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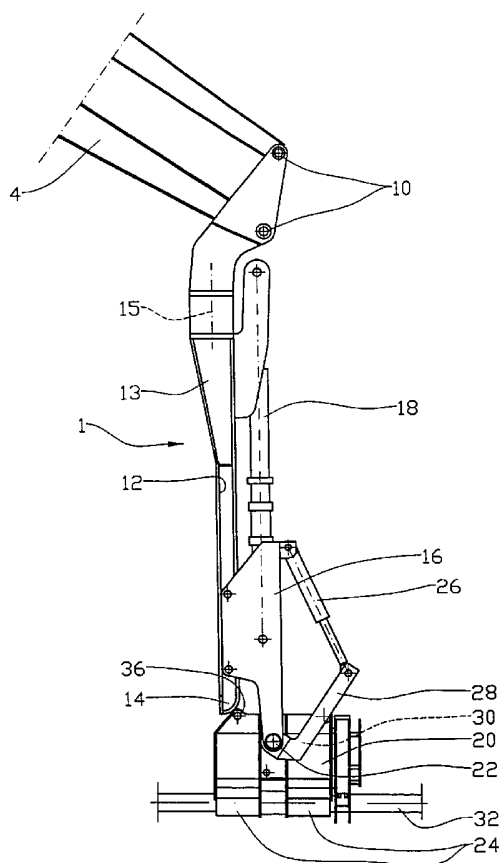
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(54) Title: A DRILL FLOOR PIPE HANDLING DEVICE



(57) Abstract: A device for a drill floor (5) pipe manipulator (2), where the pipe manipulator (2) is designed to handle relatively long vertical lengths of pipe and comprising a first arm (4) able to be raised and lowered, wherein the arm (4) is equipped with an extension arm (1), where the extension arm (1) forms a downward projecting extension of the arm (4), thus allowing a pipe gripper (20) connected to the extension arm to be placed around an approximately horizontal pipe (32) located near the drill floor (5).



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ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
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A DRILL FLOOR PIPE HANDLING DEVICE

This invention pertains to pipe handling on a drill floor. In particular, it concerns a device that allows pipes to be raised from a horizontal position to an upright vertical position by means of a traditional pipe manipulator for
5 vertical pipes.

A drill floor of the type known from e.g. petroleum production is normally equipped with machines for handling drill pipes and other types of pipes used in the drilling
10 operation.

Thus it is known to use one machine to bring pipes from a horizontal position to a vertical position and another machine to handle vertical pipe lengths during so-called tripping, where relatively long pipe lengths are joined to
15 form a pipe string, or a pipe string is separated into pipe lengths.

According to prior art, pipes having a length of the order of 10 metres are moved onto the drill floor in a horizontal position. A machine for turning pipes grips the pipe and turns the pipe from a horizontal to a vertical position, whereupon the vertical pipe is placed in the so-called mouse hole of the drill floor to enable it to be joined with other pipes, or it is carried to the drilling centre, where it joins a pipe string.

Pipe lengths that have been prepared for insertion into a well, and which are normally placed in transitional storage in a so-called fingerboard, may be from 30 to 40 metres long. The machine used to handle these relatively long pipes, the pipe manipulator, is designed primarily to grip one of these relatively long pipe lengths and transport it between the borehole and the finger board.

Due to the design of known pipe manipulators, it is not possible to use a pipe manipulator according to prior art to rotate horizontal pipes located on/by the drill floor to a vertical position.

The object of the invention is to remedy the disadvantages of prior art.

The object is achieved in accordance with the invention, by the characteristics given in the description below and in the appended claims.

Fitting an extension arm to the grip arm, hereinafter designated the first arm, of the pipe manipulator, where the extension arm is designed to displace an adapted pipe gripper from its normal lower position downwards to a horizontally

positioned pipe on/by the drill floor, makes it possible to use the manipulator to turn the pipe from a horizontal position immediately above the drill floor upwards to a vertical position which is adjusted so as to allow the pipe
5 to be coupled to pipes of the same type.

In a preferred embodiment the extension arm is formed so as to always be in a vertical position, to prevent an excessive bending moment on the arm. The extension arm will during the vertical and horizontal displacement maintain this
10 predominantly vertical position by means of the parallel guide unit of the first arm, which is known *per se*.

The lower part of the extension arm is designed to rotate about its own longitudinal axis in order to retrieve pipes located at any orientation relative to the pipe manipulator.

15 When retrieving a pipe that is oriented essentially in the horizontal position, the pipe gripper is displaced by means of a guide to the lower end portion of the extension arm, where it is designed to turn from its vertical position to a horizontal position. The first arm is displaced down towards
20 its lower position, so that the pipe gripper may grip the pipe. It is a favourable characteristic of the invention that the gripper is controlled when turning near the vertical position, while turning freely near the horizontal position.

Thus the turning is controlled during the first phase of the
25 rotation of the pipe gripper from the vertical position, while during the last part of the turning toward the horizontal position, the pipe gripper is turned by gravity.

When the pipe gripper has gripped the horizontally oriented pipe, the first arm is moved up while the pipe gripper, together with the pipe, turns freely from its horizontal position. When the pipe nears its vertical position, the
5 turning control of the pipe gripper is connected, whereby the pipe may be controlled about the near vertical direction and placed in the desired position. The pipe gripper is displaced along the guide of the extension arm in order to be placed in the desired position relative to the first arm.

10 The device is also well suited for turning pipes from a vertical position to a horizontal position.

For a person skilled in the art it is obvious that a reduction in the number of machines located on a drill floor, where the space is relatively restricted, is of great value.

15 The relatively simple structure of the invention will also make it possible to save both on investment and operating costs.

The following describes a non-limiting example of a preferred embodiment illustrated in the accompanying drawings, in
20 which:

Figure 1 is a side view of a pedestal manipulator fitted with an extension arm;

Figure 2 is a front view of the pedestal manipulator of figure 1 as a pipe gripper grips a horizontal pipe;

25 Figure 3 shows the same as figure 2, but here the pipe is being turned from a horizontal to a vertical position;

Figure 4 shows the same as figure 3, but here the pipe is in a position that is nearer to the vertical, where the angle of the pipe relative to the vertical axis is controlled;

Figure 5 is a side view of the extension arm on a larger scale, where the pipe gripper, which is in its lower horizontal position, grips a horizontal pipe;

Figure 6 shows the same as figure 5, but here the pipe is being pulled up and the pipe gripper is turning freely about its suspension;

Figure 7 shows the same as figure 6, but here the pipe gripper is displaced to a position in which the turning of pipe gripper about its suspension is controlled; and

Figure 8 shows the same as figure 7, but here the pipe gripper is in its upper and vertical position.

In the drawings, reference number 1 denotes an extension arm connected to the parallel guiding first arm 4 of a pedestal manipulator 2. The pedestal manipulator 2, which is placed on a drill floor 5, is of a type that is known *per se*, is designed to rotate about its vertical axis 6, and is equipped with a second arm 8, see figure 1. The pedestal manipulator is designed to grip a relatively long vertical length of pipe 9 and through use of the arms 4, 8 displace the length of pipe 9 in the radial direction relative to the axis 6. In figure 1, the second arm 8 is shown in the inactive position.

The extension arm 1 is hinged to the parallel guiding first arm 4 by means of hinge pins 10. Thus the extension arm 4

will remain in a mainly vertical position during the radial displacement of the first arm 4 relative to the axis 6 and during the vertical displacement of the first arm 4.

The extension arm 1 is provided with guide slots 12, see
5 figure 5, which extend along the longitudinal extent of the lower portion 13 of the extension arm 1 and down to the lower end portion 14 of the extension arm 1. The lower portion 13 of the extension arm 1 may be rotated about its own longitudinal extent by use of a rotary motor 15. A guide
10 carriage 16 on wheels is designed to be displaced along guide slots 12 by means of a guide cylinder 18 jointed to the extension arm 1 and guide carriage 16, respectively.

A pipe gripper 20 is jointed to the guide carriage 16 by means of an articulated axle 22. The pipe gripper 20 is
15 equipped with hydraulically controlled gripper shoes 24 of a design that is known *per se*.

An articulated cylinder 26 jointed to the guide carriage 16 is designed to turn the pipe gripper 20 about the articulated axle 22 by means of an articulated arm 28 rotatable about the
20 articulated axle 22, when the pipe gripper 20 is located about its vertical position, see figures 4 and 7.

In order for the pipe gripper 20 to be free to turn about the articulated axle 22 when the pipe gripper is near its horizontal position, see figures 2 and 5, the pipe gripper 20
25 is equipped with a locking bolt 30. The locking bolt is designed to be releasable, to allow the pipe gripper 20 to turn freely about the articulated axle 22 relative to the articulated arm 28.

Through the pipe gripper 20 being designed to turn freely about the articulated axle 22, the extension arm 1 is only subjected to a slight bending moment from a pipe 32 held by one end by the pipe gripper shoes 24 of the pipe gripper 20.

5 When a horizontal pipe 32 located on a feed way 34 on the drill floor 5 is to be raised to the vertical position, the guide carriage 16 is displaced to its lower position, whereupon the articulated cylinder 26 turns the pipe gripper 20 about the articulated axle 22 from the vertical position
10 and in the direction of the horizontal position. The locking bolt 30 is then released, releasing the pipe gripper 20 with respect to the articulated arm 28 to allow the pipe gripper 20 to turn to the horizontal position under the influence of gravity. The first arm 4 of the pedestal manipulator 2 is
15 displaced down towards its lower position until the pipe gripper shoes 24 of the pipe gripper 20 are placed around the pipe 32, see figures 2 and 5.

The pipe gripper shoes 24 then grip the pipe 32, whereupon the arm 4 is displaced upwards, and the pipe 32 is then
20 lifted by one end from the feed way 34 on the drill floor 5, while at the same time being turned freely from a horizontal position to a vertical position about the articulated axle 22, see figures 3 and 6.

When the pipe 32 and the pipe gripper 20 approach a vertical
25 position the locking bolt 30 locks the pipe gripper 20 to the articulated arm 28, see figures 4 and 7. Thus the pipe 32 may, when located near its vertical position, be turned about the articulated axle 22 by means of the articulated cylinder 26 and be placed in the desired position in a controlled
30 manner.

The guide cylinder 18 is well suited for precise positioning of the pipe 32, e.g. when the pipe 32 is to be joined with another pipe.

In this shown preferred embodiment the guide carriage 16 is
5 equipped with wheels 36, the wheels 36 being designed to roll
on the lower portion 13 of the extension arm 1. The lower end
portion 14 of the extension arm 1 is rounded to allow the
wheels 36 to enter the end portion 14 in an expedient manner
during the vertical displacement of the guide carriage 16.
10 This design causes the guide carriage 16 to be locked about
its turning direction when in a pulled-up position.

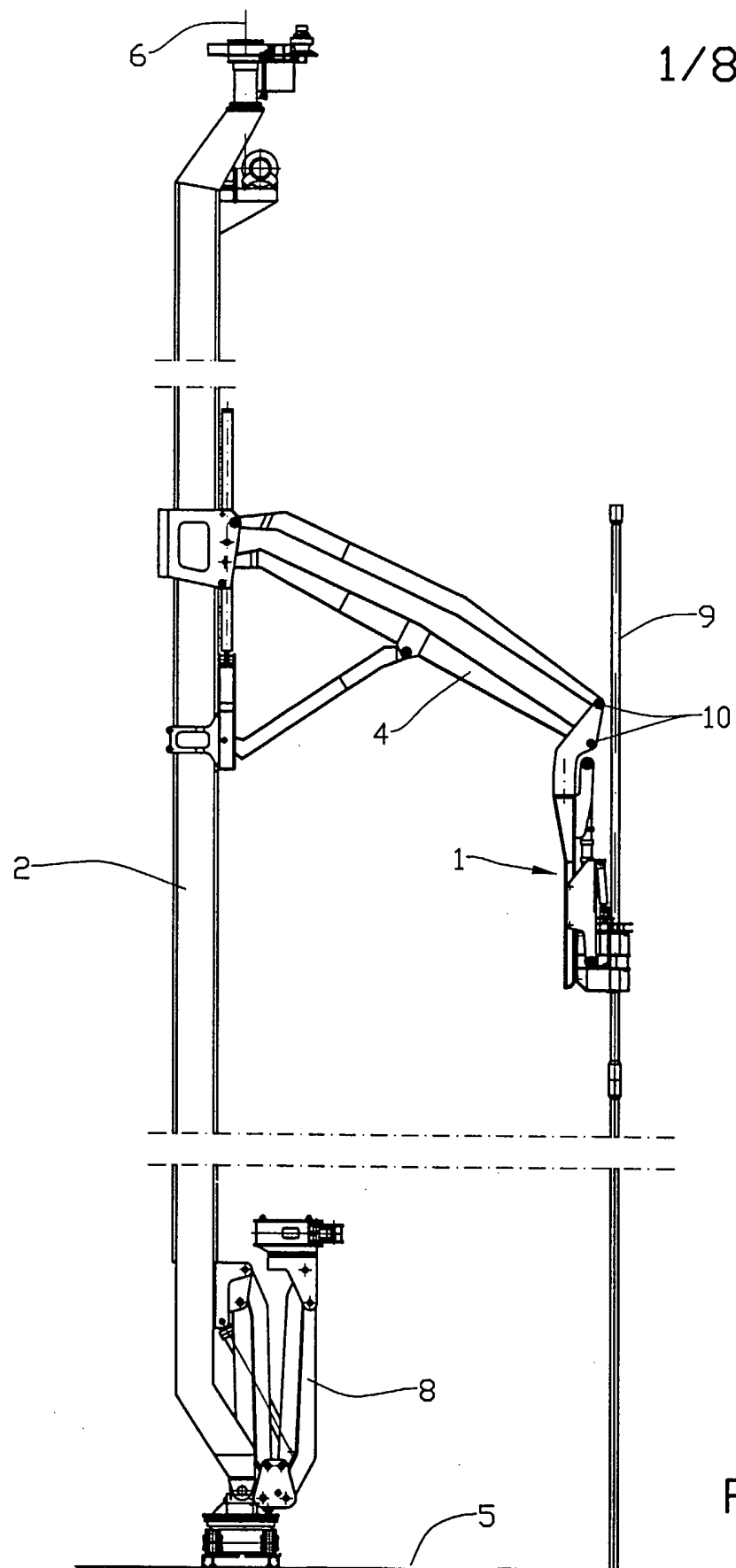
When the pedestal manipulator 2 handles relatively long
vertical lengths of pipe, the pipe gripper 20 is used in a
manner similar to that of the pipe gripper of the first arm 4
15 on a conventional pedestal manipulator 2.

C l a i m s

1. A device for a drill floor (5) pipe manipulator (2),
where the pipe manipulator (2) is designed to handle
relatively long vertical pipe lengths and comprising a
5 first arm (4) able to be raised and lowered,
c h a r a c t e r i z e d i n that the arm (4) is
equipped with an extension arm (1), where the extension
arm (1) forms a downward projecting extension of the
raisable and lowerable first arm (4), thus allowing a
10 pipe gripper (20) connected to the extension arm (1) to
be placed around an approximately horizontal pipe (32)
located near the drill floor (5).
2. A device in accordance with Claim 1,
c h a r a c t e r i z e d i n that the pipe
15 gripper (20) is designed to, in the vertical plane, turn
in under the lower end portion (14) of the extension arm
(1).
3. A device in accordance with one or more of the preceding
claims, c h a r a c t e r i z e d i n that the
20 turning of the pipe gripper (20) in the vertical plane
is controlled by means of an actuator (26) when the pipe
grripper (20) is in a near vertical position.
4. A device in accordance with one or more of the preceding
claims, c h a r a c t e r i z e d i n that the
25 pipe gripper (20) turns freely in the vertical plane
when the pipe gripper (20) is in a near horizontal
position.

5. A device in accordance with one or more of the preceding claims, c h a r a c t e r i z e d i n that the pipe gripper (20) is connected to the extension arm (1) by means of a guide carriage (16) that is displaceable
5 along the extension arm (1).
6. A device in accordance with one or more of the preceding claims, c h a r a c t e r i z e d i n that the extension arm (1) is connected to the first arm (4), so that the extension arm (1) is always in a predominantly
10 vertical position.
7. A device in accordance with one or more of the preceding claims, c h a r a c t e r i z e d i n that the pipe gripper (20) is equipped with wheels (36) designed to roll on the lower portion (13) of the extension arm
15 (1) when the pipe gripper is located next to the lower portion (13).
8. A device in accordance with one or more of the preceding claims, c h a r a c t e r i z e d i n that the lower portion (13) of the extension arm (1) is rotatable
20 about its own longitudinal extent.
9. A method for axial precision feeding of a pipe (32) during the joining of the pipe (32) with another pipe by means of an extension arm (1), where the extension arm (1) comprises a pipe gripper (20) that may be displaced
25 vertically along the extension arm (1) by means of a guide cylinder (18), c h a r a c t e r i z e d i n that after the pipe (32) has been positioned for screwing onto another pipe or pipe length (9), the pipe (32) is precision fed into or over the pipe coupling of

the other pipe or pipe length (9) by means of the guide cylinder (18).



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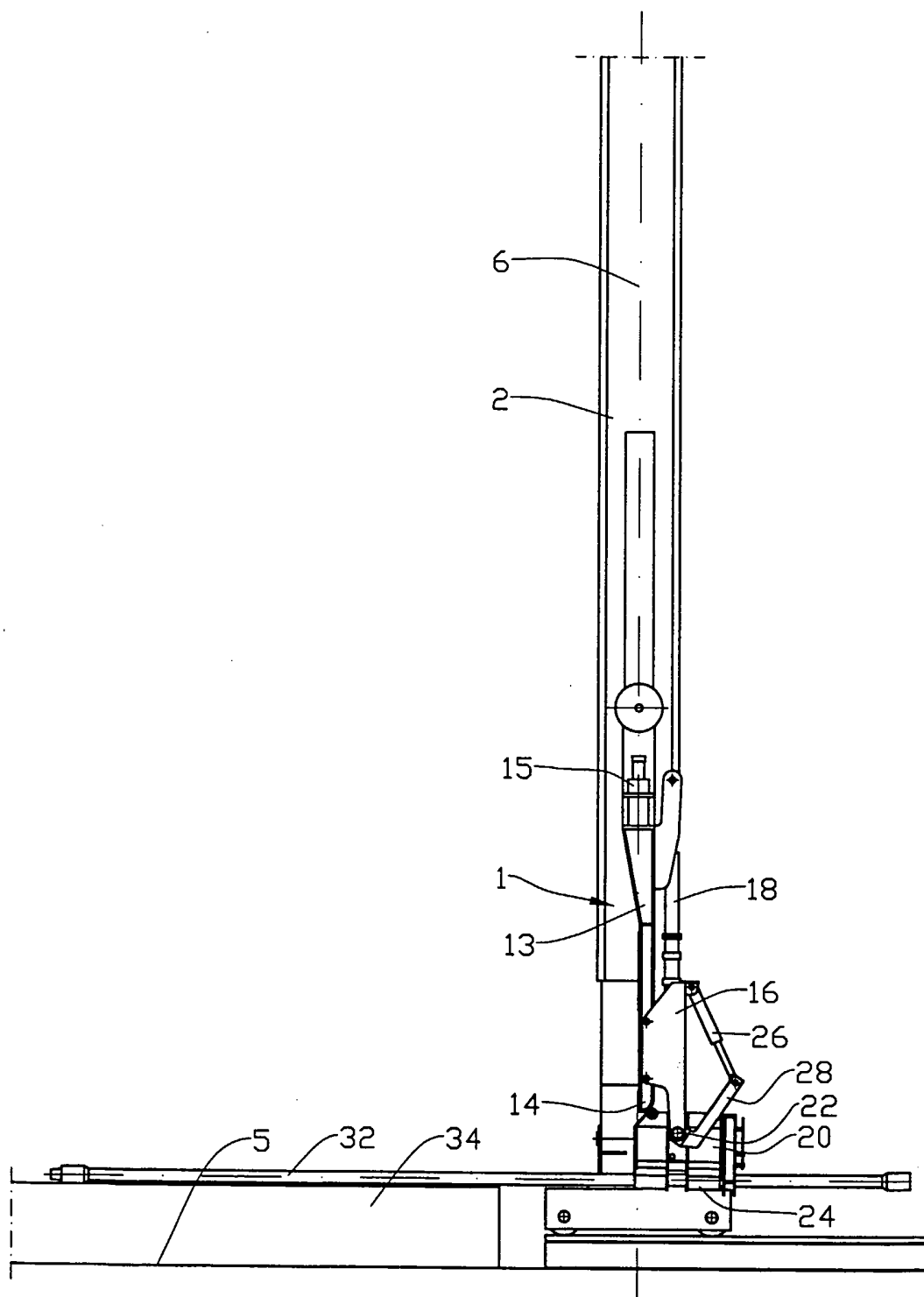


Fig. 2

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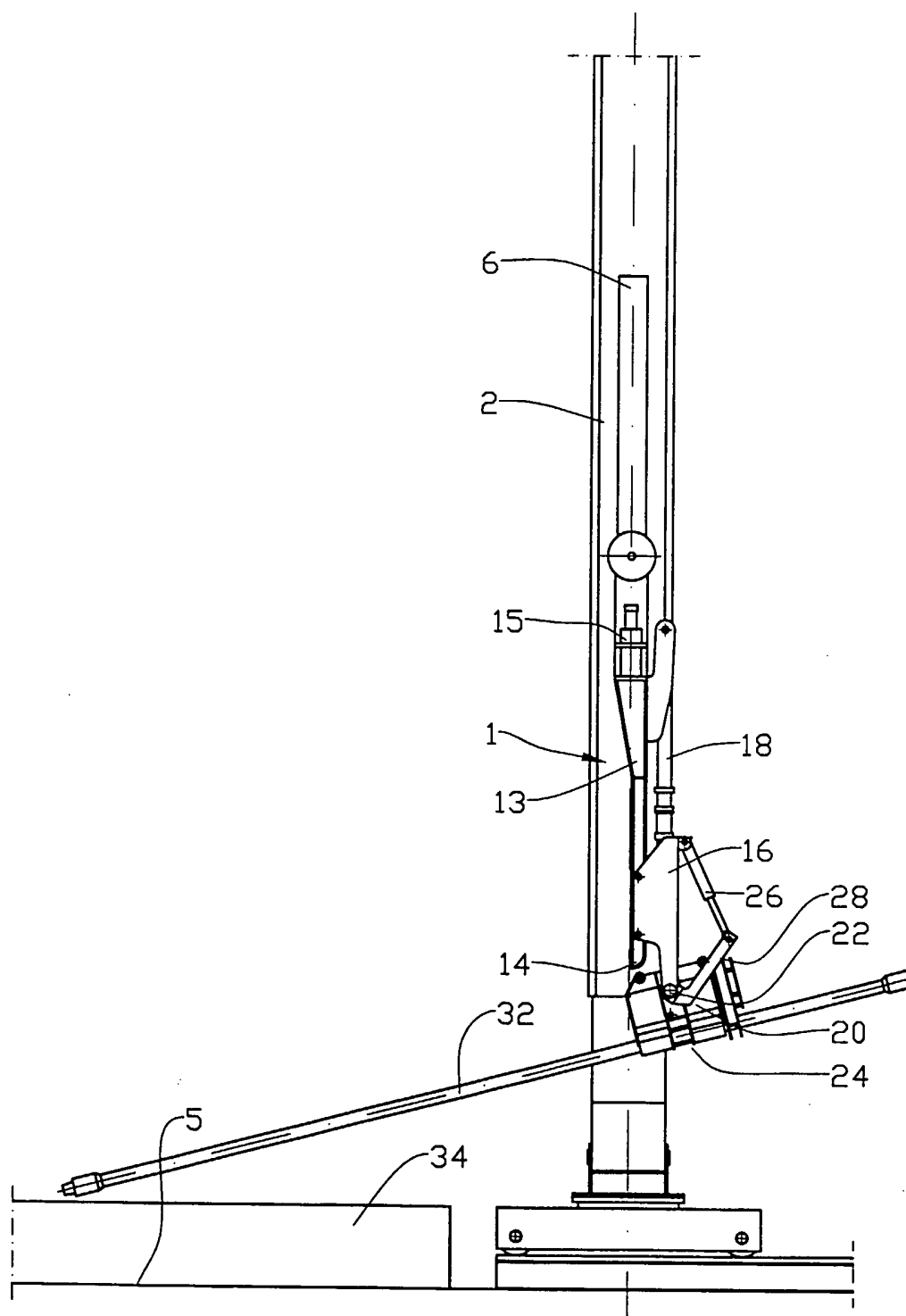


Fig. 3

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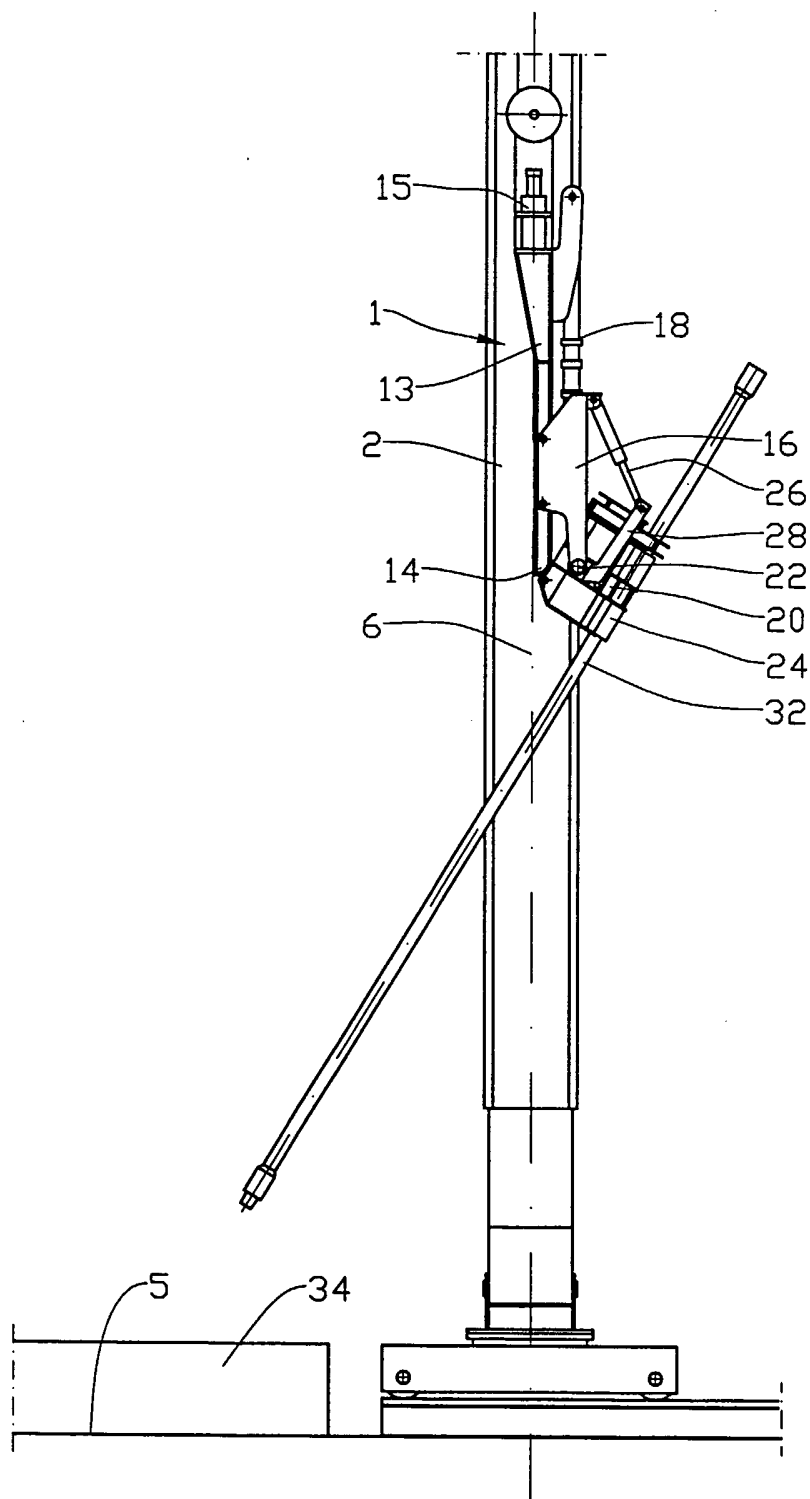


Fig. 4

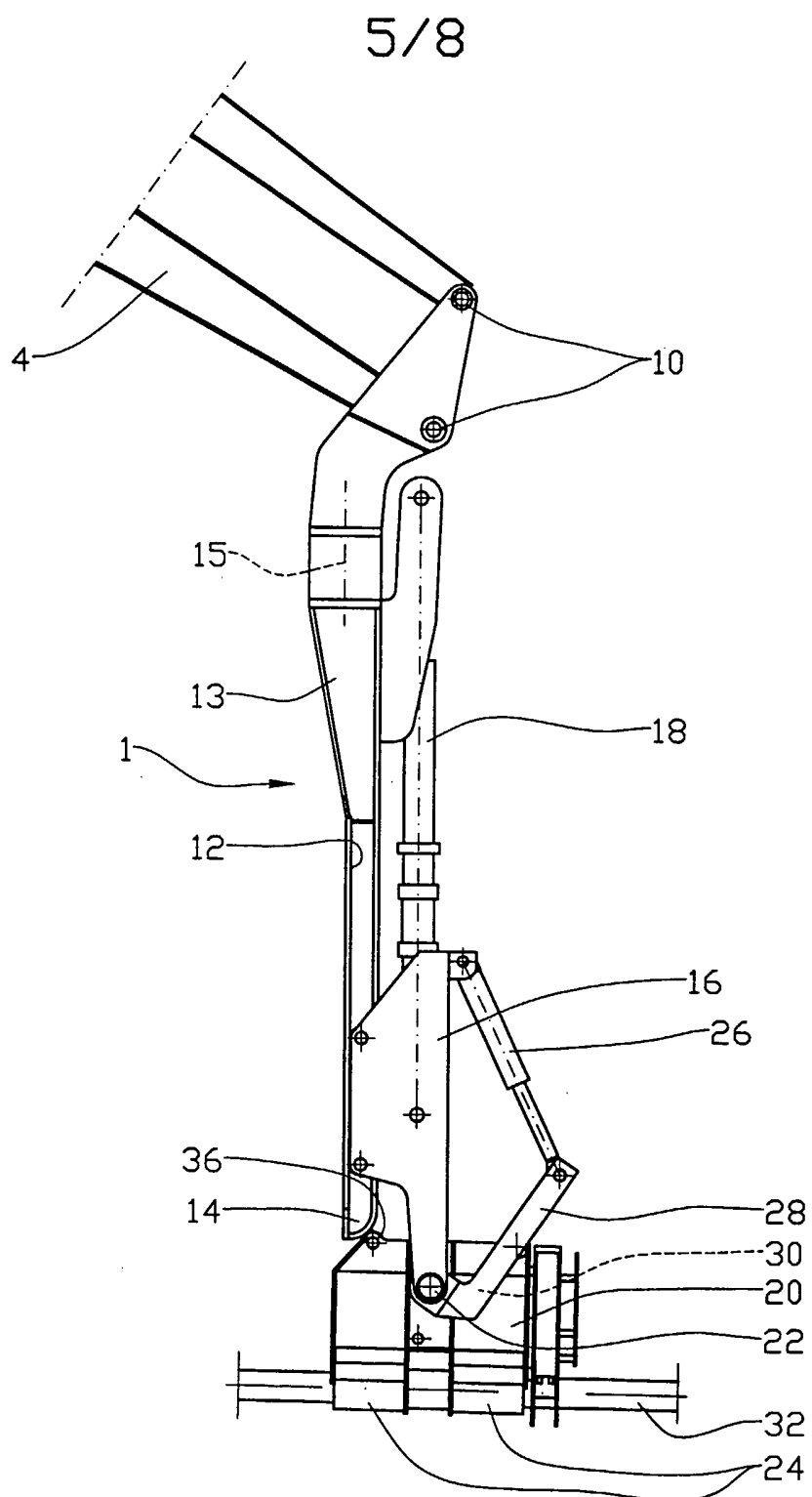


Fig. 5

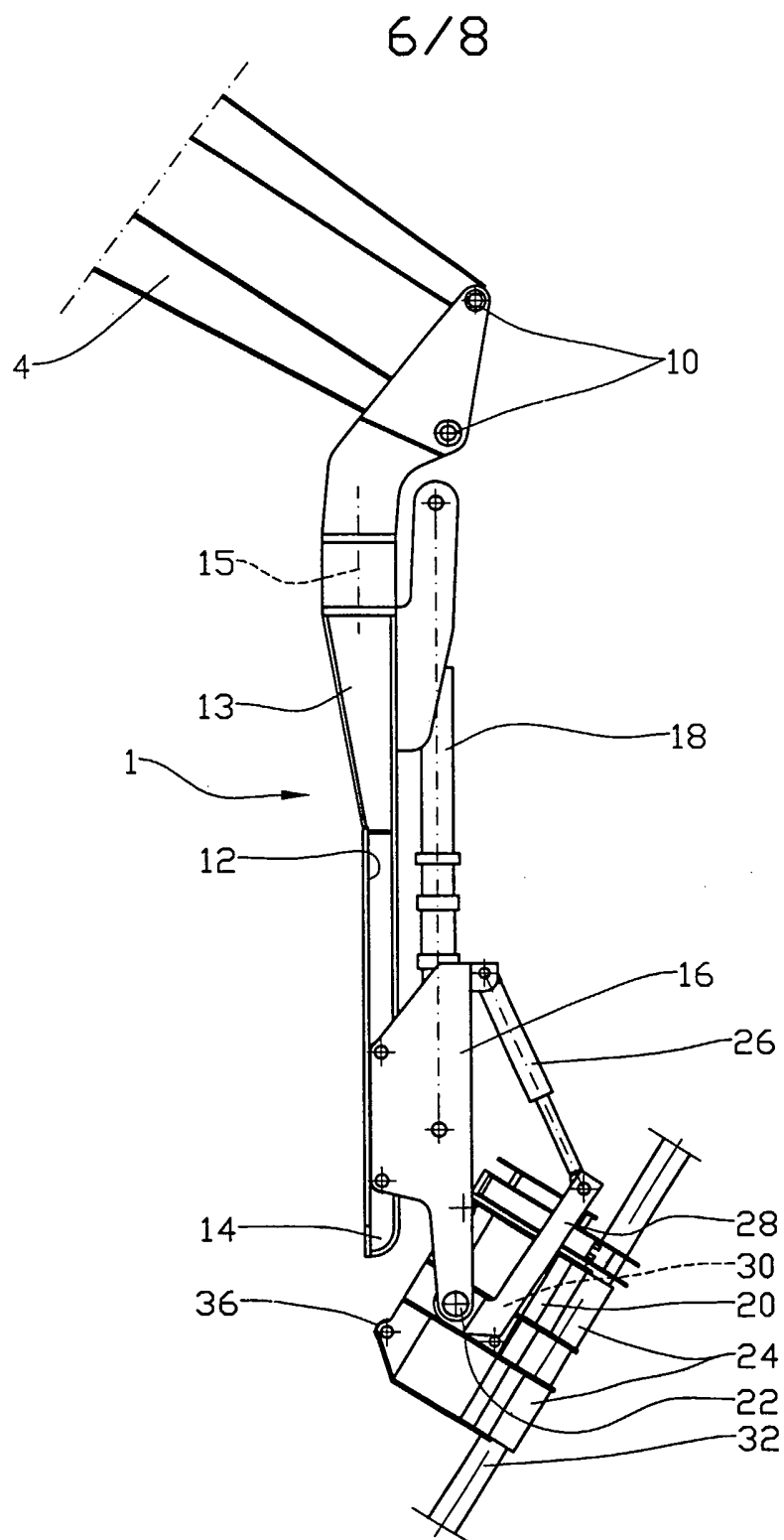


Fig. 6

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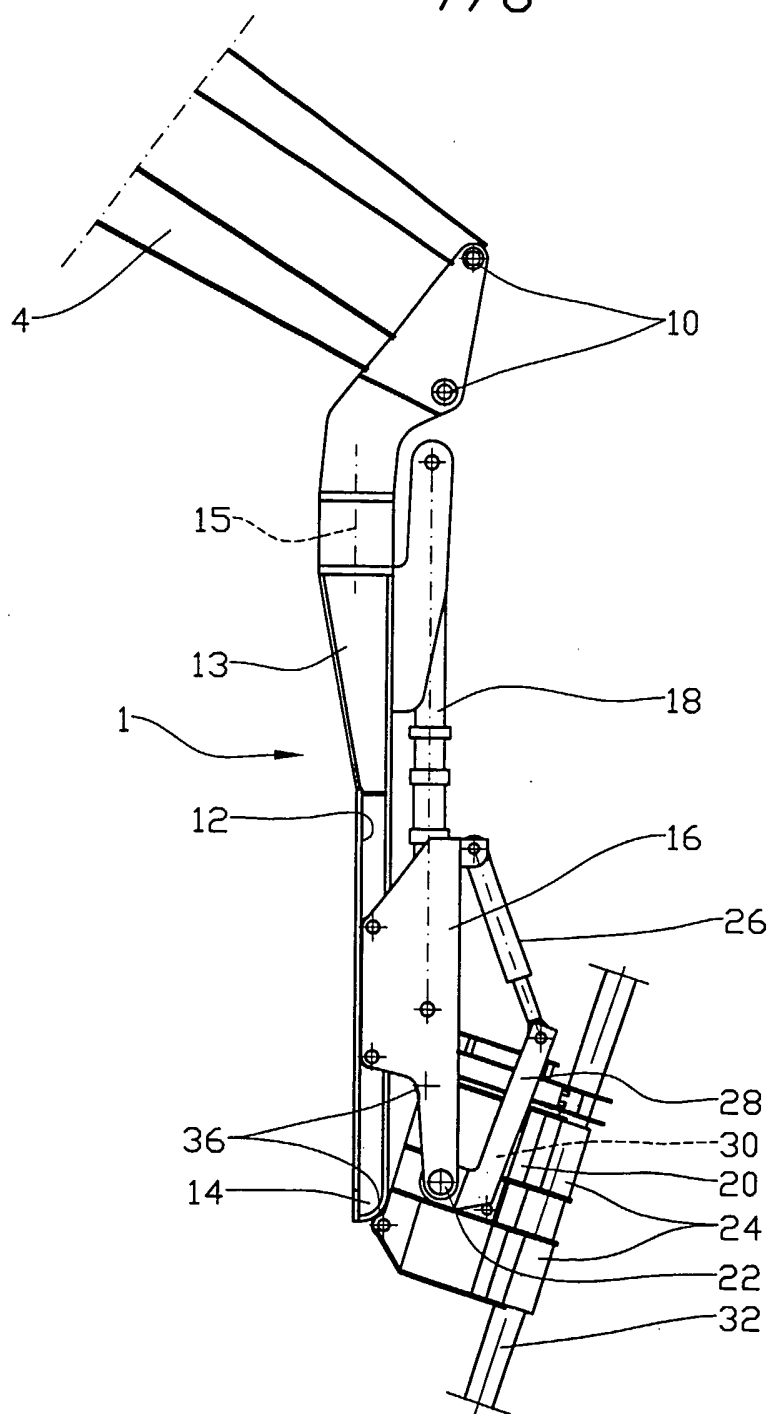


Fig. 7

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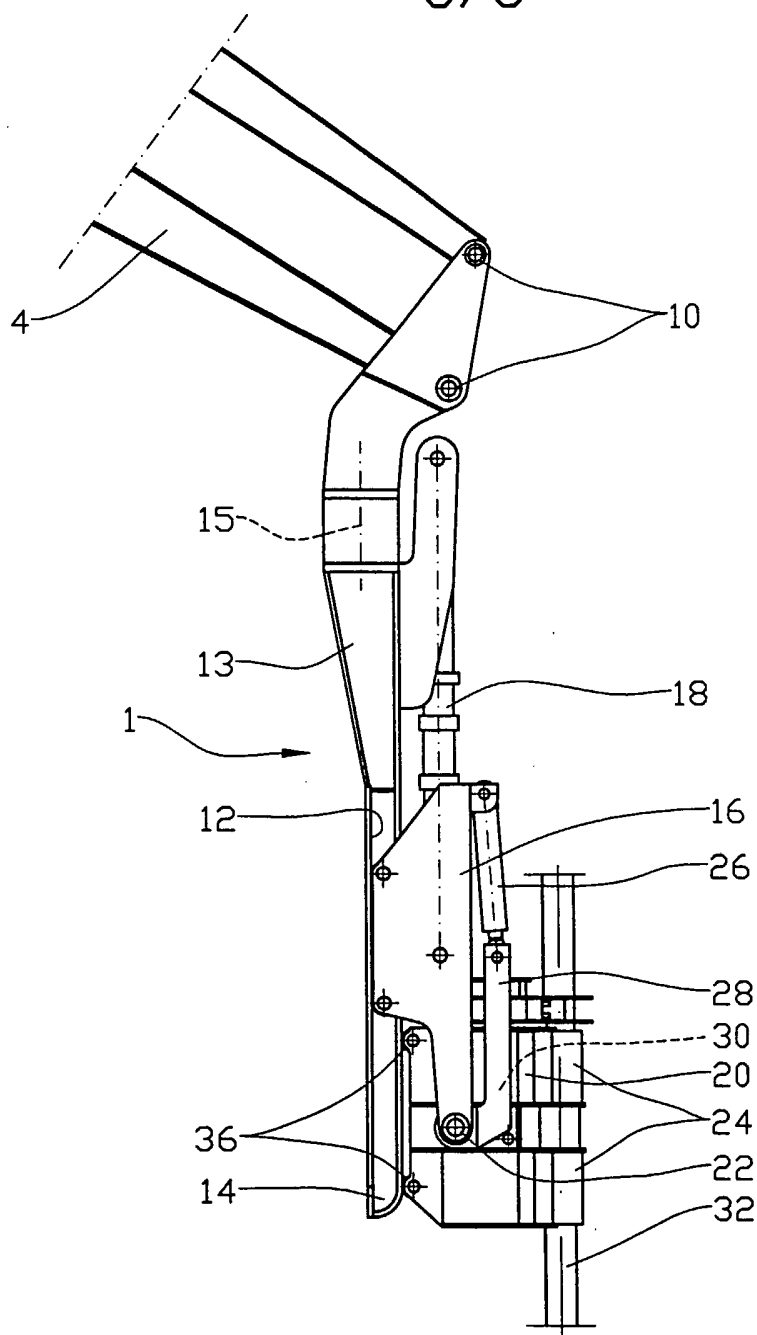


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 03/00285

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E21B 19/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 0065193 A1 (BOART LONGYEAR PTY. LTD.), 2 November 2000 (02.11.00) --	1-9
A	US 5941324 A (N.L. BENNETT), 24 August 1999 (24.08.99) -- -----	1-9

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

06/09/03

International application No.

PCT/NO 03/00285

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