June 21, 1966 C. O. LINDGREN 3,256,943

DRILLING APPARATUS

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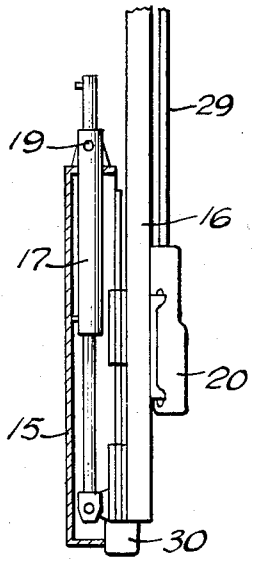


Fig. 6

Fig. 1

Inventor
Carl Olov Lindgren
by Jarvis C. Marble
his attorney

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DRILLING APPARATUS

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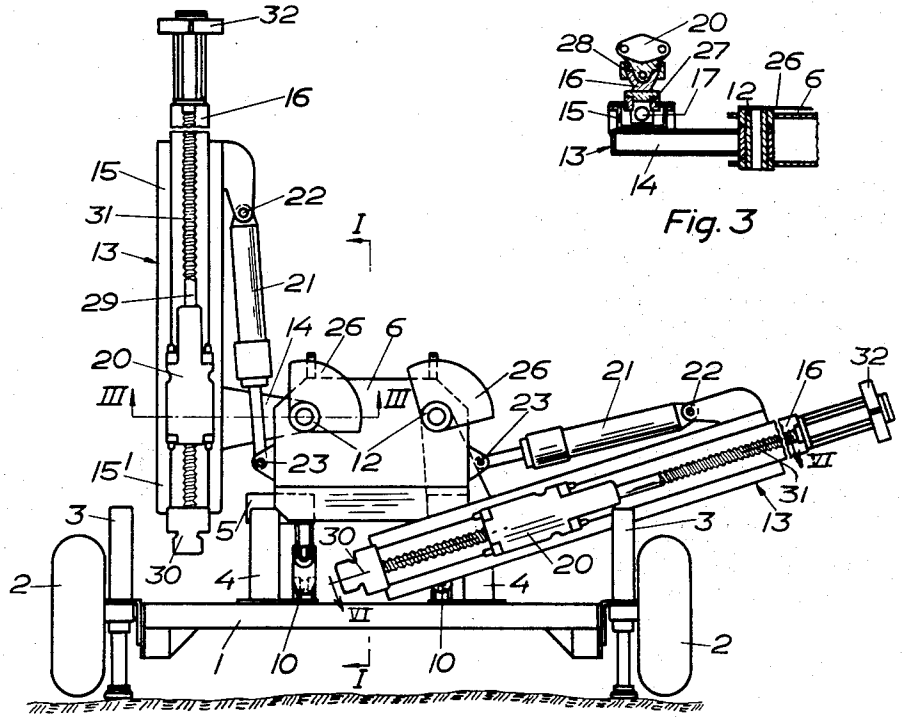


Fig. 2

Fig. 3

Inventor
Carl Olov Lindgren
by Jarvis C. Marble
his attorney

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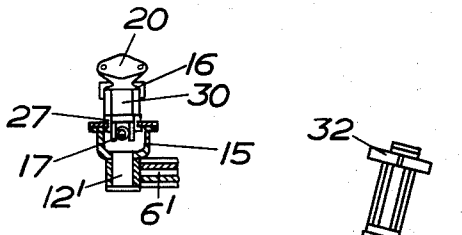


Fig. 5

Fig. 4

INVENTOR.
Carl Allow Lindgren
BY Jarvis C. Marble
his attorney

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DRILLING APPARATUS

Carl Olov Lindgren, Orebro, Sweden, assignor to Atlas Copco Aktiebolag, Nacka, Sweden, a corporation of Sweden

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10 Claims. (Cl. 173—43)

This invention relates to rock drilling apparatus for drilling under ground rows of holes in fan shaped arrangement disposed transversely to the direction of the drift to be worked.

The primary object of the invention is to provide a drilling apparatus of the aforementioned character which makes possible mechanized and convenient directing and manipulation of the drilling machine or machines of the apparatus in order to drill rows of holes in fan shape.

Another object of the invention is to provide a rock drilling apparatus of the aforementioned character having a pair of swingable feed bars carrying drilling machines by means of which it is possible to drill holes in fan shaped arrangement transversely to the direction of the drift with each feed bar being directable independently of the other through its swing.

A further object of the invention is to provide a rock drilling machine of the aforementioned character in which the drill holes may be disposed in planes which regarding their inclination with respect to the direction of the drift are adjustable within an angle of considerable width.

The above and other objects of the invention will become obvious from the following description and from the accompanying drawings in which two embodiments of the invention are illustrated by way of example. It should be understood that these embodiments are only illustrative of the invention and that various modifications may be made within the scope of the claims without departing from the scope of the invention.

In the drawings FIG. 1 is a longitudinal sectional view on the line I—I in FIG. 2 of a drilling apparatus according to the invention and with the feed bar in its extended foremost position. FIG. 2 is a rear view on a somewhat smaller scale of the drilling apparatus in FIG. 1 with the manoeuvring stand removed and the feed bars in a rear position. FIG. 3 is a sectional view on line III—III in FIG. 2. FIG. 4 is a view of a modified arrangement of the cradle and the feed bars in FIG. 2. FIG. 5 is a sectional view on line V—V in FIG. 4. FIG. 6 is a sectional view on the line VI—VI of FIG. 2.

The rock drilling apparatus depicted in the FIGS. 1–3 incorporates a base frame **1** which may be provided with tired wheels **2** or may be mounted in other ways. At the corners of the base frame **1** there are fixed hydraulic power jacks **3** for relieving the wheels **2** from load when the drilling apparatus works. For transportation purposes the base frame **2** may be provided with a suitable drive, not shown.

Transversely of the base frame **1** and in opposite and spaced apart relation thereon there are affixed two upstanding brackets **4**. The brackets **4** carry at their top coaxially arranged bearings **5** on and between which a cradle **6** is swively journalled on pivots **7** forming a transverse frame. Two spaced apart connecting brackets **8**, which carry the pivots **7**, project downwardly from the cradle **6** each of them carrying at its free end a pivot **9**. The two pivots **9** are arranged coaxially. Hydraulic double acting power cylinders **10** are pivotally journalled at one end on pivots **11** forwardly of the base frame. The other ends of the power cylinders **10** are swivelly journalled on the pivots **9**. By supplying pressure fluid to the

power cylinders **10** the cradle **6** may be turned from a generally horizontal position, suitable for transportation, to an upstanding, for example vertical working position (FIG. 1). In some cases adjustability past the vertical position may be taken into consideration for drilling in a position tilted somewhat to the rear.

The transverse frame or cradle **6** carries spaced apart pivot providing means or parallel pivots **12** journalled in the cradle **6** and defining a pair of parallel axes of rotation extending in the upright position of the cradle **6** longitudinally of the base frame **1** at right angles to and across the axis of the pivots **7** of the cradle **6**. To the pivots **12** are affixed supports **13** having the basic form of a right angle member **14**, **15**, one leg, **14**, of which carries the pivot **12**. The other elongated leg **15** of the angle member **14**, **15** or support **13** carries displaceably on guiding means **27**, FIG. 3, extending longitudinally of the leg **15**, the rear portion of a feed bar **16**, which is supported by the leg **15**, extends together with leg **15** freely outwardly and/or upwardly from pivot **12**. The leg **15** may be provided with a short rearward extension **15**[1] past the leg **14**. A double acting hydraulic power cylinder **17** is journalled at its ends on the feed bar **16** at the pivot **18** and on the leg **15** of the support **13** at the pivot **19**. By extension or contraction of the power cylinder **17** the feed bar **16** may be moved towards and away from the rock face on the guiding means **27** of the support **13**.

A drilling machine **20** carrying a drill steel **29** is displaceably arranged on guiding means **28**, FIG. 3, along the feed bar **16**, and a feed motor **30** serves for example over a feed screw **31** or in other ways to feed the drill **20** towards a rock face. The feed bar may also carry a power operated drill steel guide **32**. The details of the drilling machine, the feed bar, the feed motor and the drill steel guide are not illustrated in detail since they may be carried out in any conventional manner well known to those familiar with the art.

One end of a double acting hydraulic power cylinder **21** is by means of a pivot **22** attached to the protruding outer end of the support **13**, while the other end of the power cylinder **21** by means of a pivot **23** is attached to the cradle **6**. By actuating the power cylinders **21** both supports **13**, which when being in vertical parallel position are arranged in mirror symmetry with respect to a central and vertical longitudinal plane through the base frame **1**, may be lowered or adjusted angularly from a substantially vertical position outwardly to a nearly horizontal position, for example from a position 10° off the vertical to a position of 84° on the other side of said vertical.

The pressure fluid for operation of the different jacks, power cylinders, the feed motor, the drill steel guide, and the drill of the illustrated drilling apparatus is supplied from suitable sources not illustrated via a manoeuvring device **25**, and the various hoses for conveying pressure fluid have been omitted since they would make the drawing rather congested and since the provision of such hoses is obvious to those skilled in the art.

In operation the drilling apparatus may be moved along the drift to be worked with the cradle **6** in substantially horizontal position and the feed bars **16** extending longitudinally of the base frame, and may be located in a suitable working position, whereupon the power jacks **3** are extended for firmly contacting the floor of the drift. By suitable manipulation of the manoeuvring elements of the manoeuvring device **25** the operator, while standing at the rear on the base frame **1**, thereupon adjusts the cradle **6** by means of the power cylinders **10** to a suitable angle with respect to the horizontal. Through actuation and stepwise setting of the power cylinders **21** of the supports **13** the drill holes are then drilled in fan

shaped disposition in the transverse plane defined by the tilt of the cradle **6** thus selected. Simultaneously, the protrusion of the feed bar is controlled by means of the power cylinder **17** for compensating differences in the distance between the pivots **12** and the rock face in connection with changes of the angular position of the feed bars **16**. With the two fan halves completed the operator contracts the power jacks **3** and moves the base frame longitudinally to a suitable location for drilling the adjacent row of holes in fan shape, whereupon the cycle of operation is repeated for drilling the remaining rows of holes in fan shape transversely of the drift.

The pivots **12** may carry protractor discs **26** on which the angular setting of the supports **13** may be read.

As readily seen each feed bar **16** is directable and covers its half of the fan of holes to be drilled independently of the other feed bar. In order to extend the swing of the supports **13** in a manner to make possible lowering of both supports simultaneously to horizontal position, the rear portion **15¹** of the supports **13** may be shortened or omitted.

In the modification according to FIG. 4 there is provided a cradle **6¹** which may be mounted in analogy with the cradle **6** in FIG. 2 on a suitable base frame, not shown. On the cradle **6¹** and in low spaced apart and parallel disposition thereon the pivots **12¹** are journalled for carrying the supports **13¹**. The supports **13¹** form straight elongated frame members **15** with the pivot providing means or pivots **12¹** connected directly to the rear end of the straight frame **15**. On the upper part of the cradle **6¹** the pivots **23¹** for one end of the power cylinders **21** are provided in spaced apart parallel arrangement. The opposite ends of the power cylinders **21** are pivotally connected at **22** directly to the respective forward ends of the straight frames **15**. The supports **13¹** are provided with reciprocable feed bars **16** supported in the manner of one-sided free jibs and with drills **20** in full analogy with the embodiment according to FIGS. 1–3. With the low disposition of the pivots **12¹** on the cradle **6¹** there is gained a lowering of the centre of gravity for the drilling apparatus. In operation the modified arrangement according to FIG. 4 is identical with the embodiment of FIGS. 1–3.

The embodiments of the invention above described and illustrated in the drawings should only be considered as examples and the invention may be modified in several different ways within the scope of the following claims.

What I claim is:

1. In a duplex rock drill rig and supporting apparatus for drilling rows of holes in a fan shaped arrangement in an underground drift with all said holes lying in a single plane transversely of said drift and with said apparatus carrying a plurality of rock drills simultaneously controlled and operated by a single operator, the combination which comprises a base frame for supporting said apparatus and adapted to be moved along said drift to successive drilling locations, a pair of parallel pivot means arranged above said base frame and with the axes thereof extending substantially longitudinally of said base frame on either side of the central vertical longitudinal plane thereof, means for supporting said pair of pivot means on said base frame, elongated drill supporting members with one end of each one journaled on each of said pivot means for free pivoting movement with respect thereto through a plurality of angular drilling positions distributed in fan shape and all of which lie substantially in a single plane extending transversely of said base frame and perpendicularly to said central vertical longitudinal plane thereof with each of said members pivoting substantially independently of the other through opposite quadrants in said transverse plane defined by said central plane and a horizontal plane through said base frame, means for supporting and carrying a rock drill on each of said drill supporting members on the ends thereof opposite said pivots for movement therewith through said angular drilling positions and including a feed bar slidably supporting and feed said rock drill and connected to said supporting member adjacent one end of said feed bar whereby said feed bar and said rock drill are disposed in upward and outward directions from said pivots and with the ends of said feed bars adjacent said supporting members disposed closely enough to said supporting members to avoid abutting and interfering contact of said ends in any of said angular positions of said pivots, and separate power means operatively engaged with each of said drill supporting members for moving each said member independently through all said angular drilling positions thereof in said transverse plane around said pivots.

2. A rock drill rig and supporting apparatus as recited in claim **1** in which said means for supporting said pair of pivot means on said base frame includes a tiltable cradle carrying both said pivot means, means for mounting said cradle on said base frame for tilting movement about an axis disposed transversely of said base frame, and power means connected to said cradle for tilting said cradle and said pivot means and said drill supporting members thereon through a plurality of angular positions including a substantially horizontal position for defining the angle of said transverse plane through which said drill supporting members pivot about said pivot means.

3. Rock drilling apparatus as set forth in claim **1**, in which each said drill supporting member has the general form of an angle member, one leg of which extends along one of said rock drill supports while the other at its end is connected to one of said pivot providing means.

4. Rock drilling apparatus as set forth in claim **1**, in which each said drill supporting member forms a straight frame member connected to said pivot means at the end remote from the operating end of the respective rock drill.

5. In a duplex rock drill rig and supporting apparatus for drilling rows of holes in a fan shaped arrangement in an underground drift with all said holes lying in a single plane transversely of said drift and with said apparatus carrying a plurality of rock drills simultaneously controlled and operated by a single operator, the combination which comprises a base frame for supporting said apparatus and adapted to be moved along said drift to successive drilling locations, a pair of parallel pivot means arranged above said base frame with the axes thereof extending substantially longitudinally of said base frame and equidistantly on either side of the central vertical longitudinal plane thereof, means for supporting said pair of pivot means together on said base frame, an elongated drill supporting member journaled on each of said pivot means for free pivoting movement with respect to said pivot means and said base frame through a plurality of angular positions distributed in fan shape all in substantially the same transverse plane and in mirror symmetry through opposite quadrants of said transverse plane on opposite sides of said central longitudinal plane, means for supporting and carrying a rock drill and appertaining feeding apparatus therefor on each of said drill supporting members for movement therewith and extending therealong in upward and outward directions from said pivot means, said supporting and carrying means being affixed at substantially right angles to said supporting members adjacent one end thereof whereby said ends of said supporting and carrying means avoid abutting and interfering contact in all angular positions of said supporting members, said pivot means and said drill supporting members and said rock drill and feeding apparatus thereon all being disposed so that the lower ends thereof are spaced above said base frame and on opposite sides of said central longitudinal plane thereof in all angular positions of said drill supporting member, and separate fluid power means operatively connected to each of said drill supporting members for moving each said member through said angular positions thereof.

6. A rock drill rig and supporting apparatus as recited

in claim 5 in which said means for supporting said pair of pivot means on said base frame includes a tiltable cradle carrying both said pivot means, means for mounting said cradle on said base frame for tilting movement about an axis transversely thereof, and power means for tilting said cradle and said pivot means and said drill supporting members thereon through a plurality of angular positions including a substantially horizontal position for defining the angle of said transverse plane through which said drill supporting members pivot about said pivot means.

7. In rock drilling apparatus for drilling rows of holes in a fan shaped arrangement in an underground drift with all said holes lying in a single line substantially in a single plane transversely of said drift, the combination which comprises a base frame carriage adapted to be moved longitudinally in and along said drift, a supporting frame pivotally disposed on said base frame for tilting movement with respect thereto about an axis transverse thereto from a substantially vertical to a substantially horizontal position, a pair of percussive rock drill devices each including an elongated feed bar for carrying said rock drill and feeding means thereon for feeding and retracting said rock drill, a pair of pivot shafts mounted on said supporting frame horizontally spaced apart equidistantly on each side of the longitudinal vertical central plane of said base frame with the axes of said pivot shafts being parallel, an elongated drill supporting member pivotally journaled on each of said pivot shafts, means for mounting each of said rock drill devices on each of said drill supporting members for pivotally supporting said rock drill devices in a plurality of angular drilling positions distributed in fan shape and all of which lie substantially in said single plane extending transversely of said base frame and with said individual rock drill devices at opposite sides of said central longitudinal plane, power cylinder means operatively connecting each of said drill supporting members with said cradle for separately moving each of said rock drill devices through said plurality of angular drilling positions independently of the other.

8. Apparatus as recited in claim 7 in which said supporting frame is a tiltable cradle disposed transversely of said base frame, and which includes a second power means connected between said tiltable cradle and said base frame for tilting said cradle and said pivot means and said drill supporting members disposed thereon through a plurality of angular positions including a substantially horizontal position for defining the angle of said transverse plane through which said drill supporting members pivot about said pivot means.

9. A rock drilling apparatus for underground drilling of rows of holes in fan shaped arrangement transversely to the direction of the drift to be worked, said apparatus comprising a base frame movably arranged in its longitudinal direction in and along said drift, a cradle pivotally supported on said base frame to turn longitudinally thereof selectively from a substantially vertical to a substantially horizontal position, a rock drill, an elongated feed bar for slidably carrying said rock drill and having feeding means thereon for feeding and retracting said rock drill along said feed bar, pivot providing means carried by said cradle and defining an axis of rotation extending longitudinally of said base frame, an elongated support extending along one end portion of said feed bar, cooperating guiding means on said support and said feed bar for supporting said feed bar movably in its longitudinal direction on said support, said pivot providing means being connected to the end portion of said support remote from the free end of said feed bar for swivelly supporting said rock drill in a plurality of angular drilling positions distributed in fan shape all of which lie substantially in a single plane extending transversely to said base frame

and perpendicularly to the longitudinal vertical central plane of said base frame, first power cylinder means each in driving engagement with said support and provided between said support and said cradle for angularly adjusting said support on said pivot providing means relative to said cradle, second power cylinder means in driving engagement with said feed bar and provided between said support and said feed bar for adjusting said feed bar longitudinally relative to said support, and third power cylinder means in driving engagement with said cradle and provided between said cradle and said base frame for selectively adjusting the angle of tilt therebetween from a substantially vertical position of said cradle to a substantially horizontal position thereof relative to said base frame thereby to define the angle of tilt of said transverse plane.

10. A rock drilling apparatus for underground drilling of rows of holes in fan shaped arrangement transversely to the direction of the drift to be worked, said apparatus comprising a base frame movably arranged in its longitudinal direction in and along said drift, a pair of rock drills, a pair of elongated feed bars for slidably carrying each one of said rock drills and having feeding means thereon for feeding and retracting said rock drills along said feed bars, a pair of pivot providing means carried by said base frame, said pivot providing means being spaced apart equidistantly from the longitudinal vertical central plane of said base frame and defining a pair of parallel axes of rotation extending longitudinally of said base frame, a pair of elongated supports each extending between and interconnecting one of said feed bars and one of said pivot means adjacent one end portion of said feed bar for carrying said feed bars, the end portion of each said support remote from the free end of said feed bars being connected to said pivot providing means with said supports and said feed bars extending freely outwardly in lateral direction from said pivot providing means for swivelly supporting said rock drills in a plurality of angular drilling positions all of which lie substantially in a single plane extending transversely to said base frame and perpendicularly to said longitudinal vertical central plane of said base frame and with said rock drills and said feed bars at opposite sides of said vertical central plane whereby said ends of said feed bars adjacent said supports avoiding abutting and interfering contact in all angular positions of said supports, and a pair of power means each in driving engagement with one of said supports and provided on said base frame for angularly adjusting each said support on said pivot providing means through said plurality of drilling positions.

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BROUGHTON G. DURHAM, *Primary Examiner.*

NORMAN YUDKOFF, *Examiner.*

W. J. MALONEY, D. F. FAULCONER, L. P. KESSLER, *Assistant Examiners.*