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(54) **Pipe handling equipment and method for a rock drilling machine**

Verfahren und Vorrichtung zum Handhaben von Rohren für eine Gesteinbohrmaschine

Installation et procédé de manipulation de tiges pour une machine de forage de roche

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Description

AREA OF INVENTION

[0001] The present invention relates to the area of drilling in soil and rock, especially lining drill tube drilling with double drill tubes, and relates to a handling equipment included in a rock drilling machine for handling such drill tubes at the connection of the screw joints thereof.

PRIOR ART

[0002] At lining drill tube drilling in soil and rock, a technique with double drill tubes is often used, whereby the flush fluid is supplied to the drilling tip through the inner drill tube and the drilling mud is transported up to the ground in the space between the outer and the inner drill tube.

[0003] There are several drilling methods on the market, which are based on this principle. The drilling is usually performed with heavy, crawling thread supported and chain fed rock drilling machines. The diameter of the drilling hole is often between 100 and 200 mm. The drilling takes place in dependence of the application, in different slopes against the horizontal plane and the drilling depth is seldom more than about 200 m.

[0004] The drill tubes are usually interconnected with screw joints, which must be adapted for transmitting considerable torque and shock stresses. Of this reason, the drill rods are usually heavy and cumbersome to handle manually, especially at inclined drilling.

[0005] Due to the fact that the drill tubes extend inside each other, problems arise at the joining of the drill tubes, since the joining takes place so that the outer and inner drill tubes are screwed on and off separately.

[0006] Different assisting machines have been constructed for making easier the handling of the drill tubes and also for acting as magazines in such rock drilling machines. All such previously known devices suppose that the outer and inner drill tubes are handled each separately, whereby the lighter inner drill tubes are handled manually.

[0007] US-A-3734208 discloses a well drill transfer mechanism for transferring a drill and a surrounding casing segment from a horizontal storage position on the drilling rig to a vertical drilling position adjacent a drilling rig mast. The transfer mechanism comprises a selection means for removing a drill-casing segment from its storage position and placing it in a horizontal pick station and a transfer arm for picking the drill-casing segment and raise it to a vertical position. The transfer arm comprises a lower mandible for grasping a casing segment and an upper mandible for grasping a drill segment. The selection means comprises a multiple tiered storage rack tiltable to present a drill-casing segment at the end of the rack, and carriage means for moving a selected drill-casing segment from the end of

the tier and to said pick station. The storage position is always horizontal and non-parallel to the rig mast.

[0008] US-A-4 102 409 discloses a rock drilling machine comprising a feed beam, which is adjustable to different slopes, a slide moveable along the feed beam, a first chuck for gripping a drill string, a second chuck for gripping the drill string, a reduction gearing and selection means for rotating the drill string by one of said first and second chucks with different revolution rates and torque. This machine has no magazine for the drill string and does not relate to simultaneous drilling with inner and outer drill tubes.

[0009] EP-A1-379 187 discloses a method and device for drilling with a drill rod comprising inner and outer tubes. The device comprises a semicircular drill rod magazine having drill rod holding means. A drill rod removing mechanism removes the drill rod from the holding means and pivots the released drill rod into position on a feed beam.

[0010] The use of a semi-circular magazine requires the handling machine to make a pivotal movement from the magazine to the feed beam. The semi-circular magazine is, however, difficult to load. Moreover, the pivotal movement to the feed beam does not lend itself to adjustment of the position of the drill rods on the feed beam.

DISCLOSURE OF THE INVENTION

[0011] The object of the present invention is to provide a magazine with a rugged construction and with a versatile handling equipment being movable in all three dimensions. Thus, adjustment on the feed beam is possible as well as picking up drill rods from several different positions in the magazine.

[0012] Another object of the present invention is to provide a rock drilling machine comprising a handling equipment, making possible to handle both the outer and the inner drill tubes machinally and providing a magazine for the drill tubes to be mounted or taken up. No manual handling of the drill tubes should be necessary.

[0013] According to the invention such a rock drilling machine comprises a feed beam adjustable to different slopes, a drifter moveable along said feed beam, and an adapter for connecting the drifter to the upper ends of drill tubes for transmitting percussive and/or rotational power to such drill tubes. Moreover, the machine comprises a magazine for storing drill tubes; and operation means for gripping drill tubes and moving drill tubes to a drilling position at the feed beam for being connected to the drifter and possibly to drill tubes already placed in a hole to be drilled. The magazine comprises several storage places for several inner and outer tubes and extends in parallel with said feed beam adjustable to different slopes so that said storage places are essentially parallel with said feed beam. Moreover, the magazine comprising spacing members arranged

adjacent an end portion of said magazine for cooperation with one end of an inner drill tube positioned inside an outer drill tube in the storage place of the magazine.

[0014] The operation means further comprises a first operation means for moving in a horizontal direction parallel with the feed beam; a second operation means for moving in a vertical direction perpendicular to the feed beam; a third operation means for moving in a horizontal direction perpendicular to the feed beam; and in that the operation means are activated each separately and independently of each other for gripping a drill tube in the magazine and moving and placing it in a position at the feed beam.

[0015] Further preferred embodiments will appear from the following description.

SHORT DESCRIPTION OF THE DRAWINGS

[0016] The invention is described in more details below by means of preferred embodiments and with reference to the appended drawings.

Fig. 1 is a schematic plan view of a preferred embodiment of the equipment according to the invention.

Fig. 2 is a side view taken along line II - II in Fig. 1 and shows a cradle according to the invention.

Fig. 3 is a side view taken along line III - III in Fig. 1 and shows a magazine according to the invention.

Fig. 4 is a side view taken along line IV - IV in Fig. 1 and shows a spacing magazine for the upper ends of the inner drill tubes.

Fig. 5 is a side view showing a shear-type gripper according to the invention.

Fig. 6 is a schematic plan view similar to Fig. 1 and shows an alternative embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The equipment for handling drill tubes is intended to be mounted on a rock drilling machine of conventional construction. In Fig. 1 only a few parts of the rock drilling machine are shown, viz. a feed beam 3, fixture members 19, 22 for holding the ends of the drill tubes during screwing on and off, a drifter 20 for driving the drill tubes and an adapter 21 interconnecting the upper ends of the drill tubes with the drifter. The feed beam 3 can be adjusted into different slope angles in dependence of the direction of the intended drill hole. The actual drilling work takes place by means of the drifter 20, which transmits percussive and rotation power via the adapter 21 to the drill tubes. The drifter is moved along the feed beam for example by means of chains.

[0018] Hereinbelow, the handling equipment according to the invention will be described in its rest position in which the feed beam is horizontal and the directions will be defined in view thereof. It is noted that

the feed beam during operation is adjusted to the desired angle in relation to the ground for the intended drill hole and that the entire equipment according to the invention follows such movement. Said angle can be adjusted normally between 0° - 100° in relation to the horizontal plane.

[0019] A preferred embodiment of the invention will now be described with particular reference to Figs. 1 and 2. The handling equipment comprises two transverse support beams 1 attached to the bottom side of the feed beam 3 and extending beside the feed beam. Two longitudinal guide beams 2 are attached to the transverse support beams 1 parallel with the feed beam. The guide beams 2 are interconnected by several transverse members 16, 18, 26, which are described in more details below.

[0020] Between said transverse members 16, a cradle 4 is moveable along the guide beams 2 and parallel with the feed beam. A first hydraulic cylinder 5 is connected between the cradle and on transverse support beam 1 for moving the cradle along the guide beams.

[0021] The cradle 4 is shown in more details in Fig. 2 which is a side view, however with a shear-type gripper 14 (to be described below) removed. The transverse support beam 1, the longitudinal guide beams 2 and the feed beam 3 are shown by broken lines in Fig. 2.

[0022] The cradle 4 comprises two longitudinal box members 27, 28 interconnected by two transverse beams 29, 30, one of which is shown in Fig. 2. The longitudinal box members 27, 28 encloses the guide beams 2 and are moveable along the guide beams.

[0023] Attached to one longitudinal box member 28 is a pillar 6, which extends vertically upwards from the cradle. The pillar is constructed of two box girders extending telescopically inside each other. The inner box girder is extendable out from the outer box girder by means of an internal second hydraulic cylinder 7.

[0024] A boom 8 is mounted to the upper end of the inner box girder of the pillar 6, and extends horizontally and perpendicular towards the feed beam. The boom 8 is also constructed of two box girders telescopically extending inside each other and the relative movement takes place by means of a third hydraulic cylinder 9.

[0025] At the outer extendable part of the boom 8, there is provided a grip claw 10 pivotable around an articulated bolt 11 by means of a fourth hydraulic cylinder 12. Moreover, there is an abutment in the form of an elongated plate 13, which in cross-section forms a right angle. The plate 13 is attached to the moveable part of the boom 8 and extends in parallel with the feed beam 3.

[0026] The grip claw 10 is adapted, in cooperation with said elongated plate 13, to grip and hold stationary a drill tube with different diameter normally within the interval of between 38 and 133 mm. The grip claw 10 urges the drill tubes against the elongated plate 13 thereby maintaining the drill tube parallel with the feed beam.

[0027] At the moveable part of the boom 8, there is also attached a rod 23 extending horizontally and parallel with the feed beam 3, c.f. also Fig. 1. The rod 23 is telescopically extendable in the axial direction by means of a fifth hydraulic cylinder 25 and is constructed of two box girders telescopically extending inside each other.

[0028] At the free end of the rod 23 is mounted a shear-type gripper 14 with a pertaining sixth hydraulic cylinder 15. The shear-type is shown in more details in Fig. 5. The shear-type gripper is positioned at a distance from the grip claw 10 and the distance is adjustable by the rod 23 by means of the hydraulic cylinder 25.

[0029] As mentioned above, there is provided transverse members at fixed positions along the guide beams 2. Two such transverse members are constructed as magazine members 16 and one such magazine member is shown in more details in Fig. 3. The magazine member comprises a transverse beam 16 and four vertical U-beams 31 spaced apart in the transverse direction by a distance so that outer drill tubes 33 can be placed in the space between two adjacent U-beams 31. In Fig. 3 there is shown two compartments 32 for outer drill tubes each housing a maximum of four outer drill tubes. Each outer drill tube encloses an inner drill tube 34 as described in more details below.

[0030] The drill tubes are retained by means of plate springs 17 or spring loaded holders 24 so that they cannot fall out from the magazine at vertical or so called negative drilling when the feed beam 3 is vertical or slopes more than 90° in relation to the horizontal.

[0031] The magazine members 16 are placed at a distance from each other corresponding to the length of the outer drill tubes. Preferably, each magazine member is positioned 0,2 - 0,4 meters from the end of the outer drill tubes, so that the distance between the magazine members 16 is as large as possible. The magazine members 16 are preferably welded to the guide beams 2, but it is possible to have one (or several) of the magazine member 16 (the upper) adjustable or replaceable for adoption to drill tubes of different lengths and diameters. At the bottom end of the guide beams 2, there is placed an abutment plate 26, which prevents the drill tubes from moving in the axial direction when the feed beam is inclined.

[0032] To the left of the left magazination member 16, in Fig. 1, there is mounted a spacing member 18 shown in more details in Fig. 4, for cooperation with the upper end of inner drill tubes 34 positioned inside the outer drill tubes in the magazine. Each inner drill tube is provided with a jointing sleeve 35 comprising screw windings for connection to a lower inner drill tube in the drill hole. Said jointing sleeve 35 forms an enlargement of the upper end of each inner drill tube. Said spacing member 18 comprises several vertical rods 36 as shown in Fig. 4 spaced apart for engagement below the enlargement of the jointing sleeves 35 for preventing the inner drill tubes to enter inside the outer drill tubes. Thus, each inner drill tube extends out from or to the left

of the outer drill tube as shown in Fig. 1.

[0033] The operation of the handling equipment according to the invention will now be described with reference to Figs. 1 and 2.

[0034] When the drilling starts, the outer drill tubes are placed between the magazine members 16 and the inner drill tubes are placed inside the outer drill tubes and hang in the space member 18. The inner drill tubes are placed manually in the outer drill tubes or the shear-type gripper is used as described more closely below.

[0035] The first outer drill tube and the first inner drill tube are each provided with drill tips, normally with tungsten carbide tips, but other constructions can also be used together with the invention.

[0036] By means of operation valves at the control panel of the drilling machine, all hydraulic cylinders 5,7,9,12,15 and 25 can be activated. With such operation valves, the shear-type gripper 14 is adjusted, in its open position, over the first inner drill tube 34, immediately below its jointing sleeve 35 between the space member 18 and the magazine members 16. The open grip claw 10 is at the same time positioned over the corresponding outer drill tube 33 and approximately at its longitudinal middle point. The boom 8 and the upper part of the pillar 6 are now adjusted and moved against the drill tubes so that the plate 13 will be placed firmly against the outer side of the outer drill tube. Then, both the grip claw 10 and the shear-type gripper 14 is activated by means of respective hydraulic cylinders, whereby both the inner drill tube and the outer drill tube are captured in a position parallel with the feed beam 3.

[0037] By activation of hydraulic cylinders 5, 7 and 9, the captured drill tubes can be moved into the drilling centre position above the feed beam 3 and down through the drill tube guidings 19, 22 at the lower end of the feed beam. By means of the drifter 20, first the inner drill tube is screwed to the adapter, whereupon the shear-type gripper 14 is opened. Then, the outer drill tube is screwed to the adapter, whereupon the grip claw 10 is opened. Both drill tubes are now connected to the adapter. At continued rotation of the adapter, the inner and outer drill tubes are screwed to the upper ends of corresponding drill tubes already placed in the drill hole guided by the drill tube guidings 19,22.

[0038] Both drill tubes are now connected to the drifter and the drilling starts. When the drifter has moved along the feed beam to its bottom position, the drill tubes are screwed off from the adapter by means of the drifter and a drill tube releaser 22 of known construction at the lower end of the feed beam. Now, the drifter is moved to its upper position, whereupon a new length of outer and inner drill tubes are screwed on the drill tubes already inside the drill hole and so on.

[0039] At the taking up of the drill rod, the same operations are done as with the downwards drilling, but in opposite order, whereupon the grip claw and the shear-type gripper operate as an abutment when the drill tubes by means of the drifter are screwed off the

adapter. Each loosened drill tube length is placed in position in the magazine between the U-beams 31 in the magazine 16.

[0040] In several cases, there is drilled with double drill tube systems only to a part of the drill hole, whereupon the drilling continues with only the inner drill tubes. It often occurs that the inner drill tubes are taken up separately and that the outer drill rod is temporarily left in the earth. The inner drill tubes 34 are then placed at a certain space 37 in the magazine between two U-beams 31 in the magazine, c.f. Fig. 3 to the left, from where they later by means of the equipment can be placed inside the outer drill tubes when these have arrived in place.

[0041] By using the shear-type gripper 14, an inner drill tube 34 can be placed in position inside an outer drill tube 33 already placed in the magazine space 32 in the following way. The inner drill tube is positioned in the space 37 to the left in Fig. 3. In order that the shear-type gripper 14 should be able to grip around the inner drill tube at the middle point thereof, the cradle 4 is moved to the far right in Fig. 1 and the shear-type gripper is withdrawn as far as possible towards the cradle 4. Then, the shear-type gripper will be positioned at the middle of the inner drill tube and one such drill tube is gripped and lifted from the magazine. Then, the cradle 4 is moved to the left in Fig. 1 at the same time as the rod 23 is extended in its full length. By this movement, the inner drill tubes will be positioned to the left of the mouth of the outer drill tube positioned in the magazine and can be fed inside the outer drill tube by operating the pillar, the boom, the rod 23 and the cradle 4. The inner drill tube can of course only be moved inside the outer drill tube to the half length thereof, but the continued movement takes place either with the gravitational force if the feed beam is sloping or by gripping the outer drill tube by the shear-type gripper at a position further out.

[0042] Several modifications of the handling equipment shown in Fig. 1 are obvious to a skilled person. A few modifications will be mentioned below but it is realized that several other modifications are within the scope of the invention.

[0043] One alternative embodiment of the invention is shown in Fig. 6, which corresponds to Fig. 1. In this embodiment, the drill tubes are reversed so that the enlarged jointing sleeve 35 is positioned downwards, to the right in Fig. 6. Also the direction of the shear-type gripper 14 is reversed. The spacing member is replaced by a stop member 38 preventing the outer drill tubes 33 to reach the abutment plate 26. Instead the inner drill tubes 34 extend through the outer drill tubes and extend beyond the stop member 38 until the abutment plate 26. Thus, the inner drill tubes 33 can be gripped by the shear-type gripper 14 below the outer drill tubes 33. Otherwise the operation is the same and should be evident from Fig. 6. However, the adapter must be replaced by an alternative adapter, in which the screw windings cooperating with the inner drill tubes are made

as inner windings in a hole 39 of the adapter. This construction is more rugged. In all other respects the same construction is used.

[0044] The above constructions can also be further modified. One possibility is to provide the pillar 6 with a possibility to rotate around a vertical axis, so that the rod 23 can be adjusted so that it is always parallel with the feed beam.

[0045] It is also possible to use the handling equipment, e.g. by handing the outer and inner drill tubes separately. First an inner drill tube is gripped by the grip claw 10 and placed in position at the feed beam. The inner drill tube is connected to the adapter and screwed to the inner drill tube already in the hole. Then, the adapter is disengaged from the inner drill tube and the drifter and adapter is withdrawn to the left as much as possible. Then, an outer drill tube positioned in the space 37 is gripped by the grip claw 10 and moved to a position so that it can be placed outside the inner drill tube already present at the feed beam. Finally, the adapter again engages the upper end of the outer and inner drill tubes and the outer drill tube is at the same time screwed to the outer drill tube already in the hole. The drilling machine is now ready for continued work. It is obvious that the drifter and adapter must be moveable the double distance of the length of each of the drill tubes in this case. It is also obvious that an outer drill tube can be mounted before an inner drill tube. The shear-type gripper 14 is not used and can be removed.

[0046] It is of course possible to adapt the invention to other types of drill tube handling equipments in which other types of engagement members are used instead of the grip claw and shear-type gripper.

[0047] By using the above described handling equipment mounted on a machine for soil and rock drilling of standard construction and of the type described above, the following advantages are obtained:

- 1) The difficult and heavy work with more or less manually handling of heavy drill tubes at the drilling work is completely eliminated.
- 2) The drilling can be performed with one operator instead of at least two as previously required.
- 3) The time for the drilling work can be reduced considerably by faster handling of the drill tubes.
- 4) The accident hazard at the manual handling is eliminated.

[0048] The above described embodiment has been used in practice and it has been shown that the operator very soon obtains a skill for how to use the different valves to the hydraulic cylinders and a very high precision can be obtained. If the inner drill tubes are placed inside the outer drill tubes by means of the shear-type gripper during the time the drilling machine performs work, several assembled inner and outer drill tubes are present for simultaneous movement to the working position and the connection to the adapter and the drill

tubes already in the hole is very fast.

[0049] It is possible to use modern technique for automatization of several of the movements necessary when operating the drill tube handler according to the invention. Thus, the valves to the hydraulic cylinders can be operated by a microprocessor in a certain sequence, which corresponds to a normal handling sequence. The operator can monitor the operation of the device and can intervene if necessary. It is also possible to place all controls of the valves in a operator cabin at the drilling machine so that the operator is conveniently placed in his normal operating chair.

[0050] Other modifications occur to a skilled person reading this specification and the intent is that such modifications obvious to a skilled person should be encompassed within the scope of the invention. The invention is only limited by the appended patent claims.

Claims

1. Rock drilling machine for drilling a hole by means of inner and outer coaxially extending drill tubes, comprising:
 - a feed beam (3) adjustable to different slopes;
 - a drifter (20) moveable along said feed beam;
 - an adapter (21) for connecting the drifter to the upper ends of drill tubes for transmitting percussive and/or rotational power to such drill tubes;
 - a magazine (16) for storing drill tubes; and
 - operation means (5, 7, 9, 10, 14) for gripping and moving drill tubes to a drilling position at the feed beam for being connected to the drifter and possibly to drill tubes already placed in a hole to be drilled,

characterized in that said magazine comprises several storage places for several inner and outer tubes; in that said magazine extends in parallel with said feed beam (3) adjustable to different slopes so that said storage places are essentially parallel with said feed beam; said magazine comprising spacing members (18) arranged adjacent an end portion of said magazine for cooperation with one end of an inner drill tube (34) positioned inside an outer drill tube (33) in the storage place of the magazine; and in that said operation means comprises:

 - a first operation means (4, 5) for moving in a horizontal direction parallel with the feed beam;
 - a second operation means (6, 7) for moving in a vertical direction perpendicular to the feed beam;
 - a third operation means (8, 9) for moving in a horizontal direction perpendicular to the feed beam; and
- in that the operation means are activated each separately and independent of each other for gripping a drill tube in the magazine and moving and placing it in position at the feed beam.
2. Rock drilling machine according to claim 1, **characterized** by
 - transverse support beams (1) attached to the feed beam (3) and extending beside said feed beam;
 - longitudinal guide beams (2) attached to said support beams and extending parallel to the feed beam.
3. Rock drilling machine according to claim 2, **characterized** in that the magazine comprises:
 - a transverse member (16) attached to the guide beams (2); and
 - several vertical beams (31) spaced apart a predetermined distance.
4. Rock drilling machine according to claim 2 or 3, **characterized** in that said spacing member comprises:
 - a transverse member (18) attached to the guide beams (2); and
 - several vertical rods (36) spaced apart a predetermined distance.
5. Rock drilling machine according to claim 2, 3 or 4, **characterized** by
 - a cradle (4) moveable along said guide beams by means of a hydraulic cylinder (5);
 - a pillar (6) attached to the cradle (4) and extending in the vertical direction and extendible by means of a hydraulic cylinder (7);
 - a boom (8) attached to the upper end of the pillar and extending in the horizontal direction perpendicular to and towards the feed beam and extendible by means of a hydraulic cylinder (9) said cradle (4), pillar (6) and boom (8) being adjustable to different slopes so that said guide beams are parallel with said feed beam.
6. A rock drilling machine according to any one of the previous claims, **characterized** by
 - operation valves, which are arranged to control each of said operation means, said operation valves being manually controllable;
 - automatic control means for automatization of the operation of said operation valves; and
 - intervention means for overriding said automatic control means for manual control of said

operation valves.

7. Rock drilling machine according to any one of the previous claims, **characterized** in that said operating means comprises a grip member (10) for engagement with an outer drill tube positioned in said storage place and a gripping means (14), for example a shear-type gripper, which is attached to a rod (23) which is telescopically extendible so that the gripping means is adjustable and can be placed adjacent the end of an inner drill tube.
8. Rock drilling machine according to claim 7, **characterized** in that said grip member (10) and said gripping means (14) are moveable parallel with said feed beam.
9. Rock drilling machine according to any one of the previous claims, **characterized** in that said magazine and/or spacing members are provided with spring loaded holders (17,24) for retaining drill tubes positioned in said magazine.

Patentansprüche

1. Gesteinsbohrmaschine zum Bohren eines Loches mit Hilfe von inneren und äußeren, sich koaxial erstreckenden Bohrrohren, mit:
- einem auf unterschiedliche Neigungen einstellbaren Zuführungsbalken (3);
einer entlang des Zuführungsbalkens bewegbaren Vortriebseinrichtung (20);
einem die Vortriebseinrichtung mit den oberen Enden der Bohrrohre koppelnden Adapter (21) zur Übertragung von Stoß- und/oder Drehenergie auf die Bohrrohre;
einem Magazin (16) zur Lagerung der Bohrrohre; und
einer Betätigungseinrichtung (5, 7, 9, 10, 14) zum Greifen und Bewegen von Bohrrohren in eine Bohrposition am Zuführungsbalken, um diese mit der Vertriebsseinrichtung zu koppeln, und möglicherweise zu bereits im zu bohrenden Loch befindlichen Bohrrohren, dadurch gekennzeichnet, daß
das Magazin mehrere Lagerplätze für verschiedene innere und äußere Rohre aufweist; das Magazin sich parallel zu dem an unterschiedliche Neigungen anpaßbaren Zuführungsbalken (3) erstreckt, so daß die Lagerplätze im wesentlichen parallel zum Zuführungsbalken angeordnet sind;
das Magazin benachbart zu einem Endabschnitt des Magazins angeordnete Abstandshalter (18) zum Zusammenwirken mit dem einen Ende eines innerhalb eines äußeren Bohrrohres (33) im Lagerplatz des Magazins

angeordneten inneren Bohrrohres (34) aufweist;

und daß die Betätigungseinrichtung ein erstes Betätigungsmittel (4, 5) zur Bewegung in horizontaler Richtung parallel zum Zuführungsbalken,
ein zweites Betätigungsmittel (6, 7) zur Bewegung in vertikaler Richtung rechtwinklig zum Zuführungsbalken und
ein drittes Betätigungsmittel (8, 9) zur Bewegung in horizontaler Richtung rechtwinklig zum Zuführungsbalken aufweist; und
die Betätigungsmittel jeweils getrennt und unabhängig voneinander zum Greifen eines Bohrrohres im Magazin und zum Bewegen und Anordnen des Bohrrohres an einer Stelle am Zuführungsbalken aktiviert werden.

2. Gesteinsbohrmaschine nach Anspruch 1, gekennzeichnet durch

Querstützbalken (1), die am Zuführungsbalken (3) angebracht sind und sich zu beiden Seiten des Zuführungsbalkens erstrecken;
Längsführungsbalken (2), die an den Stützbalken angebracht und sich parallel zum Zuführungsbalken erstrecken.

3. Gesteinsbohrmaschine nach Anspruch 2, dadurch gekennzeichnet, daß das Magazin

ein an den Führungsbalken (2) angebrachtes querverlaufendes Element (16) und mehrere vertikale Balken (31) aufweist, die um eine bestimmte Entfernung voneinander beabstandet sind.

4. Gesteinsbohrmaschine nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß der Abstandshalter

ein an den Führungsbalken (2) angebrachtes querverlaufendes Element (18) und mehrere vertikale Stangen (36) aufweist, die um eine bestimmte Entfernung voneinander beabstandet sind.

5. Gesteinsbohrmaschine nach Anspruch 2, 3 oder 4, gekennzeichnet durch

ein Gestell (4), das mittels eines Hydraulikzylinders (5) entlang der Führungsbalken bewegbar ist;
einen Pfosten (6), der am Gestell (4) befestigt ist, sich in vertikaler Richtung erstreckt und mittels eines Hydraulikzylinders (7) verlängerbar ist;
einen Baum (8), der am oberen Ende des Pfostens befestigt ist, sich in horizontaler Richtung

rechtwinklig zum Zuführungsbalken zu diesem erstreckt und mittels eines Hydraulikzylinders (9) verlängerbar ist, wobei das Gestell (4), der Pfosten (6) und der Baum (8) auf unterschiedliche Neigungen einstellbar sind, so daß die Führungsbalken parallel zum Zuführungsbalken angeordnet sind.

6. Gesteinsbohrmaschine nach einem der vorangehenden Ansprüche, 10
gekennzeichnet durch

Arbeitsventile, die angeordnet sind, um jedes der Betätigungsmittel zu steuern, wobei die Arbeitsventile manuell steuerbar sind; 15
automatische Steuerungsmittel zur Automatisierung des Betriebes der Arbeitsventile; und Eingreifmittel zum Überlagern der automatischen Steuerungsmittel für eine manuelle Steuerung der Arbeitsventile. 20

7. Gesteinsbohrmaschine nach einem der vorangehenden Ansprüche, 25
dadurch gekennzeichnet, daß die Betätigungseinrichtung ein Greifelement (10) für den Eingriff mit einem auf dem Lagerplatz befindlichen äußeren Bohrrohr und eine Greifeinrichtung (14), beispielsweise eine Greifeinrichtung (14) nach Art einer Schere, aufweist, welche an einer Stange (23) befestigt ist, die teleskopisch verlängerbar ist, so daß die Greifeinrichtung einstellbar ist und benachbart zum Ende eines inneren Bohrrohres angeordnet werden kann. 30

8. Gesteinsbohrmaschine nach Anspruch 7, 35
dadurch gekennzeichnet, daß das Greifelement (10) und die Greifeinrichtung (14) parallel zum Zuführungsbalken bewegbar sind.

9. Gesteinsbohrmaschine nach einem der vorangehenden Ansprüche, 40
dadurch gekennzeichnet, daß das Magazin und/oder die Abstandshalter mit federbelasteten Haltern (17, 24) zum Halten der im Magazin befindlichen Bohrrohre versehen sind. 45

Revendications

1. Machine de forage de roche pour forer un trou au moyen de tubes de forage intérieur et extérieur s'étendant coaxialement, comprenant: 50

une poutre d'alimentation (3) réglable à différentes inclinaisons; 55
un marteau perforateur (20) mobile le long de ladite poutre d'alimentation;
un adaptateur (21) pour connecter le marteau perforateur aux extrémités supérieures des

tubes de forage pour transmettre la puissance de percussion et/ou de rotation à de tels tubes de forage;

un magasin (16) de stockage des tubes de forage ; et

des moyens de fonctionnement (5, 7, 9, 10, 14) pour saisir et déplacer des tubes de forage vers une position de forage sur la poutre d'alimentation afin d'être connectés au marteau perforateur et le cas échéant aux tubes de forage déjà placés dans un trou à forer,

caractérisée en ce que ledit magasin comprend plusieurs emplacements de stockage pour plusieurs tubes intérieurs et extérieurs;

en ce que ledit magasin s'étend parallèlement à ladite poutre d'alimentation (3) réglable à différentes inclinaisons de telle sorte que lesdits emplacements de stockage soient essentiellement parallèles avec ladite poutre d'alimentation;

ledit magasin comprend des éléments d'entretoises (18) disposés adjacents à une partie d'extrémité dudit magasin pour coopérer avec une extrémité d'un tube de forage intérieur (34) disposé intérieurement à un tube de forage extérieur (33) dans l'emplacement de stockage du magasin :

et en ce que lesdits moyens de fonctionnement comprennent:

un premier dispositif de fonctionnement (4, 5) pour le déplacement dans une direction horizontale parallèle à la poutre d'alimentation ;

un deuxième dispositif de fonctionnement (6, 7) pour le déplacement dans une direction verticale perpendiculaire à la poutre d'alimentation ;

un troisième dispositif de fonctionnement (8, 9) pour le déplacement dans une direction horizontale perpendiculaire à la poutre d'alimentation;

et en ce que les moyens de fonctionnement sont activés chacun séparément et indépendamment les uns des autres pour saisir un tube de forage dans le magasin et le déplacer et le meure en place sur la poutre d'alimentation.

2. Machine de forage de roche selon la revendication 1, caractérisée par:

des poutres transversales de support (1) fixées à la poutre d'alimentation (3) et s'étendant à côté de ladite poutre d'alimentation;

des poutres longitudinales de guidage (2) fixées auxdites poutres de support et s'étendant parallèlement à ladite poutre d'alimentation.

3. Machine de forage de roche selon la revendication 2, caractérisée en ce que le magasin comprend:
- un élément transversal (16) fixé aux poutres de guidage (2) ; et 5
plusieurs poutres verticales (31) espacées l'une de l'autre d'une distance prédéterminée.
4. Machine de forage de roche selon la revendication 2 ou 3, caractérisée en ce que ledit élément d'entretoise comprend: 10
- un élément transversal (18) fixé aux poutres de guidage (2) ; et
plusieurs tiges verticales (36) espacées l'une de l'autre d'une distance prédéterminée. 15
5. Machine de forage de roche selon la revendication 2, 3 ou 4, caractérisée par 20
- un berceau (4) mobile le long desdites poutres de guidage au moyen d'un vérin hydraulique (5);
un pilier (6) solidaire du berceau (4) et s'étendant en direction verticale et extensible au moyen d'un vérin hydraulique (7); 25
une flèche (8) fixée à l'extrémité supérieure du pilier et s'étendant dans la direction horizontale perpendiculaire à et dirigée vers la poutre d'alimentation et extensible au moyen d'un vérin hydraulique (9), 30
lesdits berceau (4), pilier (6) et flèche (8) étant réglables à différentes inclinaisons de sorte que lesdites poutres de guidage soient parallèles à ladite poutre d'alimentation. 35
6. Machine de forage de roche selon l'une quelconque des revendications précédentes, caractérisée par:
- des valves de fonctionnement qui sont agencées pour commander chacun des moyens de fonctionnement, lesdites valves de fonctionnement étant commandables manuellement;
des moyens de commande automatique pour l'automatisation du fonctionnement des dites valves de fonctionnement; et 45
des moyens d'intervention pour avoir priorité sur lesdits moyens de commande automatique pour la commande manuelle desdites valves de fonctionnement. 50
7. Machine de forage de roche selon l'une quelconque des revendications précédentes, caractérisée en ce que lesdits moyens de fonctionnement comprennent un organe de saisie (10) pour attraper un tube de forage extérieur positionné dans ledit emplacement de stockage et des moyens de saisie (14), par exemple une pince de type cisaille, qui sont fixés à 55
- une tige (23) qui est extensible télescopiquement de telle manière que les moyens de saisie soient réglables et puissent être disposés adjacents à l'extrémité d'un tube de forage interne.
8. Machine de forage de roche selon la revendication 7, caractérisée en ce que ledit organe de saisie (10) et lesdits moyens de saisie (14) sont déplaçables parallèlement à ladite poutre d'alimentation.
9. Machine de forage de roche selon l'une quelconque des revendications précédentes, caractérisée en ce que ledit magasin et/ou les éléments d'entretoise sont munis de supports chargés élastiquement (17, 24) pour retenir les tubes de forage positionnés dans ledit magasin.

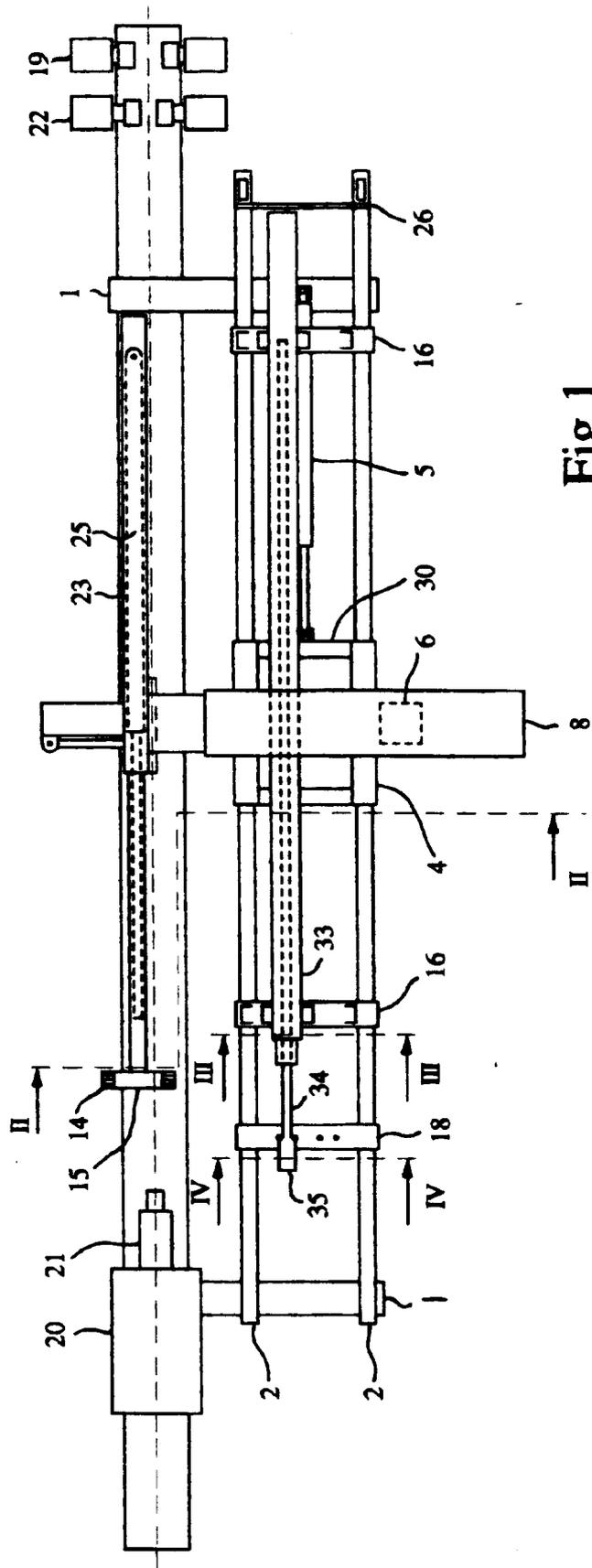


Fig 1

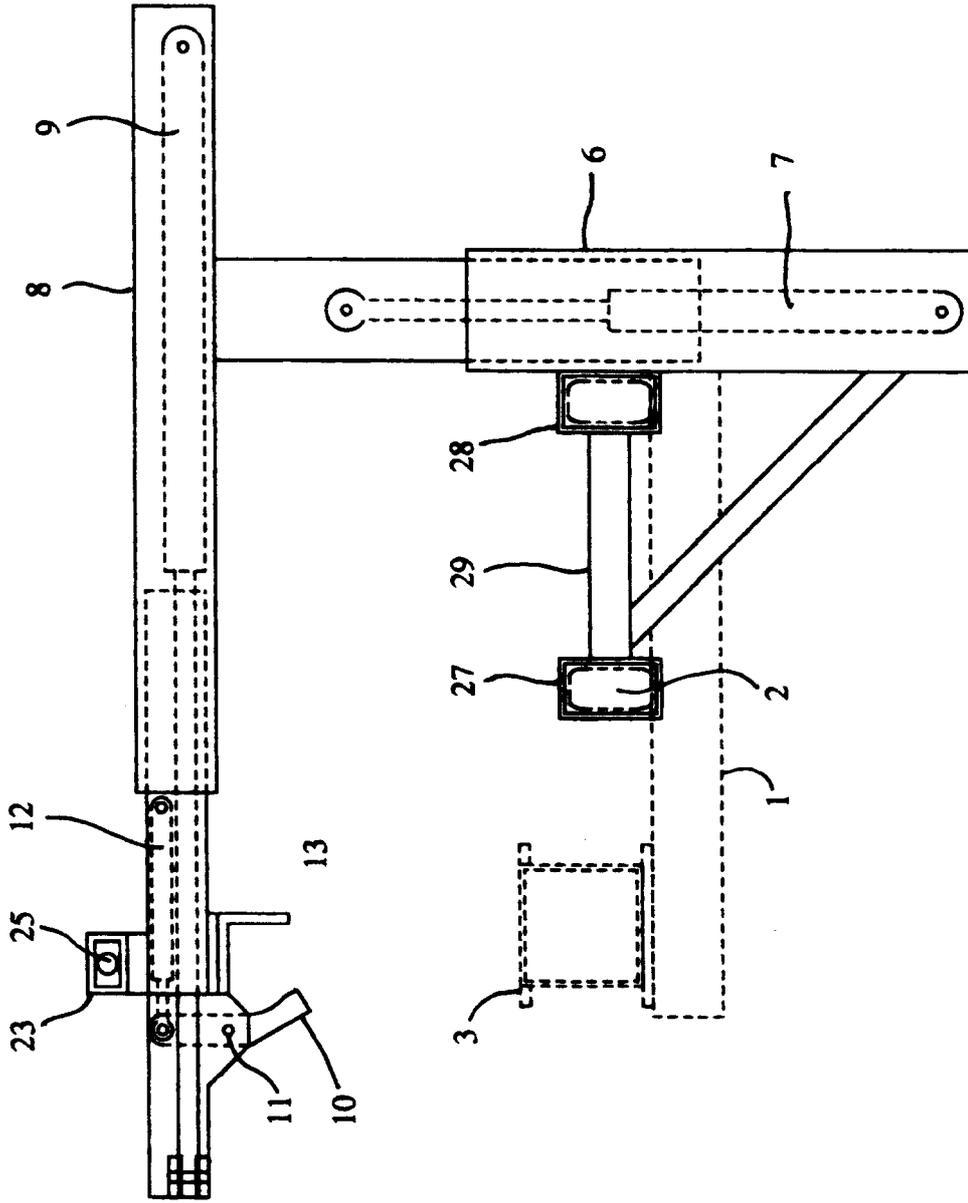


Fig 2

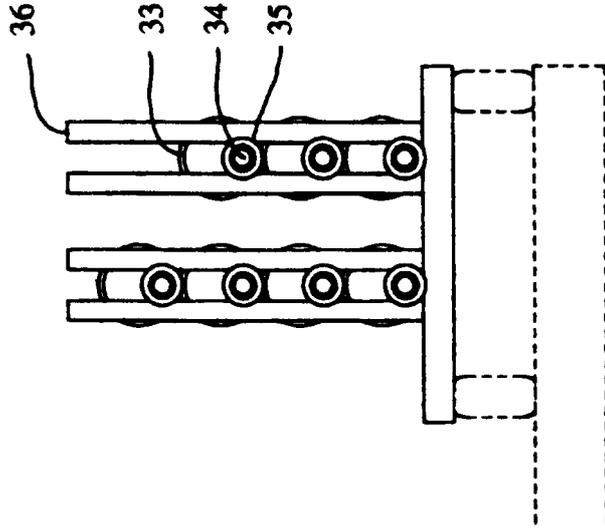


Fig 4

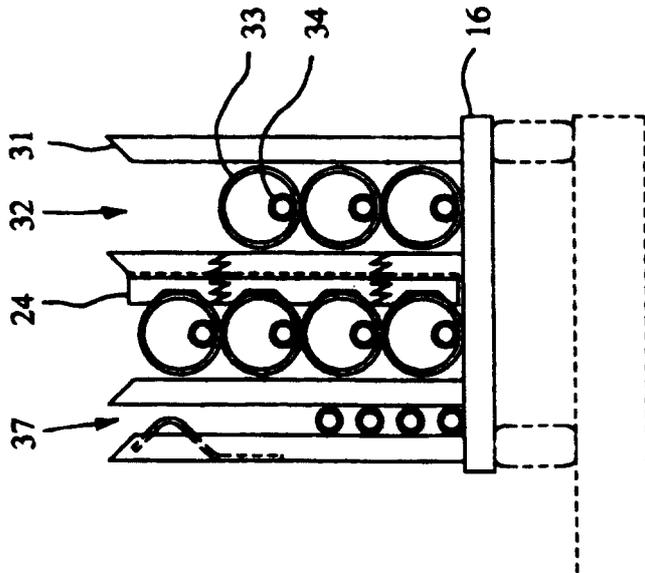


Fig 3

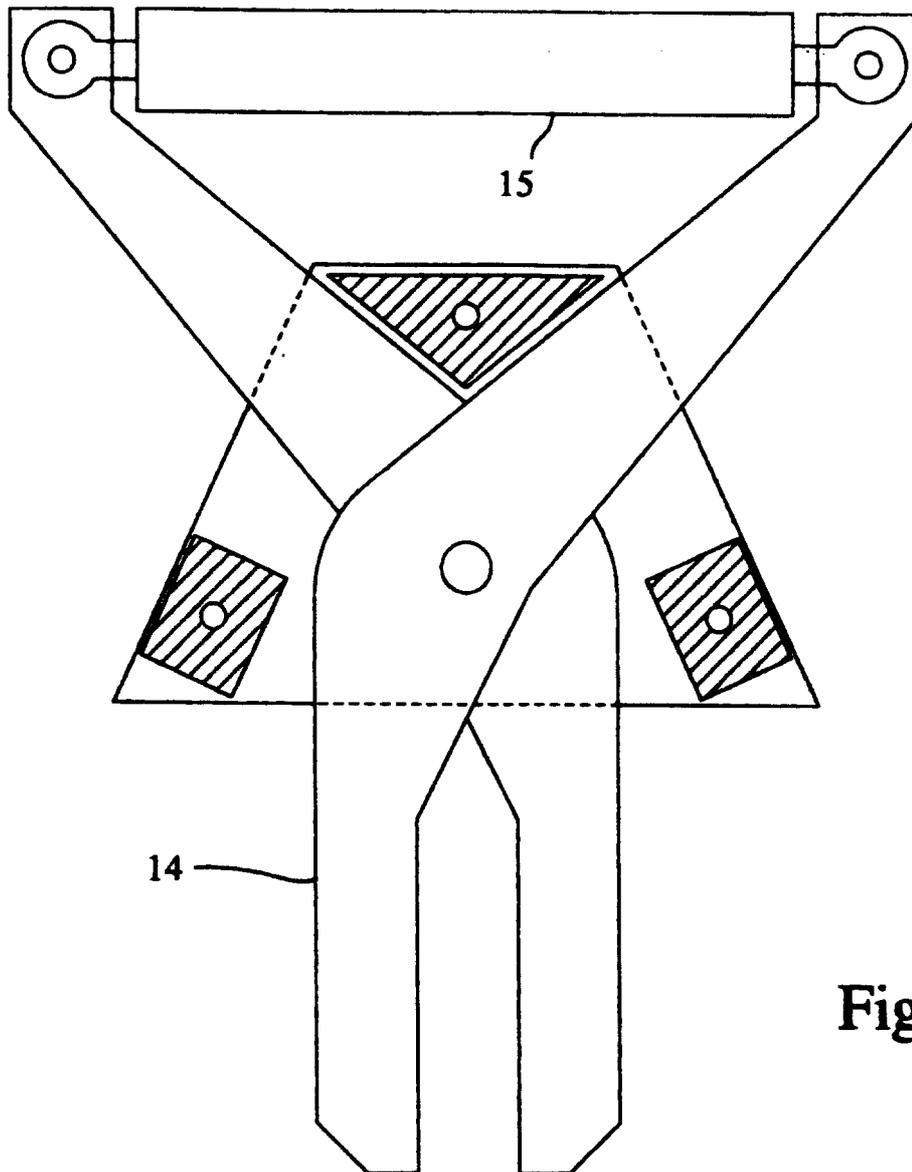


Fig 5

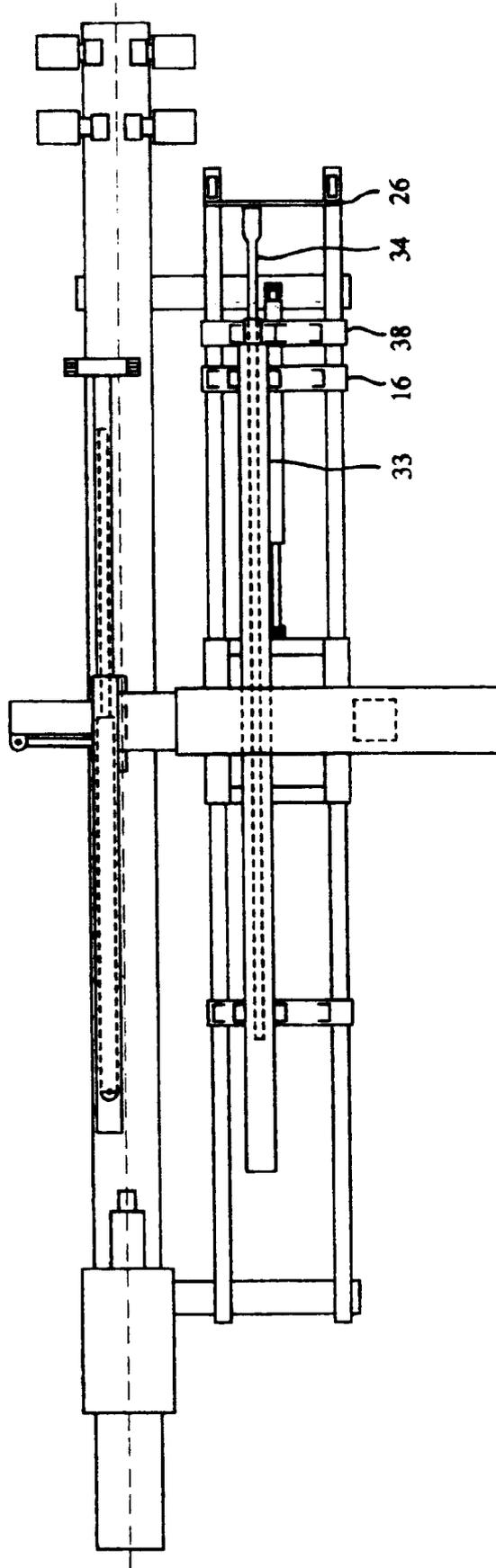


Fig 6