Aug. 1, 1967 P. C. O'LEARY 3,333,658

SELF-ALIGNING SKIP HOIST FOR USE IN SINKING SHAFTS

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FIG. 1

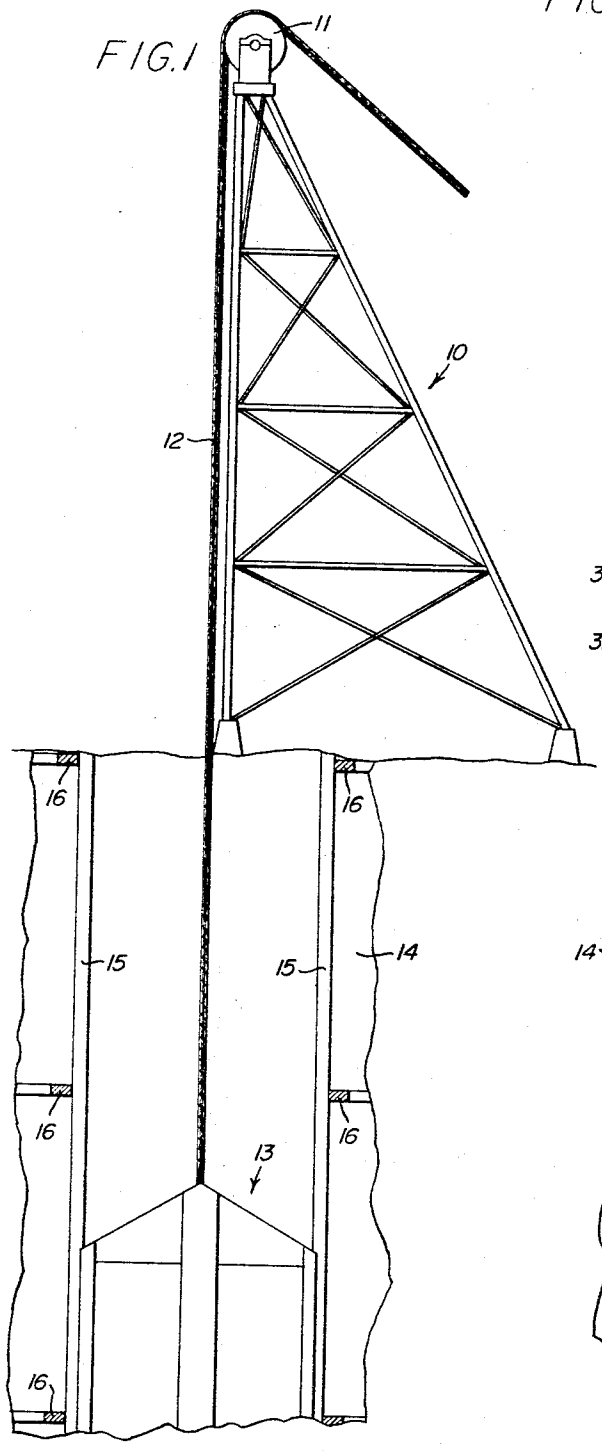

FIG. 2

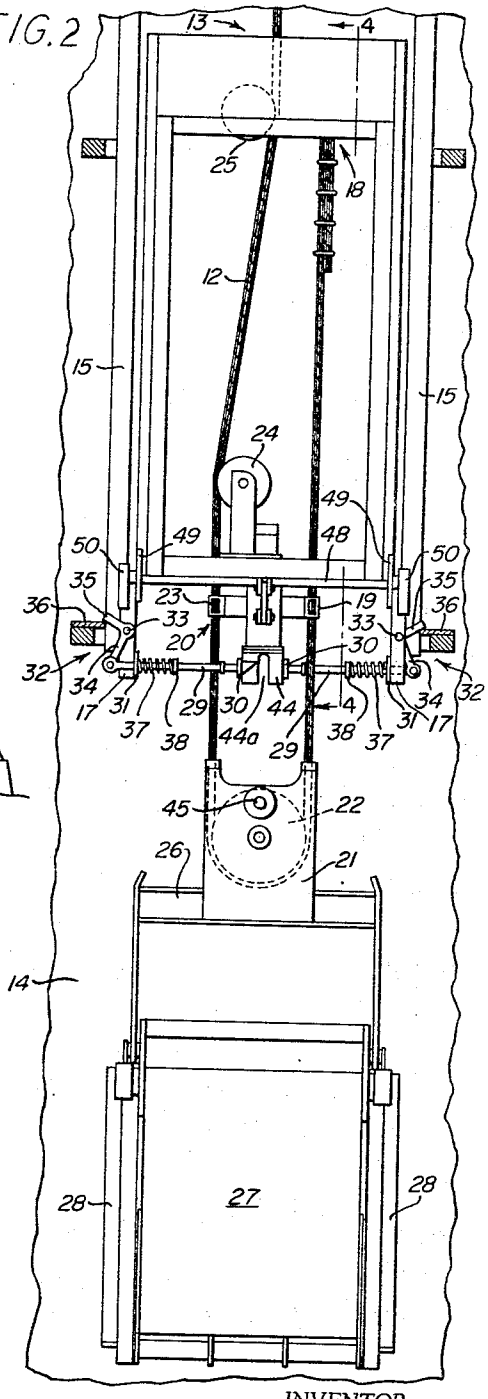

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FIG. 3.

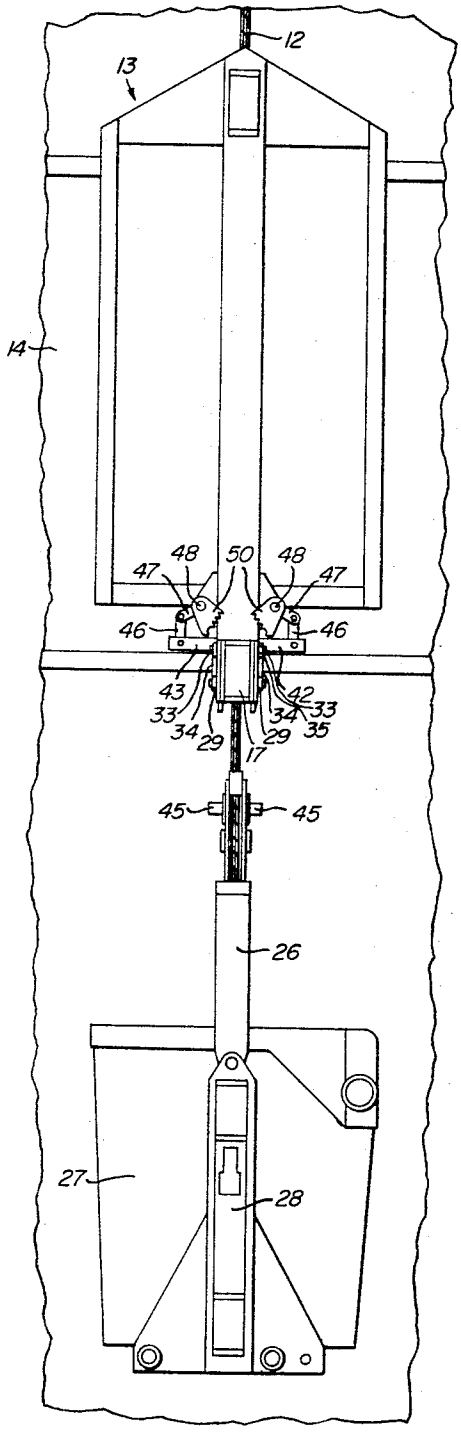


FIG. 4.

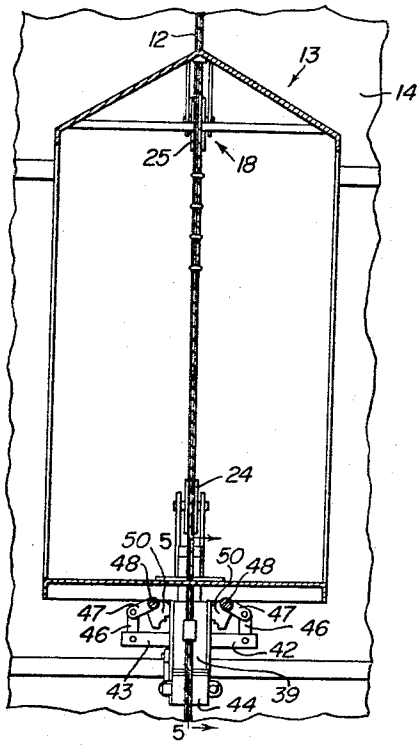
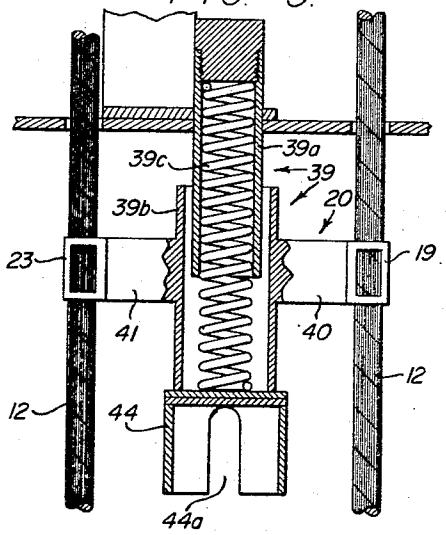


FIG. 5.



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SELF-ALIGNING SKIP HOIST FOR USE IN SINKING SHAFTS

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9 Claims. (Cl. 187—96)

This invention relates to hoisting apparatus used in sinking shafts for mines or the like. More particularly, it is concerned with improving skip hoists of the type previously disclosed in U.S. Patent No. 2,937,773, issued May 24, 1960, to Roger V. Pierce et al., and in the pending application for U.S. patent, Ser. No. 307,398, filed Sept. 9, 1963, by Lawrence A. James, now Patent No. 3,227,245.

In Patent No. 2,937,773 there is disclosed a skip hoist constructed to automatically engage guide shoes on a skip or bucket with guide rails vertically mounted on timber sets extending into a shaft. This apparatus has been found to be a great improvement over the earlier known skip hoist structures wherein skips were manually engaged with their guide rails. As noted in the aforementioned application No. 307,398, however, it is desirable to have a skip hoist that does not require a plurality of guide cables to limit the distance below the headframe that the skip can travel, nor a high and individually designed headframe. In that application there is disclosed a skip hoist employing a single cable which passes down through a guide cam carried by a crosshead, and that terminates at a cam follower carried by a skip. As the skip is moved into engagement with the crosshead the cam follower engages the cam and the skip is properly positioned so that guide shoes mounted thereon will be in alignment with guide rails in the shaft being sunk. Latch means are provided to hold the skip and crosshead in coupled relationship during their simultaneous travel in the shaft and to release the skip from the crosshead only when trip actuators contact landing chairs positioned at the bottom of the guide rails.

As with the invention disclosed in the aforementioned application No. 307,398, objects of the present invention are to provide a single cable type skip hoist wherein a standard low-height headframe is used to raise a crosshead and skip that are automatically coupled together for travel along guide rails in a shaft, and to provide means for releasing the skip from the crosshead only when the crosshead is positioned at the bottom of the guide rails.

In addition, to further insure the safety of those individuals engaged in the mucking operation at the bottom of the shaft, the present invention is also concerned with preventing dangerous spin of the skip, maintaining the skip in a guided relationship, and automatically reducing the rate of movement of the skip as it travels separately beneath the crosshead.

An outstanding feature of this invention is the manner in which a single hoisting cable is used to prevent dangerous spinning of the skip, to provide a guide for the skip, and to reduce the rate of movement of the skip as it travels separately beneath the crosshead. This is accomplished by passing the hoisting cable down through the crosshead and around a cable guide member connected to the skip. The caple is then passed back up to the crosshead where it is securely anchored.

The support means on the skip is preferably a sheave, positioned in a sheave housing that is mounted on the bail of the skip, and the cable preferably passes through guides carried by the crosshead both before and after it passes around the sheave.

The safety-type crosshead is actuated to release itself

for sliding movement along the guide rails in response to contact by the sheave housing, and safety rods carried by the crosshead hold the skip in engagement with the crosshead until actuators connected to the rods are pivoted by their contact with landing chairs at the bottom of the guide rails to move the rods to a release position.

There is shown in the accompanying drawings a specific embodiment of the invention representing what is presently regarded as the best mode of carrying out the generic concepts in actual practice. From the detailed description of this presently preferred form of the invention, other more specific objects and features will become apparent.

In the drawings:

FIG. 1 is a fragmentary side elevation of the skip, skip-hoist and headframe in use;

FIG. 2, a front elevation of the skip and skip-hoist, with the skip shown below the lowermost position of the headframe;

FIG. 3, a side elevation;

FIG. 4, a fragmentary vertical section taken on the line 4—4 of FIG. 2; and

FIG. 5, an enlarged, fragmentary vertical section taken on the line 5—5 of FIG. 4.

Referring to the drawings:

In the illustrated form of the invention a headframe **10** supports a sheave **11**, over which a hoisting cable **12** passes. Cable **12** is connected at one end to a conventional powered reel, not shown, and at its other end to a crosshead **13**, that is adapted to be raised from, and lowered into, a mine shaft **14**. Vertical guide rails **15** are fixed to reinforcement timbering **16** of the usual timber sets and extend downwardly into the shaft and guide shoes **17** (FIG. 2) at opposite sides of crosshead **13** slidably engage guide rails **15** during travel of the crosshead within the shaft.

Hoisting cable **12** extends downwardly from its connection at **18** with crosshead **13**, through a guide **19** carried by a spider **20**, and into a sheave housing **21**, around a sheave **22** that serves as a cable guide member, up through another guide **23** carried by the spider **20**, and past guide pulleys **24** and **25** to the reel, not shown.

Sheave housing **21** is fixed to a bail **26** of a skip **27**, so that pulling on the end of cable **12** connected to the reel will raise the sheave, the sheave housing, and the skip. Similarly, releasing the cable will allow the sheave, sheave housing, and skip, to drop in the shaft.

Skip **27** is of usual construction and has guide shoes **28** at opposite sides thereof adapted to engage the vertical guide rails **15**. As the skip is raised from the bottom of the shaft by the reeling in of cable **12**, shoes **28** are maintained in aligned relationship with rails **15** by the cable **12** passing through guides **19** and **23**. This arrangement effectively provides a double guide cable beneath the crosshead that prevents undesired swinging and rotation of the skip when it is below the ends of rails **15** and, automatically reduces the speed of travel of the skip when it is disengaged from the crosshead to one-half the take-up speed of cable **12**.

Safety rods **29** are provided to prevent undesired separation of the skip and crosshead during their travel along the guide rails. The safety rods are each guided for reciprocation through brackets **30** and **31** mounted on spider **20** and the crosshead, respectively. Actuator cranks **32** are pivotally mounted to the crosshead at **33** and include arms **34** pivotally connected to the ends of the safety rods adjacent the brackets **31**. The other arms **35** of the actuator cranks extend outwardly from the crosshead and are adapted to engage landing chairs **36** positioned on the reinforcement timbering at the lowermost ends of the guide rails. Springs **37**, posi-

tioned between the brackets **31** and collars **38** fixed on the rods, normally bias the rods toward spider **20**.

Spider **20** includes a central hub **39** (FIG. 5) from which arms **40** and **41**, that respectively carry guides **19** and **23**, and arms **42** and **43** (FIGS. 3 and 4) radiate. The central hub is constructed of an inner telescoping tubular member **39***a* and an outer telescoping tubular member **39***b*, with a spring **39***c* between them. Inner member **39***a* is fixed to the crosshead and the arms **40** and **41**, and **42** and **43** are fixed to outer member **39***b*.

A cup shaped member **44** preferably extends downwardly from outer member **39***b* and has slots **44***a* in the sides thereof to receive rods **45** that extend outwardly from the faces of sheave housing **21**. Rods **45**, cooperate with the safety rods **29** to prevent undesired separation of the crosshead and skip, as will be further explained.

In operation the skip and crosshead are lowered in coupled engagement into the shaft. At this time a lifting or holding force is being applied by the hoisting cable to the skip, and through the skip to the crosshead. Thus, guides **19** and **23** rest on the sheave housing **21**, and outer member **39***b* is moved upwardly with respect to inner member **39***a*, thereby compressing spring **39***c*. This also moves arms **42** and **43** upwardly with respect to the crosshead.

Arms **42** and **43** are each pivotally connected to a link **46**, the other end of which is pivotally connected to an outwardly extending finger **47** of a rod **48**. The rods **48** are journaled through mountings **49** (FIG. 2) on the crosshead and extend completely beneath the crosshead, with their ends terminating adjacent the guide rails. Safety dogs **50** are fixed on each of the ends of the rods to grip the guide rails and to prevent falling of the crosshead should slack develop in cable **12**.

When there is tension on the cable, and the skip is in engagement with the crosshead in the manner previously described, arms **42** and **43** are moved upwardly with respect to the crosshead and through links **46** and fingers **47** the rods **48** are rotated and the safety dogs are pivoted outwardly such that clearance is provided between the dogs and the rail. The coupled crosshead and skip are then free to travel within the shaft.

Should slack develop in line **12**, spring **39***c* will move arms **42** and **43** downwardly with respect to the crosshead, thereby pivoting dogs **50** inwardly such that their teeth **50***a* securely grip the guide rails. If this occurs during the time that the skip and crosshead are coupled together the skip can drop away from the crosshead only the short distance necessary for actuation of the safety dogs before rods **45** land on safety rods **29** and the fall of the skip is stopped.

When the crosshead and skip are lowered to the bottom of the guide rails, and arms **35** contact landing chairs **36**, actuator cranks **32** are pivoted to withdraw safety rods **29** from beneath rods **45**. The skip is then free to move away from the crosshead and spring **39***c* biases the safety dogs to their rail gripping position. The skip will then continue its downward travel at one-half the speed at which cable **12** is payed out.

After the skip is filled it is raised into engagement with the crosshead, the safety dogs are released, and the crosshead and skip are raised to the top of the shaft together, all as has been previously described.

Whereas there is here illustrated and specifically described a certain preferred construction of apparatus which is presently regarded as the best mode of carrying out the invention, it should be understood that various changes may be made and other constructions adopted without departing from the inventive subject matter particularly pointed out and claimed herebelow.

I claim:

1. A skip hoist for use in sinking a shaft having guide rails terminating short of the bottom of the shaft and a hoisting device located at the top of the shaft, said skip hoist comprising

a crosshead having guide-rail-engaging means adapted to anchor such crosshead adjacent to the lower ends of the guide rails of the shaft;

a skip having guide shoes adapted to engage said guide rails and to be disengaged therefrom when said crosshead is anchored adjacent to the lower ends of the guide rails;

means for releasably attaching said skip to said crosshead;

a cable guide member carried by said skip;

means, including a hoisting cable for raising and lowering said skip below the guide rails and for moving said skip and said crosshead together along the guide rails;

guide means carried by the crosshead;

means for attaching one end of said hoisting cable to the hoisting device, said cable extending downwardly through said crosshead and the guide means carried thereby and around said cable guide member; and

means fixing the other end of the said hoisting cable to said crosshead.

2. The skip hoist of claim **1**, wherein said guide means includes a pair of spaced guides carried by the crosshead, the cable passing down through one of the guides before passing around the support means on the skip and up through the other of said guides before being fixed to the crosshead.

3. The skip hoist of claim **1**, wherein the skip includes a bail; a sheave housing is mounted on said bail; and the cable guide member on the skip comprises a sheave positioned in said sheave housing.

4. The skip hoist of claim **1**, wherein the guide-rail-engaging means includes pivoted dog members carried by said crosshead; means biasing said dog members into a guide rail engaging position; and means responsive to contact of the skip with the crosshead for moving said dog members into a position whereat they release the guide rail.

5. The skip hoist of claim **4**, wherein the means for releasably attaching the skip to the crosshead includes latch means carried by the crosshead for holding said skip in engagement with the crosshead, and wherein said latch means includes at least one acuator crank adapted to engage a landing chair at the lower end of the guide rails, whereby said skip is released from engagement with said crosshead.

6. The skip hoist of claim **5**, wherein the guide means carried by the crosshead includes a pair of spaced guides carried by the crosshead, the cable passing down through one of the guides before passing around the support means on the skip and up through the other of said guides before being fixed to the crosshead.

7. The skip hoist of claim **5**, wherein the skip includes a bail; a sheave housing is mounted on said bail; and the cable guide member on the skip comprises a sheave positioned in said sheave housing.

8. The skip hoist of claim **7**, wherein the guide means carried by the crosshead includes a pair of spaced guides carried by the crosshead, the cable passing down through one of the guides, around the sheave, and up through the other of said guides before being fixed to the crosshead.

9. A skip hoist for use in sinking a shaft having guide rails terminating short of the bottom of the shaft, comprising

a crosshead having guide-rail-engaging means adapted to anchor such crosshead adjacent to the lower ends of the guide rails;

a skip having guide shoes adapted to engage said guide rails and to be disengaged therefrom when said crosshead is anchored adjacent to the lower ends of the guide rails;

means for releasably attaching said skip to said crosshead;

a cable guide member carried by said skip;

a hoisting device located at the top of the shaft;

means, including a hoisting cable for raising and lowering said skip below the guide rails and for moving said skip and said crosshead together along the guide rails;

guide means carried by the crosshead;

means attaching one end of said cable to said hoisting device, said cable extending downwardly therefrom through said crosshead and the guide means carried thereby and around said cable guide member; and

means fixing the other end of said cable to said crosshead.

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