skirts 96, hanging on the outside of body 10, seal the space between the scraper and body 10 when the door is closed. The weight of the ore in the body

tends to force skirts **96** from this space and makes the seal more effective. It has been found that in some cases the labyrinth formed by means of the projection of the scraper edge **95** above the lower edge of the body serves to effectively seal the bottom edge without the use of skirt **96** or other means even though the ore may be wet. It appears that the weight of the ore compacts the ore at this opening to such an extent that leakage is substantially precluded. The adjustability of the door afforded by the jack screws permits maintenance of a tight metal-to-rubber seal about the door at all times.

As pointed out above, scrapers **95** on each side of the door clean off the inside of skirts **74** as the door closes. It will be noted that the space above the scraper and skirts **74** is open to permit any ore picked up by the scraper to fall free and avoid jamming the closure. As mentioned above, the position of door pivot **72** above and behind the body opening allows the top surface of the door to move downwardly and rearwardly out of the path of the falling ore. In order to prevent injury to the door hinge by virtue of ore becoming lodged therein, we support the pivot **72** in an open manner as may be seen in Figs. 5 and 6 to allow ore to fall free of the pivot. Thus the body hinge ears **97** and the door hinge ears **98** are spaced apart to leave ample room for any ore which might tend to hang up at the pivot to fall free.

Since the dump scrolls **66** (Fig. 3) impart dumping movement to the skip gradually the present skip can be "brought into" the scrolls faster than usual. The body travels a short vertical and horizontal distance in the scrolls to reach the full dump position at an angle which is much steeper than ordinarily found. The steep dump angle in combination with the straight walls insures a clean, fast dump, and the ability to bring the skip into and out of the scrolls rapidly with little travel adds to the time saved.

As pointed out above, the smooth action in the scrolls reduces the strain on the headframe and guide timbers (the tremendous "kick" or blow delivered to the timbers by a conventional skip is eliminated) with the savings noted. The steep dump angle keeps most of the load on the rope to maintain better counterbalancing. The reduced vertical height required in the headframe is of importance in new or old shafts.

It will be appreciated that a bottom dump skip must be free from leakage in transit and while dumping. In addition to effecting a water-tight seal for the bottom door, the door must be provided with a safe, fast operating mechanism which holds the load safely and has desirable door opening characteristics. The toggle mechanism described above holds the door shut until the body is over the bin, at which time it opens at a progressively faster rate. The entire door apparatus may be adjusted to suit the characteristics to the installation, and the mechanism is readily accessible for maintenance and repair. The toggle action has a further advantage in that the weight of the ore on the door acts to hold the door shut rather than tending to open the door. When it is realized that 15 tons of ore may rest on the door, the desirability of such positive action will be apparent.

It will be appreciated that various changes may be effected in the instant design without departing from the spirit of the invention.

Therefore this invention is not to be limited to the disclosed embodiment but is to be limited only by the scope of the claims.

We claim:

1. A bottom dump skip comprising, a stringer adapted to be guided by the shaft timbers and to support a skip body, a skip body pivotally supported in said stringer adjacent its upper end to permit the bottom of the body to swing forwardly of the stringer, said body having straight interior walls and an open bottom, a door pivotally mounted at the rear of the body and adapted to seat on said bottom, and an arm pivotally connected to said stringer and to said door to actuate the door in response to the pivotal movement of the skip body relative to the stringer, said pivotal connection between the arm and the door, when the door is closed, being disposed rearwardly of an imaginary line drawn between the skip pivot and the pivotal connection between the arm with the stringer, and movable forwardly across said line as the door opens thereby to provide a toggle action for the opening and closing movements of the door as the skip swings forwardly and rearwardly on its pivot.

2. A skip according to claim 1 in which the pivotal connection between said arm and said stringer is carried on a parallel linkage swingable about axes parallel to the axis of the pivotal connection between the arm and the stringer for permitting of vertical and transverse adjustment of the location of the pivotal connection for proper toggle action, and means for adjusting the location of the pivotal connection between the arm and the stringer.

3. In a skip according to claim 2, metal-to-rubber seal means between the door and said bottom to prevent leakage when the door is closed, the adjustability of the pivotal connection between said arm and said stringer permitting said seal means to be maintained tight.

4. A skip according to claim 1 provided with skirts depending from the body to prevent lateral spillage as the door opens, scraper means carried by said door to scrape ore from the interior skirt surfaces as the door closes, and lateral openings above said skirts to permit ejection of ore scraped from the skirts.

5. A skip according to claim 4 in which said skirts are slightly spaced laterally of the side walls of the skip and said scraper means project above the bottom of said body and between the exterior of the body and said skirts when the door is closed against the bottom of the body.

6. A bottom dump skip having an open-ended body, a door for the bottom of the body, said door being connected to the body by means of a hinge positioned upwardly and rearwardly of the bottom of the body, a rubber seal depending from the bottom front edge of the body to serve as a seat for the door, the sides of the door projecting above the bottom of the body on the outside of the body when the door is seated on said seal, and the back of the door contacting the bottom back edge of the body.

7. A skip comprising, a stringer frame adapted to be guided by the shaft timbers, an open-ended body of substantially uniform cross-section pivotally supported adjacent its upper end in said frame for swinging movement to a dumping position, dump rollers on said body adapted to engage stationary dump scrolls to swing the body to the dump position as the stringer frame is raised, a door pivotally mounted to seat on the

bottom of the body, and toggle acting arms pivotally connected between the door and the frame for operating the door as the body swings to and from the dump position, the pivot points of said arms with the door being disposed, when the door is closed, rearwardly of an imaginary line drawn between the skip pivot and the axis of the pivotal connection of the arms with the stringer frame and movable forwardly across said line as the door moves to open position, whereby the arms act to hold the door closed in the initial portion of the body movement to the dump position and to open the door at a progressively more rapid rate in the final portion.

8. A skip comprising, a stringer adapted to be guided by the shaft timbers, an open-ended body of substantially uniform cross-section pivotally supported in said stringer adjacent its upper end and rearwardly of its center of gravity, stop means mounted on said stringer below the body pivot to prevent movement of the body rearwardly into the stringer beyond its vertical position, dump rollers on the sides of said body for

engaging dump scrolls in the headframe to pivot the body forwardly out of the stringer, a door pivotally mounted on the bottom of the body to close same, and a toggle arm connected to said door and to said stringer to actuate the door in response to body movement.

ALEXANDER FINLAY.
JAMES W. CLARK.

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