Aug. 2, 1966 G. E. FOGELSTRÖM ETAL 3,263,573

FEEDING DEVICE WORKING IN STEPWISE MANNER

Filed April 13, 1964 3 Sheets-Sheet 1

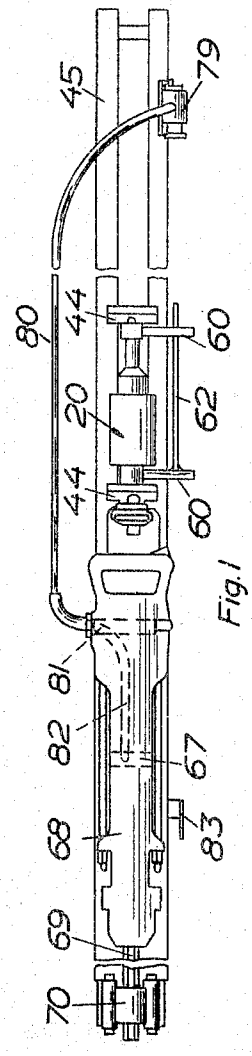

Fig. 1

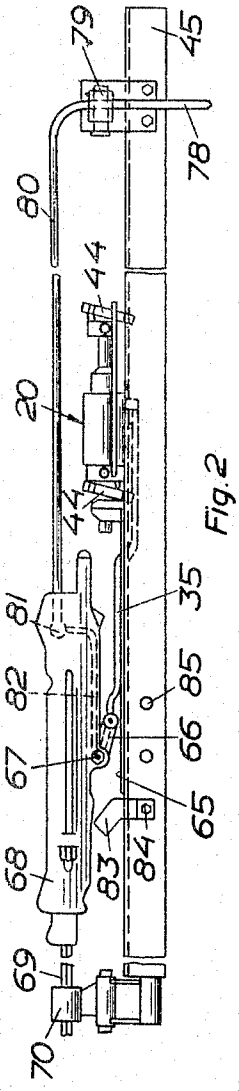

Fig. 2

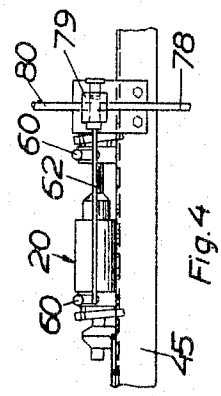

Fig. 4

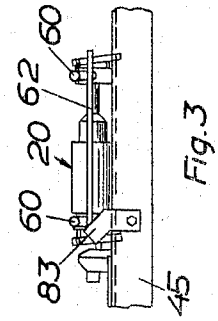

Fig. 3

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FEEDING DEVICE WORKING IN STEPWISE MANNER

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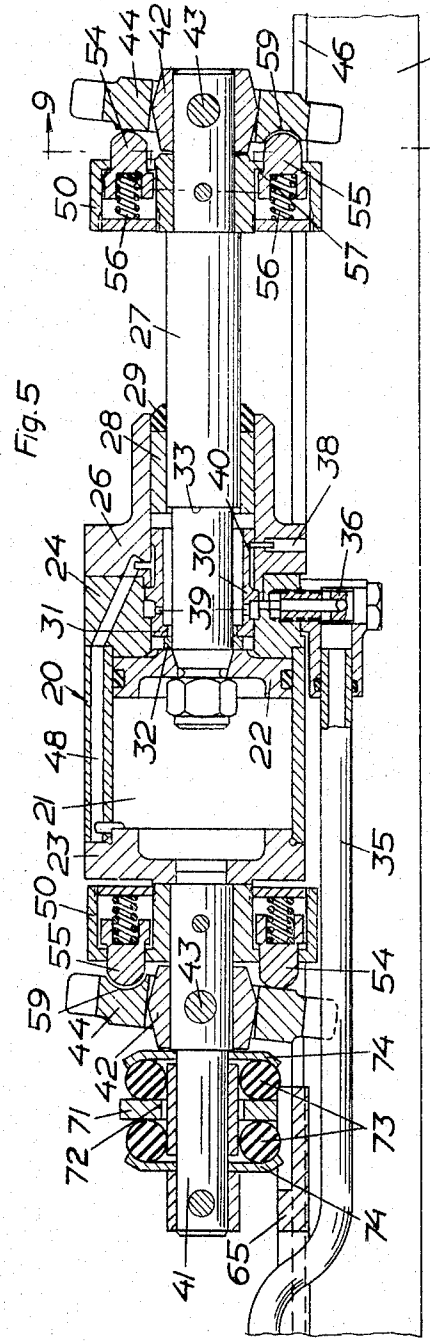

Fig. 5

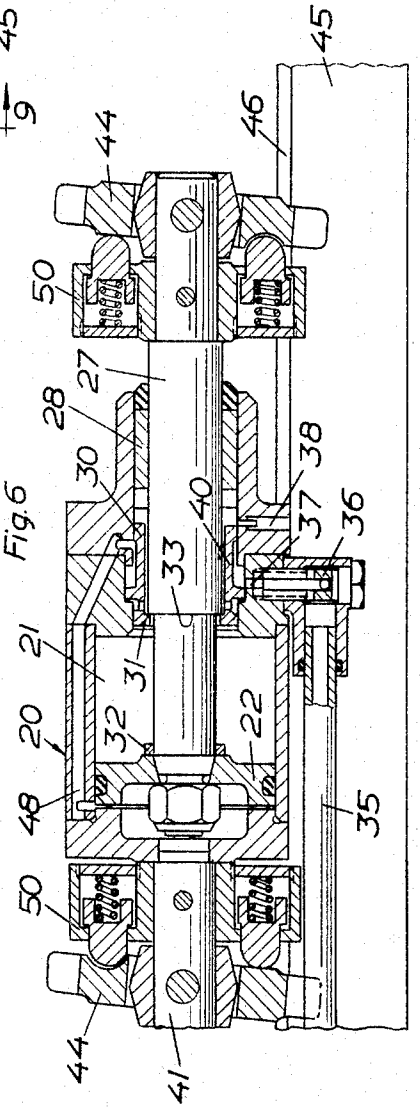

Fig. 6

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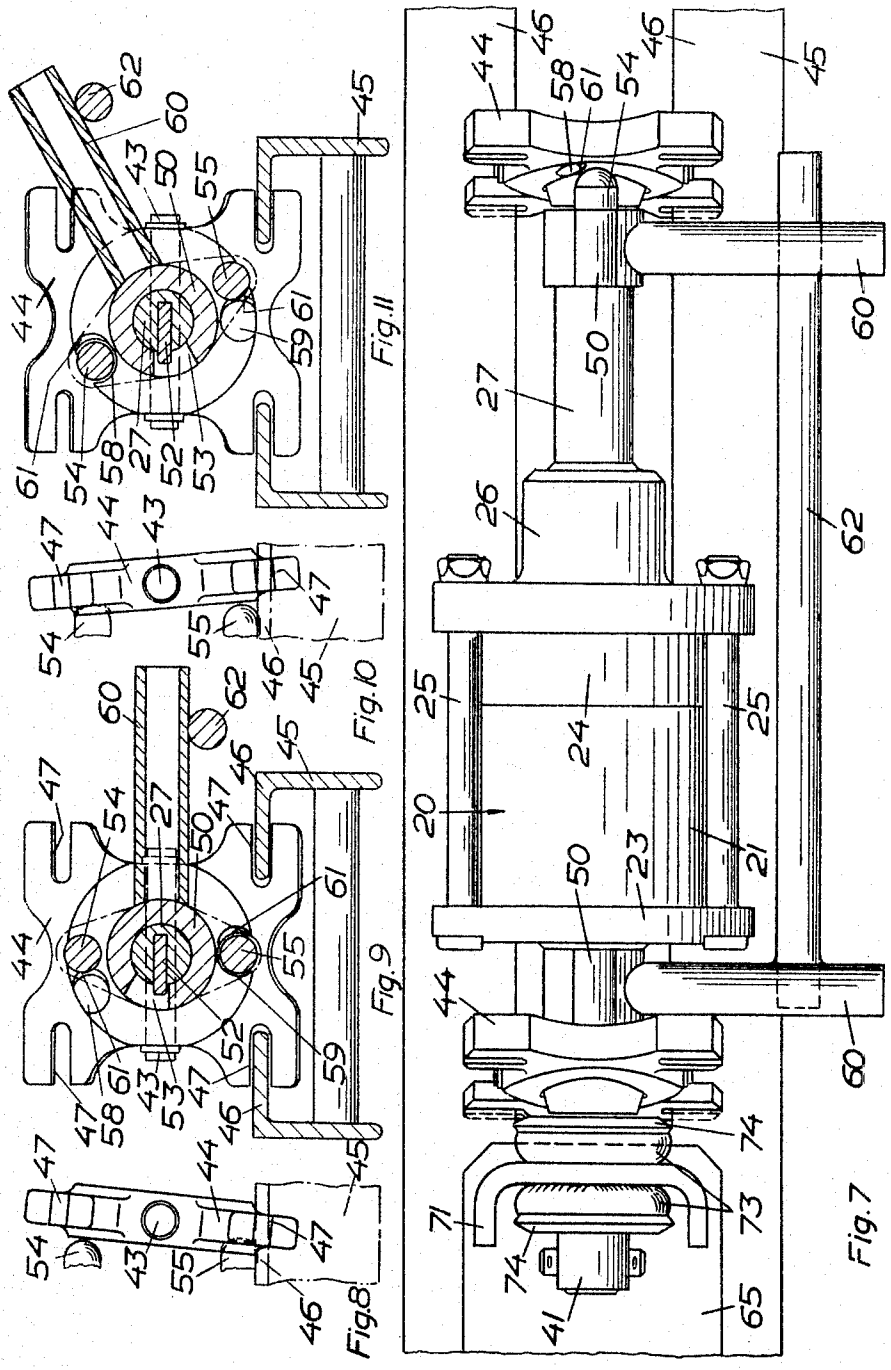

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3,263,573

FEEDING DEVICE WORKING IN STEPWISE MANNER

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10 Claims. (Cl. 91—217)

This invention relates to feeding devices for rock drills and more particularly to feeding devices of the type working in stepwise manner by the aid of a reciprocating motor and a number of stepping or locking members thereon providing uni-directional locking action against the feed bar or shell on which the rock drill is movable, such locking action being reversible by means of reversing elements associated with the locking members.

In feeding devices of this type the reversing elements hitherto have been operable independently of each other and have been shifted wholly manually, which has demanded the operator to be present at the forward end of the feed bar each time when it comes to the point of returning the feeding device to the starting position. This renders simultaneous handling of multiple drills difficult and it is an important object of the invention to make possible automated return or rearward feed of the feeding device. Another object of the invention is to provide a certain dependency in operation between the reversing elements in that shifting of one of the reversing elements from forward to rearward feed brings about shifting of the other reversing element to the rearward feed position, whereas shifting of the other reversing element from forward to rearward feed position will still be independent of the first mentioned reversing element, leaving the latter in the forward feed position. A still further object of the invention is to provide a simple and effective reversing mechanism for the locking members whereby the members for purposes of making automated shifting more easy can be shifted by a relatively small angular movement of the reversing elements.

The foregoing and further objects and advantages of the present invention will become apparent hereinafter as this description proceeds, reference being made to the accompanying drawings in which an embodiment of the invention is illustrated by way of example and by which the invention is not to be considered limited as it may be carried out in many different ways within the scope of the claims. In the drawings FIG. 1 is a top view of a feed bar and a rock drill provided with the feeding device according to the invention, FIG. 2 is a side view of the arrangement in FIG. 1. FIG. 3 shows the feeding device in FIG. 2 in a forward position on the feed bar and shifted for return. FIG. 4 shows the feeding device in FIG. 2 in starting position on the feed bar. FIG. 5 shows on a larger scale a longitudinal sectional view through the feeding device with the cylinder and piston means in extended position. FIG. 6 shows the feeding device in FIG. 5 in contracted position. FIG. 7 is a top view of the feeding device in FIG. 5. FIG. 8 is a fragmentary side view of the rear locking member in FIG. 5. FIG. 9 shows a section on the line 9—9 in FIG. 5. FIG. 10 shows the locking member in FIG. 8 after it has received an opposite inclination by the reversing element. FIG. 11, finally, shows the locking member in FIG. 9 with the reversing element in a second position of adjustment.

In the figures the feeding device is generally designated by the numeral 20 and consists of a cylinder 21 in which a slidable piston 22 is tightly guided. The cylinder 21 carries a front cover 23 and a rear cover 24 which together with a back piece 26 are connected to the cylinder 21 by means of through tensioning bolts 25. A piston rod 27 is connected to the piston 22 and projects to the rear through a guide sleeve 28 in the back piece 26. A sealing ring 29 in the back piece tightens against the piston rod 27.

A tubular distributing slide 30 is slidably guided in suitable bores in the rear cover 24 and piece 26 between the end positions depicted in FIGS. 5 and 6. The distributing slide 30 surrounds the piston rod 27 with a considerable clearance and is provided with an inner flange 31. A ring 32 affixed to the piston rod 27 adjacent the piston 22 engages the flange 31 just prior to the piston 22 reaching the end position depicted in FIG. 5, at which instant the distributing slide 30 is shifted to the position shown in FIG. 5. Furthermore the piston rod 27 has a shoulder 33 which in its turn engages the inner flange 31 just prior to the piston 22 reaching the end position depicted in FIG. 6, at which instant the distributing slide 30 is shifted to the position shown in FIG. 6.

Pressure fluid is supplied via a conduit 35 to a nipple 36 on the underside of the rear cover 24 and is conducted from the nipple through a bore 37 to the outer surface of the distributing slide 30. In the position shown in FIG. 5 pressure fluid then passes the through holes 39 and acts thanks to the clearance between the distributing slide 30 and the piston rod 27 under full pressure on the rear face of the piston 22, at which instant the piston rod is moved into the cylinder 21 and the feeding device 20 is contracted. Pressure fluid disposed in front of the piston 22 is expelled through a passage 48 and a wide peripheral groove 40 in the distributing slide to an outlet 38. After shifting of the distributing valve 30 as shown in FIG. 6, pressure fluid is conducted from the bore 37 via the wide groove 40 to the passage 48 leading to the front face of the piston 22. The piston rod 27 is then moved outwardly from the cylinder 21 and the feeding device 20 is extended thereby. Simultaneously herewith the chamber behind the piston 22 is emptied through the interior of the distributing slide 30 and the outlet 38 which has been opened by the rear edge of the distributing slide 30. As long as pressure fluid is supplied to the conduit 35 and the bore 37, the feeding device 20 evidently will perform extensions and contractions following in automatic succession one upon the other, since shifting of the distributing slide 30 will take place by means of the ring 32 and the shoulder 33 each time the piston 22 reaches proximity of the respective end positions.

A rod 41 disposed coaxially with respect to the piston rod 27 projects from the front cover 23 in forward direction. A boss 42 is carried by each of the rods 27 and 41, which bosses carry through parallel axles 43. About each axle 43 there is pivotally affixed a locking member or plate 44. The two locking plates 44 support themselves against a feed bar 45 for a rock drill and form locking members displaceable along the feed bar. These locking plates are provided for carrying the feeding device 20 and have a uni-directional reversible locking action, to be described hereinafter, in the longitudinal direction of the bar. The feed bar 45 has two coplanar parallel guide flanges 46 and each locking plate is provided with slots 47 turned in opposite directions, into which slots the flanges 46 project. The width of the slots 47 is chosen somewhat greater than the thickness of the flanges 46, by reason of which the locking plate can tilt between two outer positions, shown in FIG. 8 and FIG. 10, respectively, which are inclined in opposite directions with respect to the feed bar. In these outer positions the slots 47 evidently will clamp the flanges 46 providing a frictional engagement between the locking plate 44 and the flanges 46 if the inclination of the locking

plate is increased by force actuation on the axle **43** in one axial direction of the feed bar. If on the other hand the axle will be actuated by a force tending to decrease the inclination of the locking plate, the locking plate **44** will be able to slide freely along the flanges **46**. In the outer position shown in FIG. 8 a force actuation on the axle **43** to the right evidently will lock the locking plate **44** to the feed bar **45**, which is indicated by dot and dash lines, whereas a force actuation to the left will cause the locking plate **44** to slide freely to the left. Thus one receives a uni-directional locking action to the right and free movability of the locking plate to the left. In the outer position depicted in FIG. 10 one receives in analogy herewith uni-directional locking action and free movability in opposite directions.

A pair of reversing elements are arranged for positioning the locking plates **44** to the alternative outer positions. Each of the reversing elements consists of a housing **50** turnably arranged at one side of the respective locking plates **44** on the piston rod **27** and the rod **41**, respectively. The housing **50** is turnable between two positions of adjustment defined by a transverse pin **52**, which projects radially from the respective rods **41** and **27** and by coaction with a groove **53** in the housing **50** limits the turning motion of the latter. A pair of diametrically opposed elastic biasing or spring means directed axially towards the appurtenant locking plate **44** and consisting of spring pressed plungers **54**, **55** are provided in the housing **50**. The plungers **54**, **55** are biased by compression springs **56** axially in outward direction from the housing **50** engaging the locking plate **44** at the upper as well as at the lower side of the axle **43**. A shoulder **57** on each plunger **54**, **55** restricts the axial projection thereof by engaging the inner wall of the housing **50**. In order that the diametrically opposed plungers **54**, **55** shall be able to move the locking plate **44** into inclined outer position, either of the plungers must be thrown out of operation. This is accomplished by two dimples **58**, **59** disposed at an angular distance from one another somewhat smaller than 180 degrees, which dimples are provided on the side of the locking plate **44** facing the plungers. The dimples **58**, **59** are disposed in such manner than the plunger **55** of the reversing element **50** falls into the dimple **59** in the forward feed position of the reversing element **50** shown in FIG. 9. This throws the plunger **55** out of operation while the opposed plunger **54** continues to push against the upper part of the locking plate **44** thereby moving the plate into the inclined position for forward feed shown in FIG. 8. When the reversing element is turned to its rearward feed position shown in FIG. 11, the plunger **55** leaves the dimple **59** and pushes the lower part of the locking plate **44** while the opposed plunger **54** falls into the upper dimple **58** and is thrown out of operation thereby. The inclination of the locking plate **44** will then be according to FIG. 10.

The reversing elements **50** are provided with operating handles **60** projecting in lateral direction. Chamfered portions **61** are provided at one side of each of the dimples **58**, **59** for making the passage of the respective plungers **54**, **55** to and from the dimples more easy. As soon as the plunger **54** with its spring **56** under certain compression during shifting from forward to rearward feed reaches the chamfered portion **61** of the dimple **58**, the spring force acting on the plunger **54** therefore will assist in turning the reversing elements **50** the remaining angle to their fully shifted position, which final turning is performed under compression of the spring acting on the other plunger **55**. Thanks to the closeness of the empty dimple to the adjacent active plunger the full turning angle during shifting will be small. The two reversing elements **50** on the respective rods **51** and **27** are mounted with the plungers turned away from each other. Since the handles **60** as well as the locking plates **44** in the two positions of adjustment preferably should be parallel the plungers on the reversing element which is sitting on the rod **41** are mounted upside down with respect to the reversing element **50** and its plungers on the piston rod **27**. For making possible exchangeability between the locking plates **44** and correct cooperation with the respective reversing elements, the locking plates **44** are provided with opposed slots **47** in paired symmetrical disposition as depicted in FIGS. 9 and 11.

To one of the handles **60**, for example to the forward handle, there is affixed a coupling rod **62** which extends to and under the other handle **60**. When the forward handle is swung upwards the coupling rod **62** simultaneously therewith will move the rear handle to the other position of adjustment upwards whereby both reversing elements **50** are moved from forward to rearward feed position.

On the flanges **46** in front of the feeding device **20** there is slidably guided a slide **65**. On a transverse pivot **67** carried by an upstanding bracket **66** on the slide **65** there is in conventional manner affixed a drill **68** carrying a drill steel **69**. A conventional drill steel guide **70** may be provided forwardly on the feed bar **45** for guiding the drill steel **69**.

To the rear end of the slide **65** is fixed an upstanding plate **71**, FIGS. 5 and 7, having a central hole **72** therethrough. The rod **41** of the feeding device **20** projects into the hole **72** and at opposite sides of the plate **71** there are arranged annular rubber buffers **73** around the rod **41**. Thrust plates **74**, which are axially affixed to the rod **41**, are arranged outside the rubber buffers **73** alternately pushing each against one of them when the feeding device moves in forward or rearward direction along the feed bar **45**. The hole **72** surrounds the rod **41** with a considerable clearance, due to which fact the feeding device **20** will be supported substantially solely by the two locking plates **44**.

From a suitable pressure source, not shown, pressure fluid is supplied via a conduit **78** to a two-way valve **79** fixed to the rear end of the feed bar **45**. In the open position of the valve **79** shown in FIG. 2, a pressure fluid is conducted to a hose **80** and thence to the open main valve **81** of the rock drill **68**, the main valve being indicated diagrammatically only in the figures. Pressure fluid from the main valve drives the hammer motor (not shown) of the rock drill. Via a passage **82** a portion of the pressure fluid is branched to passages passing through the transverse pivot **67** and thence onto the bracket **66** and the conduit **35**, whereby the feeding device receives pressure fluid and starts operation.

At a suitable location on the forward end of the feed bar **45** there is affixed a cam plate **83** which by means of a bolt **84** can be fixed in a selective position to holes **85** on the feed bar **45**. The cam **83** is arranged to cooperate with the coupling rod **62** or the forward handle **60** on the feeding device **20**.

In the position shown in FIG. 2 the feeding device **20** thus receives pressure fluid and its piston **22** is brought into reciprocation while the hammer motor of the rock drill **68** is operating. With the reversing elements **50** and the locking plates **44** in the position shown in FIG. 2 and FIGS. 5–9, the successive extensions and contractions of the feeding device **20** will produce a successive stepwise displacement of the feeding device **20** in forward direction along the feed bar **45**. The rear thrust plate **74** of the feeding device **20** transmits the feeding force, which is defined by the pressure in the cylinder **21** in front of the piston **22**, to the plate **71** of the slide **65** via the rear rubber buffer **73**. The pressure in front of the piston **22** displaces the cylinder **21** and the rod **41** in forward direction while the forward locking plate **44** slides along the flanges **45**. As soon as the drill **69** has penetrated into the rock a distance corresponding to a full throw of the piston, the distributing slide **30**, FIG. 5 will be shifted, whereby the piston **22**, the piston rod **27** and the rear locking plate rapidly will be brought forward to the position shown in FIG. 6. During such movement the forward locking plate **44** forms a support

for the feeding force by locking against the feed bar **45**. As the drilling work progresses the rock drill **68** is thus fed in forward direction. When the desired drilling depth has been reached the feeding device **20** will approach the cam plate **83**, which will turn the forward handle **60** from the forward feed position corresponding to FIG. 9 to the rearward feed position corresponding to FIG. 11. Simultaneously herewith the coupling rod **62** will turn the rear handle **60** to the same position of adjustment, whereby the inclination of both locking plates **44** is shifted in the manner hereinbefore described. Such shifting will be performed easily thanks to the small turning angle necessary for shifting and to the assistance provided by the springs **56** of the plungers **54**. In the new position of the reversing elements **50** and locking plates **44** shown in FIGS. 3, 4 10 and 11, the successive extensions and contractions of the feeding device will produce a stepwise return of the feeding device back to the starting position on the feed bar **45** under the action of a pulling force on the slide **65** defined by the pressure behind the piston **22**. Return is finished in FIG. 4 and at this instant the coupling rod **62** encounters the valve **79** and moves it to cut-off position. The pressure fluid supply to the drill **68** as well as to the feeding device **20** is interrupted hereby and operation of these parts ceases.

When a new working cycle is to be started, the operator depresses the rear handle **60**, FIG. 4, whereby the coupling rod **62** and the forward handle **60** simultaneously are pushed down to a position corresponding to forward feed. The locking plates **44** will now again take up the inclination shown in FIG. 2. Simultaneously herewith the two-way valve can be opened without hindrance, FIG. 2, which alternatively may be performed manulally or by spring action, at which instant the new working cycle is started.

What we claim is:

1. A feeding device for rock drills comprising an elongated feed bar for slidably supporting a rock drill therealong, a pair of locking members movably mounted on said feed bar, adjustable means on said locking members providing in a first position of adjustment uni-directional locking against said feed bar to allow forward and to prevent rearward movement of said members along said feed bar and in a second position of adjustment uni-directional locking against said feed bar to allow rearward and to prevent forward movement of said members, a pressure fluid operated extensible and contractable feed motor connected to said drill and movable therewith, said motor including cooperating cylinder and piston elements coupled one to each of said locking members for moving said members and thereby said rock drill step by step along said feed bar by successive extensions and contractions of said motor in the direction defined by the position of adjustment of said adjustable means, means for automatically controlling the delivery of pressure fluid to said motor for continuously extending and contracting said cylinder and piston elements, first and second reversing elements movably mounted on said motor each adjacent one of said locking members for movement between a forward and a rearward feed position and having means thereon for moving said adjustable means from their first to their second position of adjustment as a result of said reversing elements being moved from said forward to said rearward feed position, said first reversing element being journalled for movement from said forward to said rearward feed position independently of said second reversing element for purposes of rendering said feed motor inactive by causing opposite locking action of said members, and coupling means connected to said second reversing element and engageable with said first reversing element for moving the latter from said forward to said rearward feed position in unison with said second reversing element.

2. A feeding device according to claim **1** in which there are provided cam means on said feed bar cooperating with said reversing elements and said coupling means for mechanically shifting said reversing elements in unison from said forward to said rearward feed position upon said feeding device having moved a predetermined feed length, and means for adjusting the longitudinal position of said cam means on said feed bar.

3. A feeding device according to claim **2** in which a pressure fluid supply line is connected to said drill and there is provided a cut off valve in said line rearwardly on said feed bar actuatable to cut off the fluid supply to said rock drill, and an abutment on said feed motor cooperating with said cut off valve for causing actuation thereof upon said feeding device having moved back said feed length.

4. A feeding device according to claim **1** in which each locking member consists of a locking plate pivotally mounted about an axle disposed on said feed motor transversely with respect to said feed bar, said locking plate being pivotable about said axle between two outer positions inclined in opposite directions with respect to said feed bar, clamping surfaces on each locking plate frictionally cooperating with said feed bar in said outer positions thereby to provide said uni-directional locking in forward and rearward direction, respectively, a pair of biasing means on each said reversing element disposed adjacent each locking plate at opposite sides of said axle and pushing against said locking plate for pivoting it about said axle, and means for throwing respectively one or the other of said opposite biasing means out of operation for providing forward or rearward feed, respectively, depending on the feed position of said reversing elements.

5. A feeding device according to claim **4** in which there are provided angularly spaced dimples on said locking plates at opposite sides of said axle for alternately receiving said biasing means, whereby respectively one or the other of said biasing means is thrown out of operation.

6. A feeding device according to claim **1** in which said reversing elements are journalled for turning movement about an axis disposed longitudinally of said feed bar, an operating handle on each reversing element, and a longitudinal coupling rod connected to one of said handles and engageable with said other handle for shifting said handles and thereby said reversing elements in unison from said forward to said rearward feed position.

7. A feeding device for rock drills comprising an elongated feed bar for slidably supporting a rock drill therealong, a pair of locking members movably mounted on said feed bar and supporting themselves thereon, adjustable means on said locking members providing in a first position of adjustment uni-directional locking against said feed bar to allow forward and to prevent rearward movement of said members along said feed bar and in a second position of adjustment uni-directional locking against said feed bar to allow rearward and to prevent forward movement of said members, a pressure fluid operated extensible and contractable feed motor disposed longitudinally of said feed bar, said motor including cooperating cylinder and piston elements coupled one to each of said locking members for being carried thereby on said feed bar and for moving said members step by step along said feed bar by successive extensions and contractions of said motor in the direction defined by the position of adjustment of said locking members, means for automatically controlling the delivery of pressure fluid to said motor for continuously extending and contracting said cylinder and piston elements, a connection between said feed motor and said rock drill for transmitting the step by step movement of said feed motor to said rock drill, said connection having means providing relative movability between said drill and said feed motor transversely to the longitudinal direction of said feed bar to permit said feed motor to rest solely on said locking members, first and second reversing elements movably

mounted on said motor each adjacent one of said locking members for movement between a forward and a rearward feed position and having means thereon for moving said adjustable means from their first to their second position of adjustment as a result of said reversing elements being moved from said forward to said rearward feed position, and means for synchronizing the movement of said reversing elements from said forward to said rearward feed position.

8. A feeding device according to claim 7 in which there are provided cam means on said feed bar cooperating with said reversing elements and said synchronizing means for mechanically shifting said reversing elements in unison from said forward to said rearward feed position upon said feeding device having moved a predetermined feed length, and means for adjusting the longitudinal position of said cam means on said feed bar.

9. A mechanism movable by fluid power step by step in either direction along an elongated support comprising a pair of locking members movably mounted on said support and supporting themselves thereon, adjustable means on said locking members providing in a first position of adjustment uni-directional locking against said support to allow forward and to prevent rearward movement of said members along said support and in a second position of adjustment uni-directional locking against said support to allow rearward and to prevent forward movement of said members, a pressure fluid operated extensible and contractable motor disposed longitudinally of said support and carried solely by said locking members thereon, said motor including cooperating cylinder and piston elements coupled one to each of said locking members at the opposite ends of said motor for being carried by said members on said support and for moving said members step by step along said support by successive extensions and contractions of said motor in the direction defined by the position of adjustment of said adjustable means, means for automatically controlling the delivery of pressure fluid to said motor for continuously

extending and contracting said cylinder and piston elements, first and second reversing elements movably mounted on said motor each adjacent one of said locking members for movement between a forward and a rearward position and having means thereon for moving said adjustable means from their first to their second position of adjustment as a result of said reversing elements being moved from said forward to said rearward position, and means for synchronizing the movement of said elements from said forward to said rearward feed position.

10. A mechanism according to claim 9 in which each locking member consists of a locking plate pivotally mounted about a horizontal axle disposed on said motor transversely with respect to the longitudinal direction of said support, said locking plate being pivotable about said axle between two outer positions inclined in opposite directions with respect to said support, clamping surfaces on each locking plate frictionally cooperating with said feed bar in said outer positions thereby to provide said uni-directional locking in forward and rearward direction, respectively, a pair of biasing means on each said reversing element disposed adjacent each locking plate at opposite sides of said axle and pushing against said locking plate for pivoting it about said axle, and means for throwing respectively one or the other of said opposite biasing means out of operation for providing forward or rearward movement of said motor, respectively, depending on the position of said reversing elements.

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