

[54] CABLE CYLINDERS

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[51] Int. Cl. B23g 5/00, E21c 5/10
[58] Field of Search 173/147, 43; 308/9; 92/137

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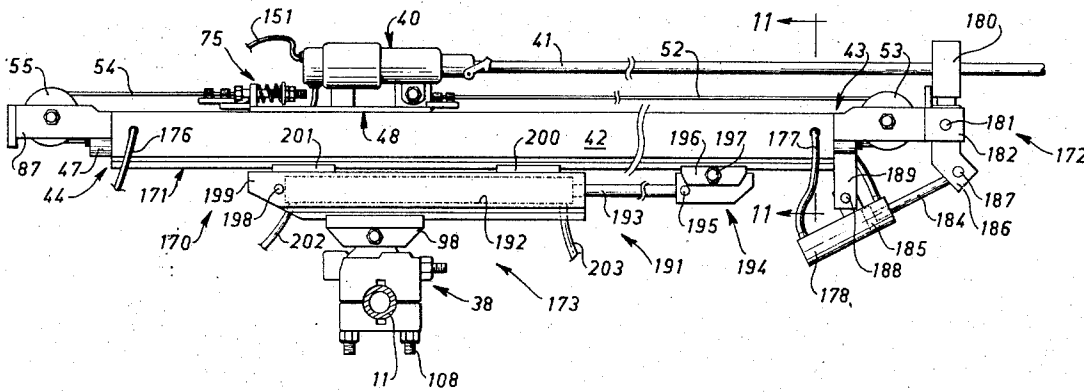
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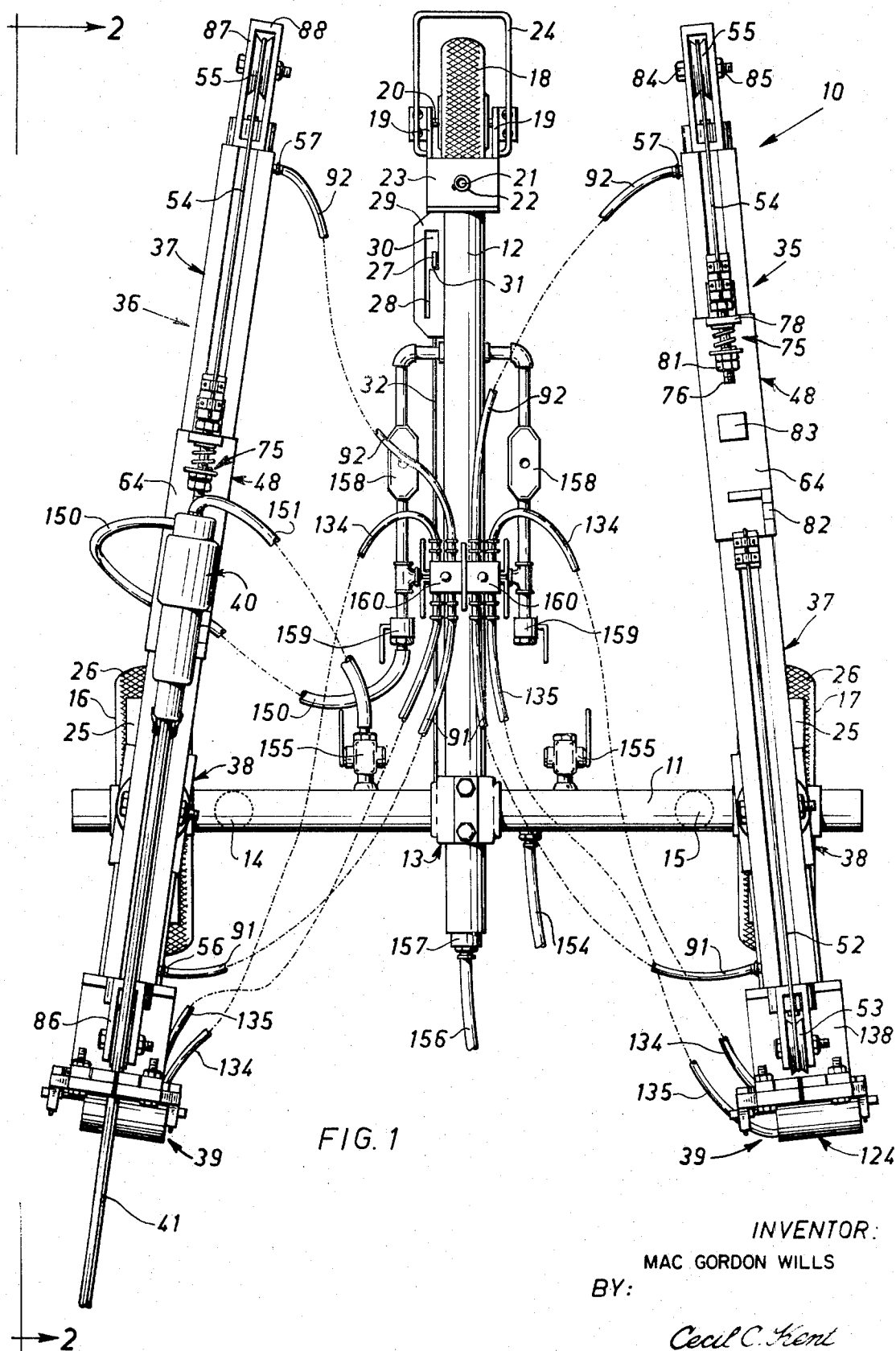
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[57] ABSTRACT

A cable cylinder particularly suited for use in a rock drill guiding and supporting structure comprises an elongated member having a cylindrical bore extending therethrough. A carriage on which a rock drill, for example, may be detachably mounted, is guidedly supported on the outside of the elongated member and connected by cables to a piston disposed within the bore, such cables extending around pulleys at each end of the elongated member. Hoses serve to supply air under pressure to the bore on a desired side of the piston to cause longitudinal movement of that piston within the bore and consequently longitudinal movement in the opposite direction of the carriage and of a rock drill supported thereon.

8 Claims, 13 Drawing Figures





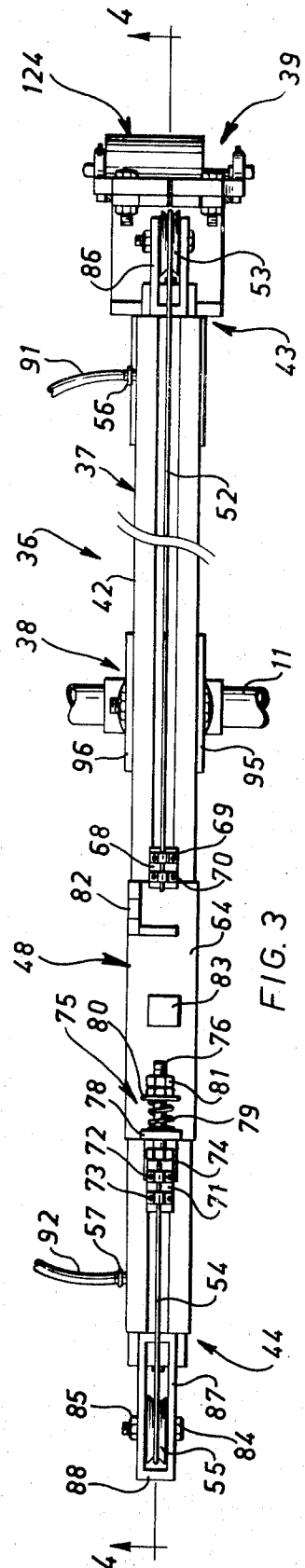


FIG. 3

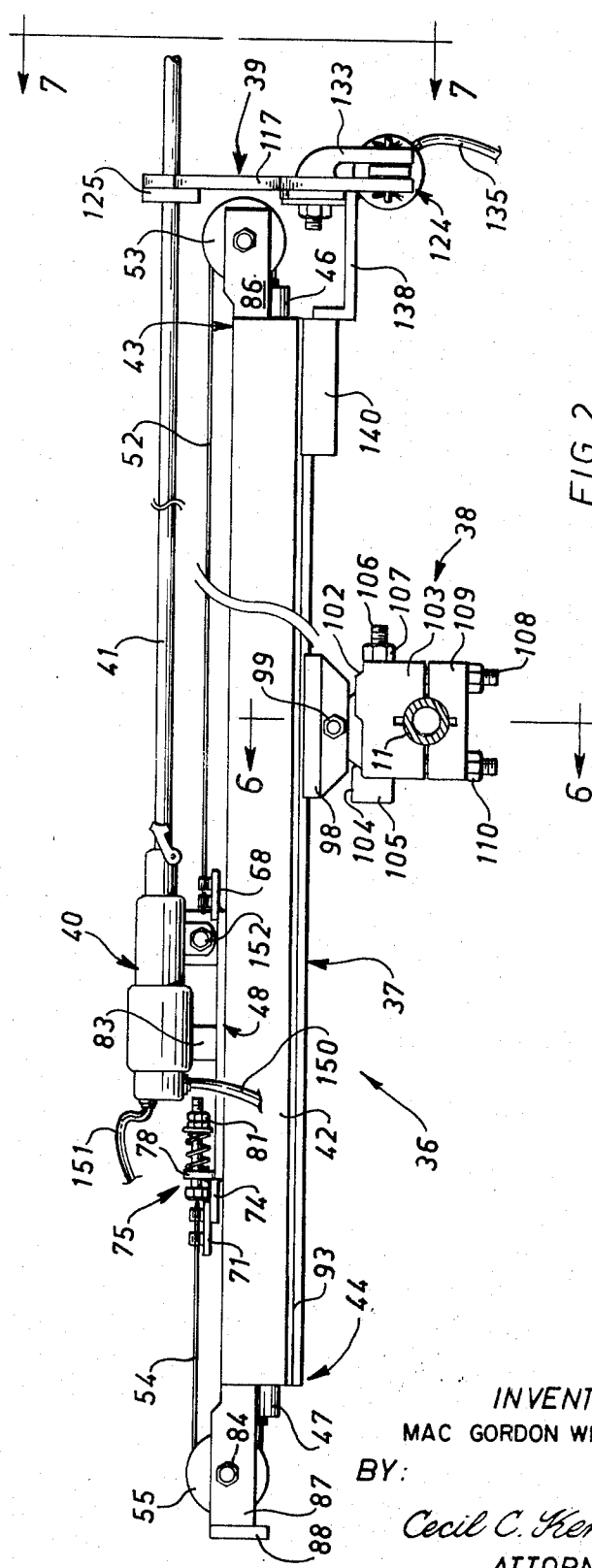


FIG. 2

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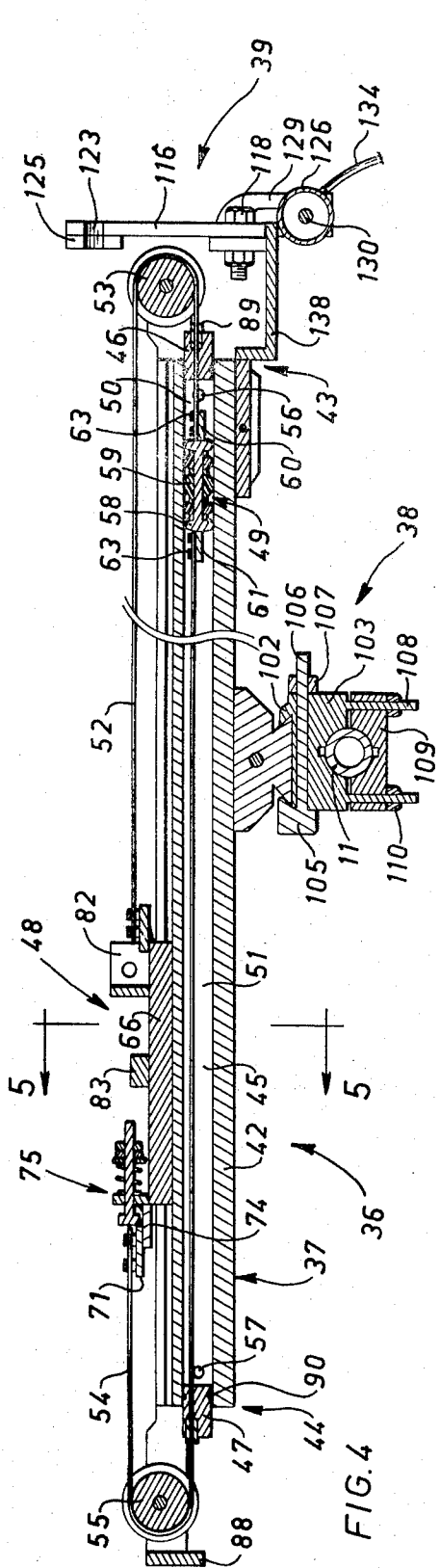


FIG. 4

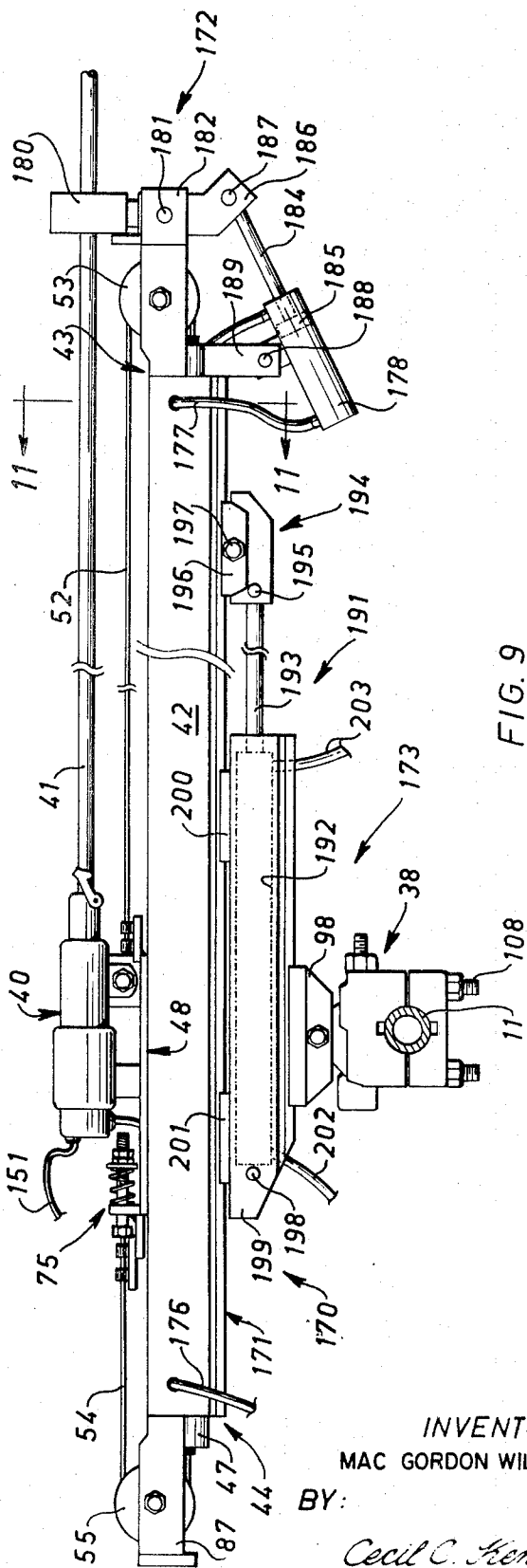


FIG. 9

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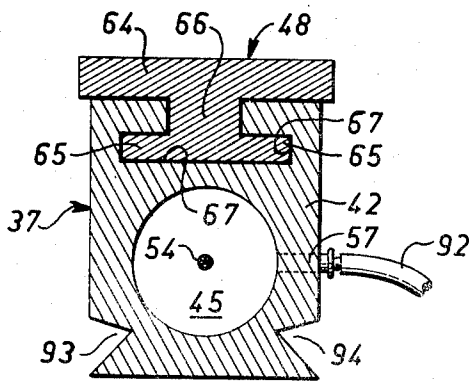


FIG. 5

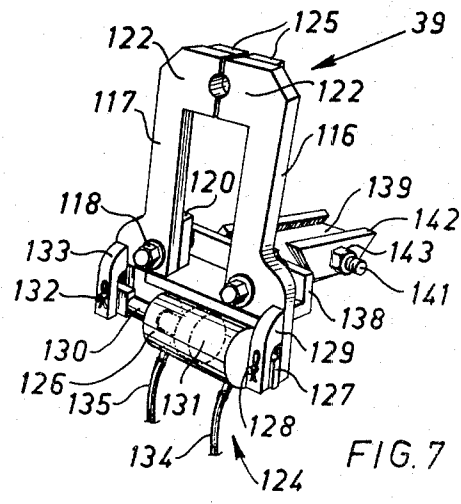


FIG. 7

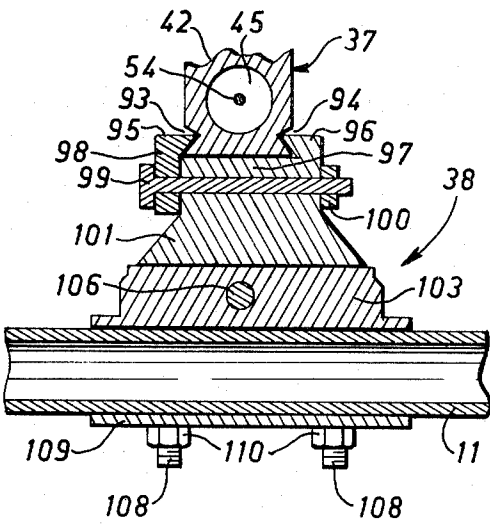


FIG. 6

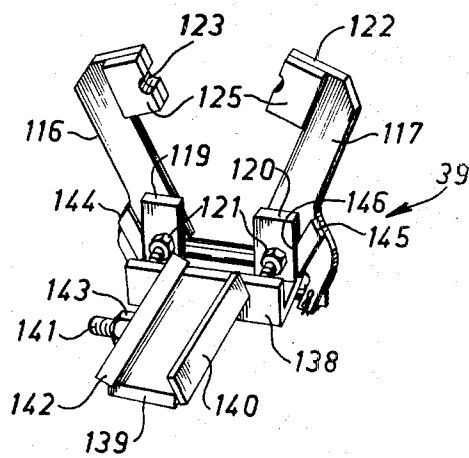


FIG. 8

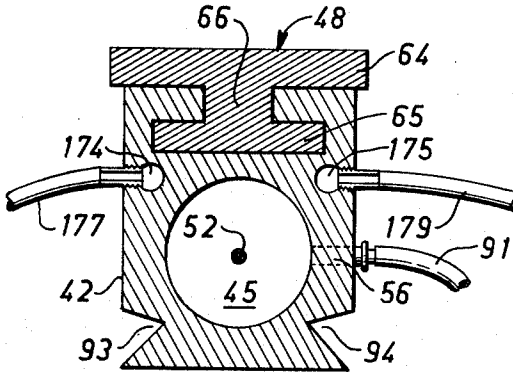
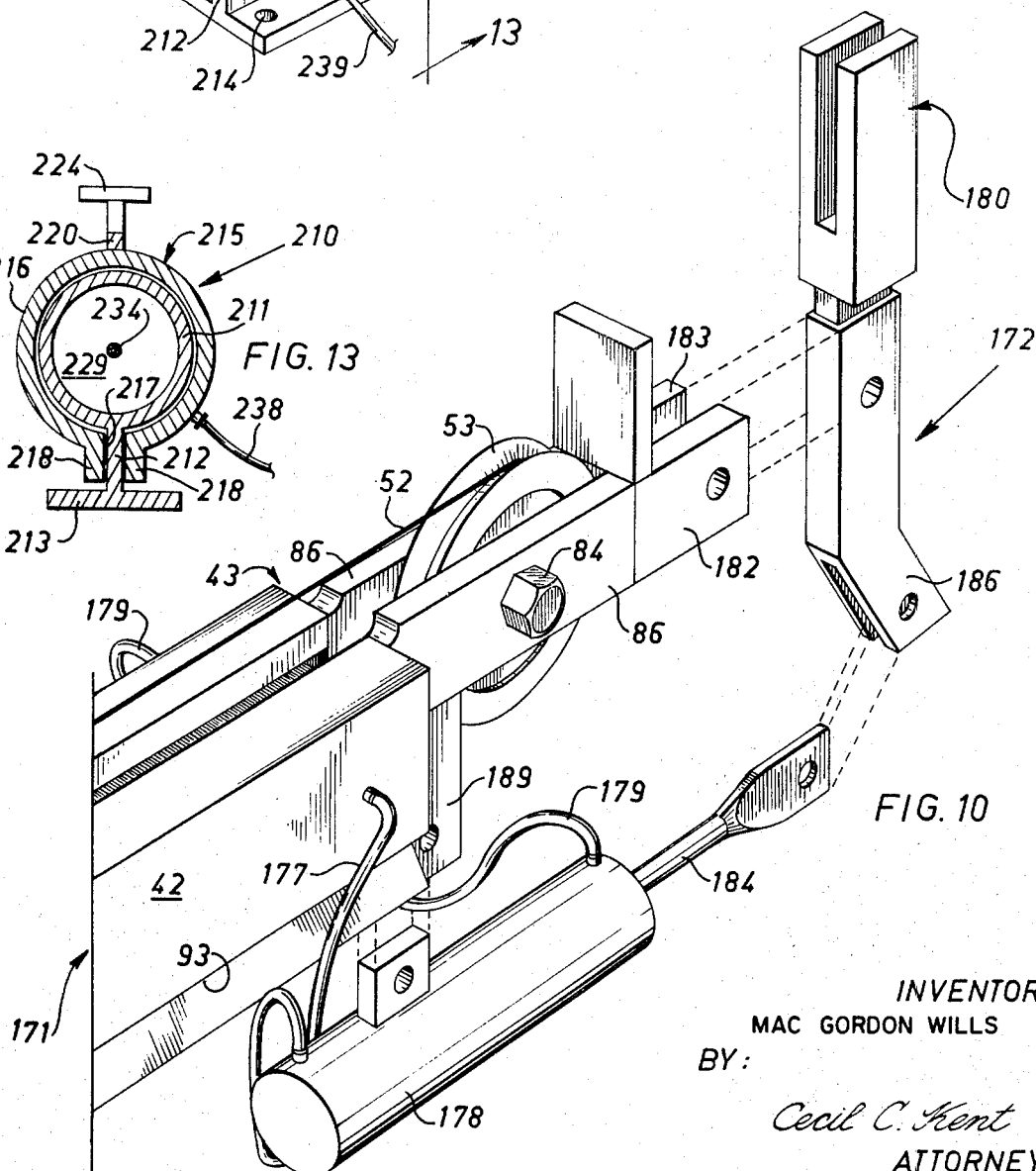
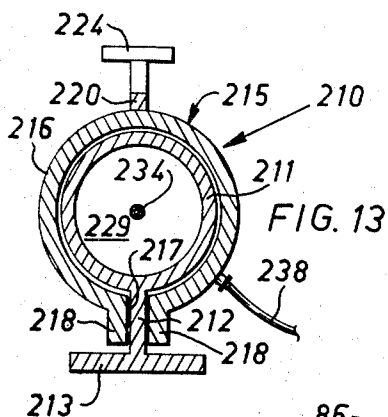
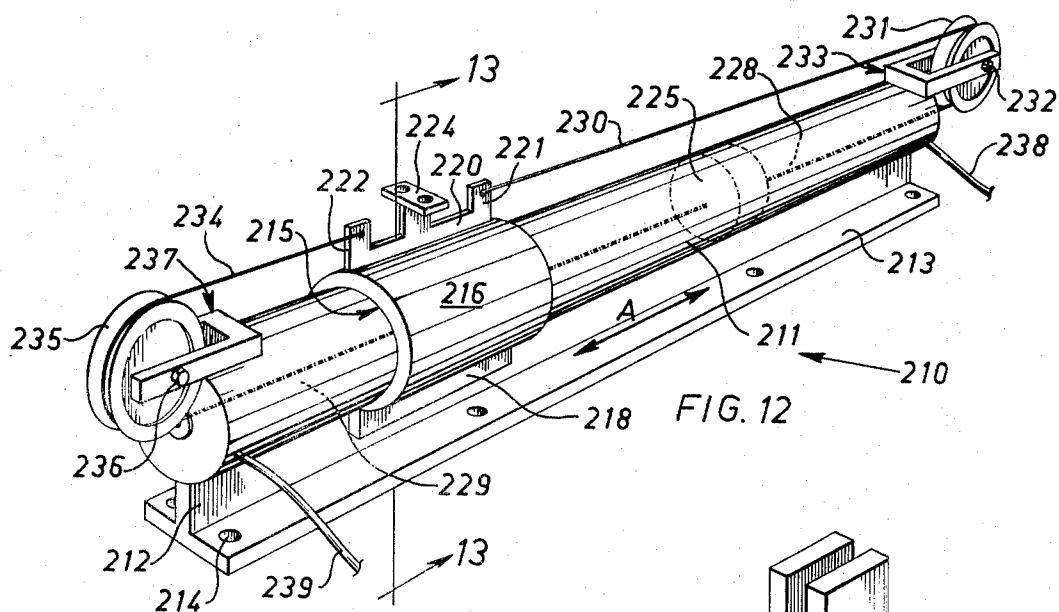


FIG. 11

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CABLE CYLINDERS

BACKGROUND OF THE INVENTION

The present invention relates broadly to fluid drive devices and more particularly to fluid actuated cylinder incorporating a piston to which resilient members such as cables are secured for the purpose of transmitting drive movement from the piston to a driven member outside the cylinder.

Fluid drive devices of this type are generally known as "cable cylinders" and have numerous applications particularly under circumstances where a relatively long stroke operation is required. Such cable cylinders may be constructed for pneumatic or hydraulic operation. Cable cylinders previously known have generally been provided with supporting means such as pulleys at each end of the cylinder, the cables from the piston extending around such pulleys to a connecting yoke. Such arrangements, although satisfactory for many purposes, do not per se significantly restrict twisting of any member drivingly secured to the yoke of such a cable cylinder.

It is a principal object of the present invention to provide a cable cylinder in which such twisting of the member being driven is substantially prevented.

It is a further object of the present invention to provide a cable cylinder of the aforementioned type which cylinder is rugged and reliable in its operation but relatively simple in its construction.

Although a broad object of the invention is to provide a cable cylinder as hereinbefore explained, the invention also aims to provide novel and useful drill guiding and supporting structures incorporating the cable cylinders of the invention, and the use of which presents numerous advantages in rock drilling operations.

SUMMARY OF THE INVENTION

In its broadest scope, the present invention provides a cable cylinder which comprises an elongated member having first and second ends and a bore extending therethrough, a closure means closing said bore at said first end, a carriage slidably mounted externally on said elongated member for guided longitudinal reciprocation therealong, a piston disposed within said bore for longitudinal reciprocation therein and defining with said closure means a cylinder chamber, a first cable extending through said cylinder chamber around a first support means disposed adjacent said first end of said elongated member, a second cable extending through said bore and around a second support means disposed adjacent said second end of said elongated member, said first and second cables each interconnecting said piston and said carriage and together forming a closed loop, and means for the supply and discharge of fluid to and from said cylinder chamber to effect longitudinal movement in said bore of said piston and opposed guided longitudinal movement of said carriage.

Although the invention embraces both single acting and double acting cable cylinders, the latter are particularly useful in the novel drill guiding and supporting structures of the invention. In such a structure, there will generally be provided, in addition to a cable cylinder as hereinbefore described, mounting means adapted releasably to secure the cable cylinder to a supporting member at any desired angular and longitu-

dinal position with respect thereto. Furthermore, in this particular application of the cable cylinders of the invention, the carriage thereof will be adapted detachably to support a rock drill thereon.

A further important feature of the cable cylinders of the invention is that the elongated bodies thereof may be formed by an extrusion technique as unitary structures each having opposed, longitudinally extending guideways slidably receiving corresponding guide flanges of the carriage, it is also useful during such extrusion to form longitudinally extending keyways adapted slidably to receive corresponding locking or clamping members of a mounting means so that the position of the unitary elongated member is longitudinally adjustable with respect to the mounting means.

With the foregoing in view, and such other or further purposes, advantages or novel features as may become apparent from consideration of this disclosure and specification, the present invention consists of the inventive concept which is comprised, embodied, embraced, or included in any method, process, construction, composition, arrangement or combination of parts, or new use of any of the foregoing, which may herein be exemplified in one or more specific embodiments of such concept, reference being had to the accompanying drawings in which:

FIG. 1 is a somewhat simplified plan view of a vehicle having adjustably mounted thereon a pair of drill guiding and supporting structures forming one embodiment of the present invention, a single rock drill being shown as being detachably mounted on one of these drill guiding and supporting structures;

FIG. 2 is a side elevation of one of the drill guiding and supporting structures of FIG. 1 when viewed as indicated by the arrows 2—2 of that Figure and showing the rock drill detachably supported thereon;

FIG. 3 is a plan view of the drill guiding and supporting structure of FIG. 2, the rock drill having been omitted for the sake of clarity;

FIG. 4 is a fragmentary vertical longitudinal section through the drill guiding and supporting structure of FIG. 2 when taken as indicated by the arrows 4—4 of FIG. 3 and showing in greater detail the structure of the cable cylinder in accordance with this invention as incorporated therein;

FIG. 5 is an enlarged transverse section through the cable cylinder of FIG. 4 when taken as indicated by the arrows 5—5 of that Figure;

FIG. 6 is an enlarged vertical section taken as indicated by the arrows 6—6 of FIG. 2 showing in greater detail the structure of a mounting means by which the cable cylinder is adjustably mounted on the vehicle of FIG. 1;

FIG. 7 is an enlarged front perspective view of the drill guiding and supporting structure of FIG. 2 when viewed as indicated by the arrows 7—7 of that Figure and showing in greater detail the construction of one useful embodiment of a drill steel centering device mounted thereon, such centering device being shown in its closed or steel-engaging position and with certain component parts in phantom outline;

FIG. 8 is a rear perspective view of the drill steel centering device of FIG. 7 showing that device in its open or steel-releasing position;

FIG. 9 is a side elevation similar to that of FIG. 2 showing an alternative embodiment of a drill guiding and supporting structure in accordance with this invention with certain hidden components being shown in phantom outline;

FIG. 10 is an enlarged and exploded perspective view from behind of the alternative embodiment of a drill steel centering device as shown in FIG. 9 as being provided on the drill guiding and supporting structure of that figure;

FIG. 11 is an enlarged transverse section when taken as indicated by the arrows 11—11 of FIG. 9, but with the carriage of the drill guiding and supporting structure moved forwardly so as to be shown in section;

FIG. 12 is a somewhat schematic perspective view of an alternative embodiment of a cable cylinder suitable, in accordance with this invention, for use as a rock drill guiding and supporting structure; and

FIG. 13 is a transverse section through the cable cylinder of FIG. 12 when taken as indicated by arrows 13—13 of that Figure.

In the drawings, like characters of reference designate similar parts in the several figures.

Referring in more detail to the drawings, it will be seen that the vehicle generally indicated at 10 in FIG. 1 comprises a hollow, transverse structural member 11 and a hollow longitudinal structural member 12 secured together by any suitable clamping means generally indicated at 13. Extending downwardly from the transverse member 11 and secured thereto, for example, by welding, there are provided a pair of upright members 14 and 15 on the lower ends of which there are rotatably mounted in any appropriate manner ground-engaging front wheels 16 and 17.

At this rearward end, the vehicle 10 is provided with a steerable wheel 18 rotatably mounted between the lower ends of yoke arms 19 through which there extends a wheel axle 20. A web (not shown) at the upper ends of the yoke arm 19 is provided with an upstanding pivot pin 21 extending through a sleeve 22 carried by a bracket 23 which is in turn secured to the forward end of a hollow longitudinal member 12. The pivot pin 21 is retained in position within the sleeve 22 by any suitable means (not shown). A U-shaped handle 24 is conveniently pivotally mounted on the yoke arms 19 to enable the vehicle 10 to be pulled or towed over the ground.

Mud-guards 25 which also function as brakes are provided for the wheels 16 and 17. Each such mud-guard may, for example, be provided with transversely disposed, wheel-engaging ribs (not shown) on its undersurface and a suitable lever system may be provided for moving the mud-guard/brakes 25 into and out of peripheral engagement with tires 26 of the wheels 16 and 17. In the particular vehicle 10 shown in FIG. 1, such movement of the mud-guard/brakes 25 is obtained by means of a brake-actuating handle 27 which is pivotally mounted on the vehicle for movement along a longitudinally extending slot 28 provided for this purpose in a guide and detent plate 29 mounted on the longitudinal member 12. At its rearward end, the slot 28 is widened as at 30 to provide a detent 31 for holding the handle 27 in its braking position so that the aforementioned ribs of the mud-guards 25 are held in frictional engagement with the tires 26 on the wheels 16 and 17

to prevent movement of the vehicle 10. Movement is transmitted from the handle 27 of the mud-guards 25 through a brake rod 32. Since the vehicle 10 already described herein does not constitute an essential part of the present invention and has in fact been described merely to illustrate one particular way in which the cable cylinders of this invention may be used, the structure of the aforementioned brake mechanism will not be described in greater detail herein.

Referring further to FIG. 1, it will be seen from that figure that two drill guiding and supporting structures generally indicated at 35 and 36 in accordance with the present invention are adjustably mounted on the hollow transverse member 11 of the vehicle 10. These guiding and supporting structures 35 and 36 are generally identical to each other and a detailed description of only one of these structures will now be given. The same legends will be used for indicating corresponding components of the two structures.

The drill guiding and supporting structure 36 shown in FIGS. 1 to 5 comprises a cable cylinder generally indicated at 37, a mounting means generally indicated at 38 and a drill steel centering means generally indicated at 39. In FIGS. 1 and 2, the drill guiding and supporting structure 36 is shown with a pneumatically operated rock drill generally indicated at 40 detachably supported thereon and with a drill steel 41 disposed in the drill 40 and extending forwardly therefrom through a respective one of the aforementioned centering means 39. The guiding and supporting structure 36 is further shown as being detachably and adjustably mounted by means of the mounting means 38 on the aforementioned hollow transverse structural member 11.

Referring now in greater detail to the structure of the cable cylinder 37 which, in itself, forms a novel structure in accordance with a broad feature of the invention, it will be seen that this cable cylinder 37 is in the form on an elongated member 42 having a first end 43 and a second end 44. A cylindrical bore 45 extends through the elongated member 42. First and second closure means generally indicated at 46 and 47 (FIG. 4) are provided at the first and second ends 43 and 44 respectively of the elongated member 42 and serves to close the respective ends of the cylindrical bore 35.

A carriage generally indicated at 48 is slidably mounted externally on the upper surface of the elongated member 42 for longitudinal reciprocation therealong in a manner which will be described in greater detail hereinafter. A piston generally indicated at 49 is disposed within the cylindrical bore 45 for longitudinal reciprocation therein and defines with the first and second closure members 46 and 47 respectively first and second variable volume cylinder chambers 50 and 51 respectively.

A first cable 52 is secured to and extends from the piston 49 through the first cylinder chamber 50 and round a first support means disposed adjacent the first end 43 of the elongated member 42, and in the embodiment illustrated, this first support means is in the form of a pivotally mounted pulley 53. From the pulley 53, the first cable 52 extends longitudinally and externally to the carriage 48 to which it is secured in a manner which will be described hereinafter in greater detail.

A second cable 54 similarly interconnects the carriage 48 and the piston 49 but the cable 54 extends

through the second cylinder chamber 51 and over a support means comprising a pulley 55 pivotally mounted adjacent the second end 44 of the elongated member 42.

The structure of the cable cylinder 37 is essentially completed by the provision of fluid ports 56 and 57 for the supply and discharge of fluid such as compressed air to and from the first and second cylinder chambers 50 and 51 respectively.

Although the structure of the cable cylinder 37 has now been essentially described, further details of the specific construction therefor as illustrated in the accompanying drawings will be given herein before the operation of that cable cylinder is described. Referring further, therefore, to the piston 49, with particular reference to FIG. 4, it will be seen that this piston 49 comprises a piston body 58 having suitable piston sleeves 59 of a resilient material such as leather disposed therearound for the purpose of providing a substantially fluid-tight seal with the inner surface of the wall of the bore 45. Axially extending piston plates 60 and 61 are secured to the piston body 58 and the first and second cables 52 and 54 respectively are secured to these piston plates 60 and 61 respectively by saddle clamps and screws as indicated at 63.

As will be seen from FIG. 5, the aforementioned carriage 48 comprises a base plate 64 adapted guidingly to be supported on the top surface of the elongated member 42. Opposed outwardly and longitudinally extending guide flanges 65 are integrally formed with a downwardly and longitudinally extending central leg 66 which is in turn integrally formed with the base plate 64. The guide flanges 65 are slidably received within opposed, longitudinally extending guideways 67 extending transversely outwardly from a longitudinally extending channel provided centrally in the top surface of the elongated member 42. It will be appreciated that, with this particular construction, the carriage 48 is restrained against transverse and vertical movement with respect to the elongated member 42 but is free to undergo longitudinal reciprocation therealong as will be described hereinafter in greater detail.

The forward or first cable 52 is secured to the carriage 48 by means of a forward plate 68 suitably secured in turn, for example, by welding, to the forward end of the base plate 64. Saddle clamps 69 and screws 70 serve to secure the cable 52 rigidly to the plate 68. The second cable 54 is similarly secured to a rear plate 71 by saddle clamps 72 and screws 73. The rear plate 71 is not, however, rigidly connected to the base plate 64 but is, instead, slidably supported on a fixed rear plate 74 rigidly connected, for example, by welding, to the base plate 64.

A cable-tensioning device generally indicated at 75 comprises a forwardly extending bolt 76, the head of which is secured to the slidable rear plate 71. The shaft of the bolt 76 extends freely through an opening in an upstanding flange 78 secured to the rearward end of the base plate 64. A helical compression spring 79 surrounds the shaft of bolt 76 forwardly of the flange 78 and is held in place by washer 80 and lock nuts 81. The carriage 48 is suitably provided with an adaptor 82 and a stop member 83 adapted to support and retain a rock drill such as rock drill 40 thereon.

Referring again to the pulleys 53 and 55, it will be seen that these pulleys are pivotally supported by transversely disposed shafts formed by bolts 84 retained in position by nuts 85. The bolts 84 pass through bifurcated, longitudinally extending arms 86 and 87 suitably secured to the first and second ends 43 and 44 respectively of the elongated member 42. The rearward arms 87 are strengthened by simple end plates 88.

The first and second closure members 46 and 47 respectively are in the form of generally cylindrical plugs disposed partially within the respective ends of the bore 45 and retained in position, for example, by welding or by any suitable threaded or other engagement with the elongated member 42. Each of these plugs has a bore through which the respective one of the first and second cables 52 and 54 slidably extends. Each such bore contains a suitable fluid seal retained in position by a gland nut 89 to prevent the escape of fluid, for example, compressed air, from the cylinder chambers 50 and 51. A further seal in the form of an O-ring 90 is usefully provided between each of the aforementioned plugs and the inner surface of the wall of the bore 45.

The fluid ports 56 and 57 are usefully provided with suitable nipples to which fluid-carrying hoses 91 and 92 can be secured in any appropriate manner.

Referring again to the elongated member 42, it will be seen from FIGS. 5 and 6 that this member is provided with opposed, longitudinally extending keyways 93 and 94 in its side walls and that these keyways are slidably received between corresponding locking members or tongues 95 and 96 respectively of the mounting means 38. In particular, it is to be noted that this portion of the mounting means 38 comprises a body 97 having the tongue 96 integrally formed therewith on its upper surface. The opposed tongue 95 is integrally formed with a movable plate 98 which is carried by a bolt 99 extending therethrough and through the body 97. A nut 100 serves to tighten the tongues 95 and 96 in the keyways 93 and 94 respectively to prevent longitudinal movement of the elongated member 42 through the mounting means 38.

Diverging downwardly and outwardly from the body 97 and integrally formed therewith, there is provided a generally circular, frusto-conical member 101. The lower end of this member 101 is rotatably received between a generally arcuate, upwardly extending flange 102 (FIG. 2) integrally formed with an upper saddle clamp 103 and a generally arcuate flange 104 of a clamping plate 105 supported by a bolt 106 which in turn extends through the saddle clamp 103. A nut 107 is provided for holding the arcuate flanges 102 and 104 firmly against the frusto-conical member 101 to prevent undesired rotation of the elongated member 42.

Four bolts 108 extend downwardly from the upper saddle clamp 103 freely through a lower saddle clamp 109 and nuts 110 are provided for clamping the saddle clamps 103 and 109 securely about the transverse member 11 of the vehicle 10.

Referring now in greater detail to the centering means 39 provided in each of the drill guiding and supporting structures 35 and 36 of the vehicle 10, it will be seen particularly in reference to FIGS. 7 and 8 of the accompanying drawings that each such means 39 com-

prises a pair of upstanding arms 116 and 117 pivotally mounted about bolts 118 extending through upstanding transversely disposed plates 119 and 120, which bolts are secured by nuts 121. The arms 116 and 117 are provided at their upper ends with transverse inward extensions 122 formed in their opposed inner surfaces with opposed, semi-circular recesses 123 which encircle a drill steel such as drill steel 41 when the arms 116 and 117 are pivoted together to the positions actually shown in FIG. 7. On relative pivoting movement of the arms 116 and 117 away from each other under the control of a cylinder means generally indicated at 124, the drill steel 41 is disengaged by the arms 116 and 117 and can consequently readily be removed from therebetween. The aforementioned inward extensions 122 are usefully reinforced by plates 125 formed with recesses aligned with the aforementioned recesses 123.

The cylinder means 124 includes a cylinder 126 provided at its blind end with an axial extension 127 pivotally connected to the arm 116 at 128. A bifurcated downward extension 129 of the arm 116 is provided for this purpose. A piston rod 130 extending from a piston 131 within the cylinder 126 is similarly pivotally connected at 132 to a downward bifurcated extension 133 of the aforementioned arm 117. Fluid hoses 134 and 135 serve to supply and discharge fluid to and from the cylinder 126 for moving the arms 116 and 117 of the centering device 139 between the positions actually shown in FIGS. 7 and 8.

In the particular embodiment illustrated in FIGS. 1 to 8, the aforementioned upstanding plates 119 and 120 are secured to a base bracket 138 which is in turn secured to a rearwardly extending base plate 139 by means of which the centering device 39 can be detachably secured on the forward end of a respective one of the drill guiding and supporting structures 35 and 36 of the vehicle 10. For this purpose, the base plate 139 has secured thereto a fixed guide plate 140 received within the forward end of the aforementioned keyway 93 of the elongated member 42. A bolt 141 is loosely received through a hole in a movable clamping plate 142 which is held in the keyway 94 of the elongated member 42 by means of a nut 143. Stop plates 144 and 145 are secured to the rear surfaces of the arms 116 and 117 respectively transversely outwardly of the aforementioned upstanding plates 119 and 120 respectively and each of the stop plates 144 and 145 is provided with a sloping surface 146 for abutment with an outer edge of a corresponding one of the plates 119 and 120 to prevent outward movement of the arms 116 and 117 beyond the positions actually shown in FIG. 8 and to ensure that both such arms are moved away from a drill steel on actuation of the cylinder means 124.

Although the rock drill 40 forms no part of the present invention, it will be of value in understanding the operation and use of the drill guiding and supporting structures of the invention to note that the drill 40 is provided with a hose 150 for the supply of compressed air thereto and with a second hose 151 for the supply of flushing water.

The air supply through the hose 150 serves to operate the drill 40 while the water supplied through the hose 151 is passed through the hollow drill steel 41 and serves to flush out dust and foreign particles from

the hole being drilled as well as serving to cool the drill steel.

In the use in rock drilling of the vehicle 10 shown in the accompanying drawings, the vehicle is first moved to the desired location and each of the drill guiding and supporting structures 35 and 36 is then secured in a desired position on the transverse member 11 of the vehicle, the correct transverse positions of the elongated members 42 on the transverse member 11 being obtained before the nuts 110 (FIG. 6) are tightened on the bolts 108. By loosening the nuts 107 (FIG. 2), the elongated members 42 may be rotated about the axes of the frusto-conical members 101 to any desired angular positions and then held in such positions by tightening the nuts 107.

Further adjustment of the positions of the elongated members 42 can be obtained by loosening the nuts 100 (FIG. 6) to permit the keyways 93 and 94 to be slid between the tongues 95 and 96. Once the elongated members 42 are in the desired position, the nuts 100 are tightened to hold the tongues 95 and 96 firmly in position in the keyways 93 and 94 respectively and so to secure the drill guiding and supporting structures 35 and 36 firmly on the vehicle 10.

Adjustment of the tension in the cables 52 and 54 of each of the drill guiding and supporting structures 35 and 36 is obtained simply by turning the appropriate lock nuts 81. Rock drills, such as rock drill 40, are then secured to the respective carriages 48 by bolts 152 (FIG. 2). The drill steel 41 is then inserted and locked in the respective drill 40 in a conventional manner and the arms 116 and 117 of the respective centering means 39 are then pivoted towards each other by operation of suitable fluid control means so that the drill steel 41 is encircled by the recesses 123, and is therefore fully supported forwardly of the rock drill 40.

The hoses 91 and 92 from each of the cable cylinders 37 are connected to suitable control valves actuatable to supply compressed air to a desired one of the cylinder chambers 50 and 51 and to permit air to discharge from the other of said cylinder chambers 50 and 51. If, for example, compressed air is supplied through hose 91 to cylinder chamber 50 and cylinder chamber 51 is vented through hose 92, the piston 49 within the bore 45 will move rearwardly (to the left of FIG. 4). This movement will be transmitted through the cables 52 and 54 to cause the carriage 48 carrying the rock drill 41 to move forwardly (to the right in FIGS. 2, 3 and 4), the carriage 48 being guided in the guideways 67 of the elongated member 42. When it is required to retract the drill steel 41, the aforementioned control valve is operated to vent the cylinder chamber 50 and to supply compressed air to cylinder chamber 51 to cause the piston 49 to move forwardly and the carriage 48 to move rearwardly.

Although the control valve and fluid distribution system provided on the vehicle 10 for supplying compressed air to the cable cylinders 37, to the rock drills 40 and to the cylinders 126 of the centering means 39 and for supplying water to the rock drills 40 do not form an essential part of this invention, the arrangements provided on the vehicle 10 of FIG. 1 for this purpose will now be briefly described for the sake of completeness.

For the particular vehicle 10, the aforementioned hollow transverse structural member 11 is used as a water reservoir and to this end is provided with a suitable feed nipple to which a water supply hose 154 is connected for the supply of water thereto. Water flow control valves 155 are provided for controlling the flow of water to the respective rock drill 40. The hollow longitudinal structural member 12 similarly functions as a compressed air reservoir, air under pressure being supplied thereto from a suitable source through a feed hose 156 and a check valve 157. From the structural member 12, air is supplied through lubricators 158 to pairs of valves 159 and 160. The valves 159 are used to control the flow of compressed air through the hoses 150 leading to the rock drills 40 while the valves 160 are used to control the supply of compressed air to the hoses 134 and 135 leading to the cylinders 126 of the centering means 39 and to the hoses 91 and 92 leading to the cable cylinders 37. The invention is, however, in no way restricted to the use of any particular arrangement of control valves and fluid distribution systems.

One particularly advantageous feature of the structure described with reference to FIGS. 1 to 8 of the accompanying drawings should be particularly noted. By constructing the centering means 39 so that the appropriate structural members thereof can be disengaged from the drill steel 41 once a drill hole has been initiated, wear of such structural members is considerably reduced and considerably increased useful lives for such centering means are consequently obtained.

Although the cable cylinder 37 has been described herein with particular reference to its use in the rock drill guiding and supporting structures 35 and 36, it will be appreciated that the cable cylinder 37 and other such cylinders in accordance with this invention will find use in numerous other applications where a hydraulic or pneumatic operation of this type is required. Furthermore, it is equally possible to modify the structure already described herein without departing from the scope of the invention.

As hereinbefore indicated, it should also be said that a particularly important feature of the present invention is that the elongated member 42 including the bore 45, the guideways 67 and the keyways 93 and 94 can be formed as a unitary structure. Such a structure can, for example, readily be formed by an extrusion technique from aluminum or from an alloy thereof. The fabrication or extrusion of the elongated member by other procedures and from other materials is not, however, precluded.

Another useful but optional feature of this invention will now be described with particular reference to FIG. 9 in which there is also shown an alternative structure for a retractable centering means provided for the purpose already explained herein.

The rock drill guiding and supporting structure generally indicated at 170 in FIG. 9 has many features in common with the structures 35 and 36 already described and identical components will be indicated in FIGS. 9 and 10 by the said legends as already used herein with reference to the structure shown in FIGS. 1 to 8 to avoid the need for duplication of the description. It will generally be noted that the structure 170 comprises a cable cylinder 171 having a carriage 48 on

which a rock drill 40 holding a drill steel 41 can be mounted exactly as already described. The structure 170 also includes a drill steel centering means generally indicated at 172 and a mounting means generally indicated at 173.

The cable cylinder 171 is identical to the cable cylinder 37 shown in the preceding figures of the accompanying drawings except that the elongated member 42 additionally includes longitudinally extending bores 174 and 175 (FIG. 11) which are usefully provided for the purpose of supplying fluid such as air under pressure to the centering means 172 for operation of that means. Each of the bores 174 and 175 is in fluid communication with a respective forward nipple located near the forward end 43 of the elongated member 42 and with a respective rearward nipple located near the rearward end 44 of the elongated member 42. Hoses 176, one of which is visible in FIG. 9, are coupled to the rearward nipples for the flow of pressurized fluid into respective ones of the aforementioned bores 174 and 175 from a suitable source or for the return of pressurized fluid therefrom. A hose 177 is shown as being coupled to the forward nipple of the bore 174 for the flow of pressurized fluid between that bore and the blind end of a fluid operated cylinder 178 forming part of the aforementioned centering means 172. A second hose 179 is suitably provided between the rod end of the cylinder 178 and a forward nipple of the bore 175. The provision of such additional bores in the elongated member 42 of the cable cylinder 171 is beneficial in that it reduces the length of unprotected hose required on a rock drilling vehicle or structure on which the drill guiding and supporting structure 170 is mounted and, therefore, considerably reduces the risk of damage to such hoses during operation of such vehicle or structure.

Referring now in greater detail to the structure of the centering means 172, it will be seen from FIGS. 9 and 10 that this means 172 includes a generally U-shaped drill steel-supporting member generally indicated at 180 which is pivotally mounted at 181 between a pair of forwardly extending upright plates 182 and 183 for movement between the upright steel-engaging position shown in FIG. 9 and a steel-releasing position in which the member 180 is pivoted forwardly and downwardly from the position shown in FIG. 9.

A piston rod 184 extends forwardly from a piston head 185 within the cylinder 178 and this rod 184 is pivotally connected at 187 to a downward and slightly forward extension 186 of the member 180. The cylinder 178 is itself pivotally mounted at 188 between a pair of transversely spaced apart, downwardly extending plates 189 secured to the elongated member 42 at the forward end 43 of the structure 170.

Another useful feature included in the rock drill guiding and supporting structure 170 shown in FIG. 9 comprises a hydraulically operated advance mechanism generally indicated at 191 and forming part of the aforementioned mounting means 173. The advance mechanism 191 is provided between the elongated member 42 and a universal mounting member 38 identical to that already described and shown as being used to mount the structure on a hollow transverse structural member 11.

The advance mechanism 191 includes a double-acting hydraulic cylinder 192 from which a piston rod 193 extends forwardly to a clamping means 194 to which it is pivotally attached at 195. The clamping means 194 includes a pair of opposed tongues 196 which are received in the keyways 93 and 94 of the elongated member 42 and clamped in position therein by a bolt 197 in much the same manner as that shown in FIG. 6 for the tongues 95 and 96 of the mounting means 38.

At its rearward end, the cylinder 192 is pivotally mounted at 198 within a cylinder housing frame 199 which is formed with forward and rearward pairs of upstanding plates 200 and 201 respectively which are provided with fixed tongues (not shown) which are slidably received in the keyways 93 and 94 of the elongated member 42. Fluid hoses 202 and 203 are provided for the flow of pressurized fluid to and from the blind end and the rod end respectively of the cylinder 192. On operation of the cylinder 192, the elongated member 42 is moved forwardly or rearwardly relative to the supporting structure as represented by the structural member 11, the elongated member 42 sliding through the pairs of plates 200 and 201.

As already indicated, a cable cylinder in accordance with this invention can be constructed in ways other than that described with reference to FIGS. 1 to 11 of the accompanying drawings. Another useful construction for such a cylinder will now be described with reference to FIGS. 12 and 13 of the accompanying drawings which show a somewhat schematic representation of such an alternative embodiment.

The cable cylinder indicated generally at 210 in FIGS. 12 and 13 includes an elongated cylinder 211 integrally formed with an elongated and radially extending downward flange 212. Along its radially outer edge, the flange 212 is integrally formed with a transverse mounting plate 213 having holes 214 for mounting screws or bolts (not shown) provided therethrough.

A carriage generally indicated at 215 includes a cylindrical member 216 which is disposed around the cylinder 211 for sliding movement therealong as indicated by the double headed arrow A. The cylindrical member 216 has an elongated slot 217 through its peripheral wall and the aforementioned flange 212 extends through this slot. It will be seen that the cylindrical member 216 is usefully provided along each edge of the slot 217 with downwardly projecting flanges 218 for sliding abutment with respective faces of the flange 212 to provide additional guidance for the carriage 215.

An upstanding flange 220 is integrally formed with the cylindrical member 216 and, in the particular embodiment illustrated, this flange 220 is provided with forward and rearward cable anchoring plates 221 and 222 respectively, the purpose of which will become apparent as the description herein proceeds. A mounting bracket 224 is also provided on the flange 220 for mounting a rock drill or other tool on the cable cylinder 210.

A piston 225 having suitable seals or rings (not shown) is disposed within the cylinder 211 for longitudinal reciprocation therein and the cylinder 211 is closed at its forward and rearward ends. The piston 225 and the closed ends of the cylinder 211 define forward and rearward, variable volume cylinder chambers 228 and 229 respectively.

A first cable 230 is secured to the piston 225 and extends forwardly therefrom through the cylinder chamber 228 and through an opening in the forward end of the cylinder 211, suitable seals being provided to prevent the loss of fluid from the chamber 228 through such an opening. The cable 230 then passes around a pulley 231 pivotally mounted at 232 in a forward, bifurcated pulley mounting generally indicated at 233 and suitably secured, for example, by welding, on the forward end of the cylinder 211. From the forward pulley 231, the cable 230 extends rearwardly to the carriage 215 to which it is anchored on the aforementioned forward anchoring plate 221.

Similarly, a second cable 234 is secured to the piston 225 and extends rearwardly therefrom through the cylinder chamber 229 and through the rearward closed end of the cylinder 211, appropriate sealing means (not shown) being provided to prevent the escape of pressurized fluid from the chamber 229. A rearward pulley 235 pivotally mounted at 236 in a bifurcated pulley mounting 237 suitably secured to the rearward end of the cylinder 211 has the cable 234 entrained therearound. From the pulley 235, the cable 234 extends forwardly to be secured to the anchoring plate 222 of the carriage 215. It will be understood that, if desired, a cable-tensioning device may be provided in either of the cables 230 and 234.

Operation of the cable cylinder 210 is effected by supplying fluid under pressure to a desired one of the chambers 228 and 229 and venting fluid from the other one of such chambers. For these purposes, hoses 238 and 239 are provided in a conventional manner.

Various modifications may be constructed or performed within the scope of the inventive concept disclosed. Therefore what has been set forth is intended to illustrate such concept and is not for the purpose of limiting protection to any herein particularly described embodiment thereof.

What is claimed is:

1. In the drill steel actuating tool of a mobile rock drilling machine in combination,

i. a cable cylinder of extruded material having formed therein

a. at least one longitudinally extending guideway for accommodating a superposed drill tool supporting carriage in slideable connection with said guideway, and

b. at least one longitudinally extending keyway for facilitating the slideable or rigid support of said cable cylinder,

ii. rotatable cable cylinder mounting means engageable with said keyway, and

iii. drill rod centering means on said cable cylinder said mounting means being adapted releasably to secure said cable cylinder to a supporting member at any desired angular position with respect thereto and to permit releasable securement of said cable cylinder for longitudinal movement in any desired direction in the parallel planes on which lie both said supporting member and said cable cylinder.

2. The invention according to claim 1 in which said centering means are moveably mounted on said cable cylinder adjacent one end thereof and comprise a pair of pivotally mounted drill steel-centering arms having opposed recesses adapted to encircle said drill steel when said arms are transversely pivoted toward each

other, and to permit said drill steel to be removed transversely from between said arms when said arms are transversely pivoted apart.

3. The invention according to claim 1 in which said centering means includes a generally U-shaped drill steel holding member pivotally mounted about a transversely disposed axis and adapted to support a drill steel therein and to be pivoted downwardly about said transversely disposed axis to disengage such a drill steel.

4. The invention according to claim 1 in which said mounting means includes a fluid operated ram adapted to be connected between a supporting member and said cable cylinder and operative to adjust said longitudinal position of said cable cylinder with respect to said supporting member.

5. The invention according to claim 4 in which said mounting means has at least two parallel opposed and longitudinally extending guideways adapted slideably to receive corresponding guide flanges of said carriage, there being at least two of said keyways arranged in parallel relationship said keyways being adapted slidingly to receive corresponding guide members provided on said supporting member and to be engaged by releaseable clamping means of said fluid operated ram.

6. The invention according to claim 1 in which said

cable cylinder includes two keyways extending for the length thereof, each of said keyways being located on one side and the other of the vertical axial plane of said cylinder, each of said keyways, in cross section at right angles to the longitudinal axis of said cable cylinder being seen to consist of a groove having an upper outwardly inclining wall and a downwardly and outwardly inclining wall to accomodate and facilitate the ready attachment and detachment from said keyways of complementary engaging means on said mounting means.

7. The invention according to claim 6 in which said guideway is in the form of an open ended recess in said cable cylinder taking the form, when viewed at right angles to the longitudinal axis of said cylinder of an inverted T, being adapted and so designed as to accomodate a complementary formation projecting downwardly from said carriage.

8. The invention according to claim 7 in which said cable cylinder includes, in addition to a central bore, additional longitudinally extending bores for the flow of fluid to and from said centering means for effecting operation of said centering means, said centering means being adapted to be fluid actuated for movement between a drill steel-engaging position and a drill steel-releasing position.

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