This invention relates to equipment for the removal of spoil from a mine shaft during sinking operations.

Broken rock in shaft sinking is frequently removed by manually shovelling it into hibbles which are raised to carry the rock to the surface. This is known as lashing and this term will be used in the description of the invention. In the past it has been laborious and often dangerous work owing to the confined space and the nature of the material handled.

It is the object of this invention to provide apparatus by the use of which lashing of spoil such as broken rock from the bottom of a mine shaft will be facilitated and the time taken for such operation considerably reduced.

According to this invention there is provided shaft sinking lashing gear comprising a column adapted to be supported from the two lowest decks of a shaft sinking staging by two collars, a boom secured to and extending outwardly from the column below the lower collar for supporting a grab mechanism and means for rotating the column within the collars.

Further features of this invention provide for the upper collar to include an angular contact bearing and for the lower collar to include a roller bearing.

The invention also provides for the means for rotating the column to be a pinion engaging an internal ring gear made integral with the angular contact bearing, the pinion being driven by an air motor.

Still further features of this invention provide for the grab mechanism to be supported from a collar adapted to traverse the length of the boom and for the operator's cabin to be positioned in the base of the collar below the boom.

A preferred form of this invention will be described with reference to the accompanying drawings in which:

FIGS. 1 and 2 are elevational views of the lashing gear, FIG. 3 a section on the line A—A in FIG. 1 showing the lower collar on a larger scale, FIG. 4 a section on the line B—B in FIG. 1 on a larger scale, with the top cover removed from the boom, FIG. 5 a diagram of the grab cable arrangement, FIG. 6 a detail of the upper collar and boom rotation gear, and FIG. 7 is a detail of one roller in the lower collar.

As shown the lashing gear consists essentially of a central hollow column 1 to which are secured an upper and a lower collar 2, 3 respectively. These collars 2, 3 are adapted to support the column from the two lowest decks 4, 5 of a shaft sinking staging which is itself adapted to be lowered down the shaft as sinking operations progress. A boom 6 extends outwardly from and is secured to the column 1 below the lower collar 3 and the bottom deck 5 of the staging. This boom supports a traversing carriage 7 from which is suspended a mechanical grab 8 which is preferably pneumatically operated.

The boom 6 is adapted to be rotated by rotation of column 1 within the collars 2, 3 and the grab 8 is raised and lowered by means of a pneumatic piston and cylinder assembly 9 housed within the column 1 and through a particular arrangement of a cable 10.

An operator's cab 11 is formed in the base of the column 1 from where the various operations of the lashing gear may be controlled.

The upper collar 2 consists of a mounting 12 secured to the deck 4 of the staging and incorporates an angular contact bearing 13 capable of carrying the load of the lashing gear both axially and radially (see FIG. 6). The inner race 14 of the bearing 13 is made integral with a fixed internal ring gear 15. The gear 15 is engaged by a pinion 16 driven through an all steel gearbox 17 by an air motor 18. The motor 18, gearbox 17 and pinion 16 are supported on the central column.

It will be noted that the contacting surfaces of the races of the bearing 13 are made as inserts 19, 20 in segmented form. This facilitates repair to the bearing 13 as and when necessary.

The lower collar 3 locates the column 1 through the bottom deck 5 of the staging in the large roller bearing 21 (see FIG. 3) which is designed to carry lateral loading. A circular track 22 is fixed to the column 1 and each roller 23 (see FIG. 7) consists of the outer runner 24 supported on the pair of anti-friction and preferably roller bearings 25 which are mounted on eccentric spindle 26. This enables each roller 23 to be moved out of contact with the track 22 and be replaced or repaired individually without interfering the normal function of the bearing 21.

The boom 6 extends horizontally from the column 1 just below the bottom deck 5 of the staging. A pair of rails 27 are provided along the length of the boom 6 and along which a carriage 7 having four wheels 28 running on the rails 27 is adapted to travel. As shown in FIG. 4 the carriage 7 is made to traverse the length of the boom 6 by means of the piston and cylinder assembly 29 which is preferably pneumatically operated. The cylinder 30 of assembly 29 is fixed to the carriage 7 while the piston rod 31 is anchored at each end to the boom 6. The assembly 29 is double acting so that air may be introduced on either side of the piston in the cylinder 30 to move the cylinder 30 and with it the carriage 7 along the boom in the desired direction.

The carriage 7 carries a pair of pulleys 32, 33 which support the operating cable 10 used to raise and lower the grab 8 which is as previously mentioned preferably pneumatically operated.

At the bottom of the column 1 is the operator's cab 11 and this cab houses the controls for the lashing gear and a retractable seat 34 for the operator. The cab is fitted with closure doors 35 and the base of the column 1 is closed off and shaped to a point as shown at 36 in FIGS. 1 and 2.

The operation of the grab 8 for loading and unloading is controlled by the operator who can manipulate the control valve for the pneumatic grab 8 directly through the lever 37 in the cab 11. The flexible air pipe 38 for the grab is positioned to the side of the cab 11 so that it will not obstruct the driver's view.

Inside the column 1 there is positioned a main hoisting pneumatic piston and cylinder assembly 9 as shown in FIGS. 1 and 2. The cylinder 39 is secured to the column 1 and has a sheave wheel 40 mounted in suitable brackets 41 below the base thereof to depend downwardly. A further sheave wheel 42 is mounted in a crosshead 43 secured to the top of the outwardly extending piston rod 44 of the assembly 9.

On the outside of the column 1 there is mounted a winch 45 adapted to be driven by a reversible air motor 46 through a suitable chain drive 47. The drive for the winch has associated therewith a pneumatically releasable brake 48.

Directly below the winch 45 is secured a deflecting
pulley 49. Adjacent the deflecting pulley 49 is a cable storage reel 50 fitted with a manually operated band brake 51. The pulley 49 and reel 50 are also secured to the outside of the column 1. A cable clamp 52 is arranged in a readily accessible position below the reel 50.

Two further pulleys 53, 54 are mounted in the upper part of the boom 6.

The cable 10 for lifting and lowering the grab 8 passes from the storage reel 50, where a reserve of cable 10 is maintained, through the clamp 52, so that this point of the cable is held fast, and into the column 1. The cable 10 then extends under pulley 53 over pulley 54 over pulley 33 on the carriage 7 and around the pulley 55 in the cross-head 56 for the grab 8. From there the cable 10 is carried back over the pulley 32 and a further pulley 47, mounted in the boom 6 at the end adjacent the column 1, down under the sheave wheel 40 up and over the sheave wheel 42 under the deflecting pulley 49 and is secured to the drum of the winch 45.

FIG. 5 clearly illustrates the cable arrangement above described.

Air for the various pneumatically operated parts of the lashing gear is carried down pipes positioned as far as possible inside the central column 1 from a central supply pipe 58 which will be provided with the necessary air-lines for air 59 and air 61.

The supply of air through the main control valves (not shown) for the air motors 18 and 46, the hoisting piston and cylinder assembly 9 and the carriage traversing piston and cylinder assembly 29 is controlled by pilot valves. The pilot valves are directly manipulated by the lashing gear operator through hand levers 60, 61 and 62 and the pedal 63. This latter is preferably used for the control of motor 18.

While the lashing gear is not in use, that is, during blasting operations, the operator's seat 54 is retracted and the doors 35 clamped, over the opening of the cab 11. The grab 8 may be drawn up under the boom 6. The pointed bottom to the column 1 will deflect any rock thrown against it during blasting and the doors 35 protect the controls from damage.

When used for lashing the grab 8 is first lowered to the bottom by releasing that cable from the drum of winch 45. This is effected by releasing the brake 48 and allowing the drum to unwind.

The brake 48 is then secured and hoisting of the spoil, collected by operation of the grab 8, is effected by introduction of air under the piston in the cylinder 39 of the assembly 9. It will be seen that cable 10 extending from clamp 52 through to winch 45 will cause the grab to be raised an equivalent amount from the shaft bottom. The stroke of the piston and cylinder assembly is designed to enable the grab to be discharged into kibbles which are used to hoist the spoil to the surface. Rotation of the shaft through operation of the air motor 18 and the traversing of the carriage 7 along the boom 6 enables the grab to operate effectively over substantially the whole of the shaft bottom. Also the positioning of the cab 11 below the deck 5 and boom 6 gives the operator an unobstructed view of the working of the grab.

It will be appreciated that worn or damaged cable 10 may readily be replaced by new cable from the reel 50 by release of the clamp 52 and operation of the winch 45 to wind the old cable onto the winch drum from where it may be removed without interfering with the operation of the lashing gear once the clamp 52 and winch 45 have been secured.

Further the winch 45 may be used as standby hoisting gear in the event of failure of the piston and cylinder assembly 9 through operation of the reversible air motor 46.

In the design of the lashing gear as many of the parts, such as pulleys, shafts, necessary plunger blocks, bearings and the like are standardized and made interchangeable to facilitate both repairs and the stocking of spare parts.

What I claim as new and desired to secure by Letters Patent is:

1. Shaft sinking lashing gear comprising a column, two collars on said column spaced apart one above the other, means for securing the collars to decks of a shaft sinking staging, a boom secured to and extending outwardly from the column below the lower collar, means for supporting a grab mechanism from the boom and means for rotating the column within the collars.

2. Shaft sinking lashing gear comprising a column, two collars on said column spaced apart one above the other, means for securing the collars to decks of a shaft sinking staging, an angular contact bearing incorporated in the upper collar, a roller bearing incorporated in the lower collar, a boom secured to and extending outwardly from the column below the lower collar, means for supporting a grab mechanism from the boom and means for rotating the column within the collars.

3. Shaft sinking lashing gear as defined in claim 2 including replaceable inserts forming contacting surfaces of the angular contact bearing.

4. Shaft sinking lashing gear as defined in claim 2 wherein the roller bearing rollers are independently removable from said bearing.

5. Shaft sinking lashing gear as defined in claim 2 in which the roller bearing rollers comprise a spindle, a pair of anti-friction bearings on said spindle, an outer runner on said anti-friction bearings, the spindles for the rollers being eccentrically mounted in said roller bearing.

6. Shaft sinking lashing gear comprising a column, two collars on said column spaced apart one above the other, means for securing said collars to decks of a shaft sinking staging, an angular contact bearing incorporated in the upper collar, an internal ring gear, an inner race of said bearing made integral with said ring gear, a piston meshing with said ring gear, a shaft for said pinion supported by said column, an air motor connected to drive said pinion to rotate the column within the collars, a boom secured to and extending outwardly from the column below the lower collar, a stage in said boom adapted to traverse the length of said boom and means associated with the carriage for supporting a grab mechanism.

7. Shaft sinking lashing gear as defined in claim 6 including a piston and cylinder assembly in said boom, a piston extension of the said extension from each end of said cylinder, one end of said piston rod secured to one end of the boom and the other end of said piston rod secured to the other end of said boom, a rigid connection between said carriage and the cylinder of the piston and cylinder assembly, wheels on said carriage and rails in said boom for supporting said carriage on said wheels.

8. Shaft sinking lashing gear as defined in claim 6 wherein the means for supporting said grab mechanism comprises a cable arrangement associated with a hoisting device for said grab mechanism.

9. Shaft sinking lashing gear comprising a column, two collars on said column spaced apart one above the other, means for securing said collars to decks of a shaft sinking staging, an angular contact bearing incorporated in the upper collar, an internal ring gear, an inner race of said bearing integral with said ring gear, a piston meshing with the latter, a shaft for said pinion supported by said column, an air motor connected to drive said pinion to rotate the column within the collars, a boom secured to and extending outwardly from the column below the lower collar, a carriage in said boom mounted to traverse the length of said boom, means associated with said carriage for supporting a grab mechanism, a piston and cylinder assembly housed within said column, a piston rod for said assembly with one end extending from said column,
a sheave wheel mounted adjacent the bottom of said cylinder, a second sheave wheel mounted on the extending end of said piston rod, a pulley for a grab mechanism and a secured loop of cable passing over said sheave wheels and over said means for supporting a grab mechanism and around said pulley.

10. Shaft sinking lashing gear comprising a column, two collars on said column spaced apart one above the other, means for securing said collars to decks of a shaft sinking staging, an angular contact bearing incorporated in the upper collar, an internal ring gear, an inner race of said bearing integral with said ring gear, a pinion meshing with the latter, a shaft for said pinion supported by said column, an air motor connected to drive said pinion to rotate the column within the collars, a boom secured to and extending outwardly from the column below the lower collar, a carriage in said boom mounted to traverse the length of said boom, a piston and cylinder assembly housed within said column, a piston rod for said assembly with one end extending from said cylinder, a sheave wheel mounted adjacent the bottom of said cylinder, a second sheave wheel mounted on the extending end of said piston rod, a pulley positioned in each end of the upper portion of said boom, a pair of pulleys mounted in said carriage, a further pulley in the lower part of said boom adjacent the column, a pulley for a grab mechanism, a loop of cable, secured ends of said loop, said cable guided along said pulleys in the upper portion of said boom, over one of the pair of pulleys in said carriage, around the pulley for the grab mechanism, over the other pulley in said carriage, over the pulley in the lower part of said carriage and over said sheave wheels.

11. Shaft sinking lashing gear as defined in claim 10 wherein the gear includes a winch, a drum for said winch, a motor for said winch, a storage reel for cable and wherein in one secured end of said secured loop is attached to said drum, a reserve of cable on said storage reel and the other secured end of said cable extended to form said reserve of cable on the storage reel.

12. Shaft sinking lashing gear as defined in claim 1 including an operator's cab positioned in the bottom of said column below said boom.

References Cited in the file of this patent

UNITED STATES PATENTS

461,874 Potter et al. Oct. 27, 1891
517,008 Matton Mar. 20, 1894

FOREIGN PATENTS

63,116 France Mar. 16, 1955
(Addition to No. 1,005,535)