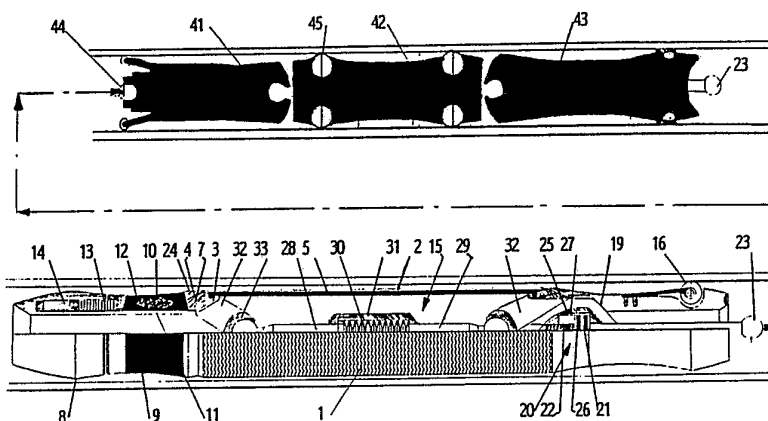




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁴ : F16L 55/10	A1	(11) International Publication Number: WO 88/ 00313 (43) International Publication Date: 14 January 1988 (14.01.88)
(21) International Application Number: PCT/NO87/00054 (22) International Filing Date: 8 July 1987 (08.07.87) (31) Priority Application Number: 862775 (32) Priority Date: 9 July 1986 (09.07.86) (33) Priority Country: NO (71) Applicant (for all designated States except US): DEN NORSKE STATS OLJESELSKAP A.S [NO/NO]; Postboks 300, N-4001 Stavanger (NO). (72) Inventors; and (75) Inventors/Applicants (for US only) : JOHANSEN, Trond, V. [NO/NO]; Ole Nordgaardsvei 78, N-7000 Trondheim (NO). RUCH, Ola [NO/NO]; Øvre Flatåsvei 32, N-7079 Flatåsen (NO). NÆSS, Ludvig [NO/NO]; Moltmyra 3A, N-7075 Tiller (NO). KRIST-JANSSON, K., P. [NO/NO]; Granhaugan 1, N-7081 Skjetnehaugen (NO). UTENG, S., F. [NO/NO]; Kolsåsen 19 A, N-7079 Faltåsen (NO).		(74) Agent: LÆRUM, Martin; Den norske stats oljeselskap a.s, Postboks 300, N-4001 Stavanger (NO). (81) Designated States: DE (European patent), DK, FR (European patent), GB (European patent), JP, NL (European patent), SE (European patent), US. Published <i>With international search report.</i> <i>In English translation (filed in Norwegian).</i>

(54) Title: DEVICE WITH A VALVE FUNCTION**(57) Abstract**

Device with valve function which can be brought into and out of a pipeline and parked in the same. The device comprises a channel for throughflowing fluid, a valve (2) which is medium controlled and/or remote-controlled, a parking brake/packer seal unit (9) which with limited force can be brought to bear against the wall of the pipeline, a cylindrical wire anchor (1) with an external diameter which is slightly lesser than the internal diameter of the pipeline and can be brought into pressure contact with the pipeline.

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DEVICE WITH A VALVE FUNCTION

10 The present invention relates to a device with a valve function which can be brought into and out of a pipeline.

Devices with a valve function which can be brought into and out of a pipeline and parked in the same are known.

15

BACKGROUND ART

From US patent document no. 3503754, for example, a pig with an axial valve system is known, where the pig can be anchored in a
20 pipeline by means of pins which are inserted through the pipeline walls from the outside and against which the pig is secured. The pig according to the patent document shall primarily be used for shut-off of the fluid flow during brief periods of pipeline repairs etc., and can not be permanently installed.

25

From US patent document no. 3746026 a blocking pig is known which features parking brakes and sealing devices for temporary shutoff of a pipeline at a predetermined point. The blocking pig, however, lacks a separate valve function, and consequently
30 cannot be permanently installed in a pipeline either.

From DE patent document no. 3142768, an internal blocking device for a pipeline is known which comprises two flanges and a cylinder connecting these. Outside the cylinder, on the
35 outermost part between said cylinder and the pipeline wall, an elastic tube has been installed, consisting of a rubber-type, synthetic material, which is reinforced with several layers of metal sheathing. Inside the tube, an inflatable bellow is mounted which receives pressure medium from pressure bottles

located inside the cylinder. The tube and the inflatable bellow have a double function in that both shall seal off fluid which flows into the pipeline and anchor the blocking device in the pipeline. The blocking device does not feature a separate valve function, and must therefore be inserted into the pipeline each time the pipeline is to be blocked.

DISCLOSURE OF INVENTION

10 The object of the present invention is to provide a device with a valve function which can be brought into and out of an already existing pipeline without having to modify the pipeline, and which can be parked at the desired point and can remain there also during normal operation over an extended period.

15 Moreover, the force exerted by the device on the pipeline during normal operation must be limited, in order to avoid local over-loading at the same time as the device must be safely anchored when the valve is closed and there is a great drop in pressure over the device. Another object is to provide a device

20 comprising a valve which closes automatically and instantly at a given pressure difference and which can also be opened/closed at a signal. According to the invention, this is provided by a device characterized by comprising a channel for throughflowing fluid, a medium controlled and/or remote-controlled valve, a

25 parking brake/packer seal unit which with limited force can be brought to bear against the wall of the pipeline, and a cylindrical wire anchor with an external diameter corresponding to or slightly less than that of the pipeline's internal diameter and which can be brought into pressure contact with the pipe-

30 line.

Another object is to provide a device of a simple design and low weight which is cheap in production. This can be obtained by locating the valve and parking brake in separate sections

35 with the cylindrical wire anchor in between to connect these and with a spring shaft located in contact with the sections to keep these at a given distance from each other.

Further advantageous features of the invention will become apparent from the description below and the dependent claims.

MODES FOR CARRYING OUT THE INVENTION

5

In the following, the invention will be further explained with reference to an embodiment of the device which is shown on the enclosed drawing.

10 The figure gives an example of a device according to the invention which is coupled together with a transport vehicle. The said transport vehicle is divided into three and consists of a driving carriage 42 and an energy and generator carriage 43. The energy and generator carriage 43 features a coupling ball
15 for possible coupling up with a stand-by pig. The motor and driving wheels 45 bear against the internal wall of the pipeline and can be driven in both directions. Instead of wheels 45, belts and other driving devices can also be utilized. The coupling and communication carriage 41 of the transport vehicle
20 is coupled to the device according to the invention. All couplings between the carriages 41, 42, 43 and between the transport vehicle and the device consist of freely pivotal universal couplings 23, 44. The coupling and communication carriage 41 and energy and generator carriage 43 are preferably equipped
25 with freely rotatable guide wheels 16, 24, which run against the internal wall of the pipeline.

In the embodiment referred, the device is shaped as an extended unit and features a throughflowing fluid channel internally,
30 which is connected with a valve 20. The valve 20 is designed to permit opening and closing of the valve in two independent ways. According to the first way, the valve 20 closes automatically if the drop in pressure over the valve 20 exceeds a given limit, and below this limit, it will be open. According to the
35 second way, the valve can be forced open or closed by means of a remote control. Instead of being fluid-operated, the valve 20 can be motor-operated.

The valve 20 is preferably located in a first section and consists of a valve seat 19 installed as a part of and on the lower side of the enclosing edge of the section and coaxially with the fluid channel, a valve body 25 with contact surface 5 adapted to the valve seat 19, a valve spindle 26, a guiding device 27 on the valve spindle 26, several centring springs 22 and an actuator 21. Through the guiding device 27, the valve body 25 is attached to the valve spindle 26 so that it can be moved a limited distance in the axial direction of the device. 10 The centring springs 22 are located on both sides of the guiding device 27 and arranged to keep the valve in open position when the drop in pressure over the device is within the given limits. When the drop in pressure exceeds this limit, the force exerted on the valve 20 from the fluid is greater than the 15 force exerted from the springs 22, and the valve is closed. When the valve is closed by means of remote control, e.g. during testing, the actuator 21 moves the valve spindle 26, and thus the valve body 25, so that this is brought to bear against the valve seat 19. When there is a negative drop in pressure 20 over the device, the springs 22 will force the valve 20 open, and fluid will be let through. A communication unit which is connected to the actuator of the valve 20 is located in the first section and makes it possible to open/close the valve 20 by means of an external wireless control. An energy source 25 which is sufficient for the execution of the desired number of closing/opening operations is connected to the valve 20 and the communication unit.

During normal operating, the device will be secured to the 30 internal wall of the pipeline at the desired point by means of a combined parking brake and a packer seal unit 9 installed in a second section. To obtain the desired elasticity, this is built up with a soft core consisting of an approximately circular elastomer hose 10 which is enclosed by a somewhat more 35 rigid annular seal packing 12. The approximately circular room enclosed by the elastomer hose 10 is connected with the

throughflowing fluid channel through an aperture 11. The annular, preferably reinforced, packer seal unit which encloses the soft core is rigid and will permit passing of welds and other protrusions on the pipeline surface, and will also allow the extremely great tolerances which such a seal packing must satisfy. The combined parking brake and packer seal unit 9, hereafter called the parking brake 9, will during normal parking and operation get its holding pressure from an actuator 13. This is accomplished by the parking brake 9 being pressed together in axial direction by the actuator 13, whereby it due to its special composition will expand radially outward to bear firmly against the inner side of the transport pipeline. When the pressure difference over the device increases, the aperture 11 will lead to increasing contact pressure between the parking brake 9 and the pipeline wall. The parking brake 9 is installed to keep the entire device parked at a desired place during normal operation with the valve in open position. The parking brake 9 works with limited, given force against the pipeline wall so that this shall not be under heavy stress over a long period of time. When the valve is closed and the pipeline is under pressure, the combined parking brake and seal packing will not be sufficiently powerful for anchoring of the device in the pipeline. A separate cylindrical wire anchor 1 has therefore been installed which has the same or a somewhat smaller diameter than the pipeline's internal diameter in the parking zone. The wire anchor 1 consists of one or several layers of high-grade wire 2 which is/are attached to clamping rings 3, 4 with conical wedges 7 mounted inside the wires. In addition, an elastomer 5 which constitutes the elastic core and seal element in the wire anchor 1 will vulcanize the wires 2 and wedges 7 to the clamping rings 3, 4. The vulcanization of the elastomer will also enter into the clamping rings 3, 4 and establish a good contact. In some cases, reinforcement in the elastomer 5 will also be relevant. In that case, also the reinforcement will be enclosed by the clamping rings 3, 4.

On larger versions, the clamping rings 3, 4 will be divided into two to provide for improved anchorage in clamping slots. The clamping ring elements 3, 4 will then appropriately clamp the elastomer 5 with reinforcement in each clamping slot.

5 Cylindrical roller bearings 24 have been installed on the largest diameter of the clamping rings. The roller bearings 24 prevent the device from jamming when passing tight bends. Corresponding roller bearings 8 are also located on the two other tops to prevent jamming in the bends.

10

When closing the valve 20, the pressure developing on the upstream side of the valve 20 will urge the wire anchor 1 outward to bear against the pipeline. The contact pressure of the wire anchor will therefore increase proportionally with the increase
15 in pressure difference over the device.

The wire anchor 1 is preferably installed between the two abovementioned sections, connecting these. To keep the sections apart, a spring shaft 15 is installed which is preferably
20 located centrally in the device, and is fastened by means of rigid stays 32 in each end which are connected to the clamping rings 3, 4 of the section. The spring shaft 15 preferably consists of two tubes 28, 29 and a spring 30 clamped between these. A sleeve 31 encloses the shaft elements 15 so that they
25 can only be moved in relation to each other in axial direction. With the shaft 15 in mounted position, the spring 15 exerts a pre-stressing force against the tube ends 28, 29. Elastomers have been installed between the shaft ends 15 and the stays 32. The shaft 15 is mounted with spring action in axial direction
30 to compensate for the contraction which must necessarily be present during full differential pressure to provide for sufficient contact between the wire anchor and the pipeline.

In one embodiment, which is not shown in the figure, a communication unit has been installed in the hollow shaft 15, which
35 can be wireless-controlled and is in contact with the actuator

13, 14 of the parking brake 9, and can activate this. Also the energy source of the actuator 13, 14 may then be stored in the hollow shaft 15.

5 The device is transported to parking position in the pipeline
by being coupled together with the transport vehicle by means
of a coupling ball, and is brought by this to the desired posi-
tion. In order to prevent the device from jamming in a bend or
from being damaged during the transport, the device features
10 several stabilization wheels 16 in the front and back. When
parking the device, energy is supplied from the transport
vehicle to the actuator 13, 14, unless energy is stored in the
hollow room of the spring shaft 15. After completed parking,
the transport vehicle is disconnected and removed. The device
15 preferably features coupling balls 23 in both ends so that it
can be removed again in any direction. Centrally in the coup-
lings 23, there are connections which enables the vehicle to
activate or partly activate the valve 20 and parking brake 9
respectively.

CLAIMS

5 1. Device with valve function which can be brought into and out
of a pipeline, and be parked in the same, **characterized by**
that the device comprises a channel for throughflowing
fluid, a valve (2) which is medium controlled and/or remote
controlled, a parking brake/packer seal unit (9) which with
10 limited force can be brought to bear against the wall of the
pipeline, a cylindrical wire anchor (1) with an external
diameter which is slightly lesser than the internal diameter of
the pipeline and can be brought to pressure contact with the
pipeline.

15

2. Device according to claim 1, **characterized by the**
valve (20) being located in a first section, the parking
brake/packer seal unit (9) in a second section, and the
sections being connected by the cylindrical wire anchor (1) and
20 kept apart by means of a shaft (15).

3. Device according to claim 1, **characterized by the**
cylindrical wire anchor (1) consisting of at least one layer of
high-grade wire (2) which outwards borders to the pipeline
25 wall, and inside comprise a fluid-tight elastomer layer (5)
which is preferably vulcanized to the wire layer (2) and where
both layers (2, 5) at each end of the cylindrical wire anchor
are attached to clamp rings (3, 4) on the first and second
section respectively.

30

4. Device according to claims 1 and 3, **characterized by**
the wire anchor (1) being urged against the pipeline wall as a
consequence of the differential pressure which is developed by
the closing of the valve, which makes that the wire anchor (1)
35 absorb the increased axial force exerted on the device.

5. Device according to claim 1, characterized by the parking brake/seal packing (9) consisting of a soft core with an elastomer hose (10) which encloses a room connected through an aperture (11) with the transversing channel, and the elastomer hose (10) being enclosed by a more rigid, annular packing (12), which is preferably reinforced.

6. Device according to claims 1 and 5, characterized by the parking brake/seal packing (9) being brought to parked position bearing against the pipeline wall by being compressed in the radial direction of the device, causing the parking brake/seal packing (9) to expand in axial direction.

7. Device according to claims 5 and 6, characterized by increased differential pressure over the device transferring increased pressure through the aperture (11) to the room enclosed by the elastomer hose (10), resulting in increased contact pressure between the parking brake/seal packing (9) and the pipeline wall.

20

8. Device according to claim 1, characterized by the valve in uninfluenced position being kept in centered open position by centering springs (22), and being automatically and instantly closed at differential pressure exceeding a predetermined limit.

9. Device according to claim 1, characterized by the possibility to open and close the valve (20) by means of an activator (21) which is wireless-controlled and is stored in the first section.

10. Device in accordance with claims 1 and 2, characterized by the shaft (15) being installed with spring action in axial direction to compensate for contraction which arises due to increased differential pressure to provide for sufficient contact between the wire anchor and the pipeline wall.

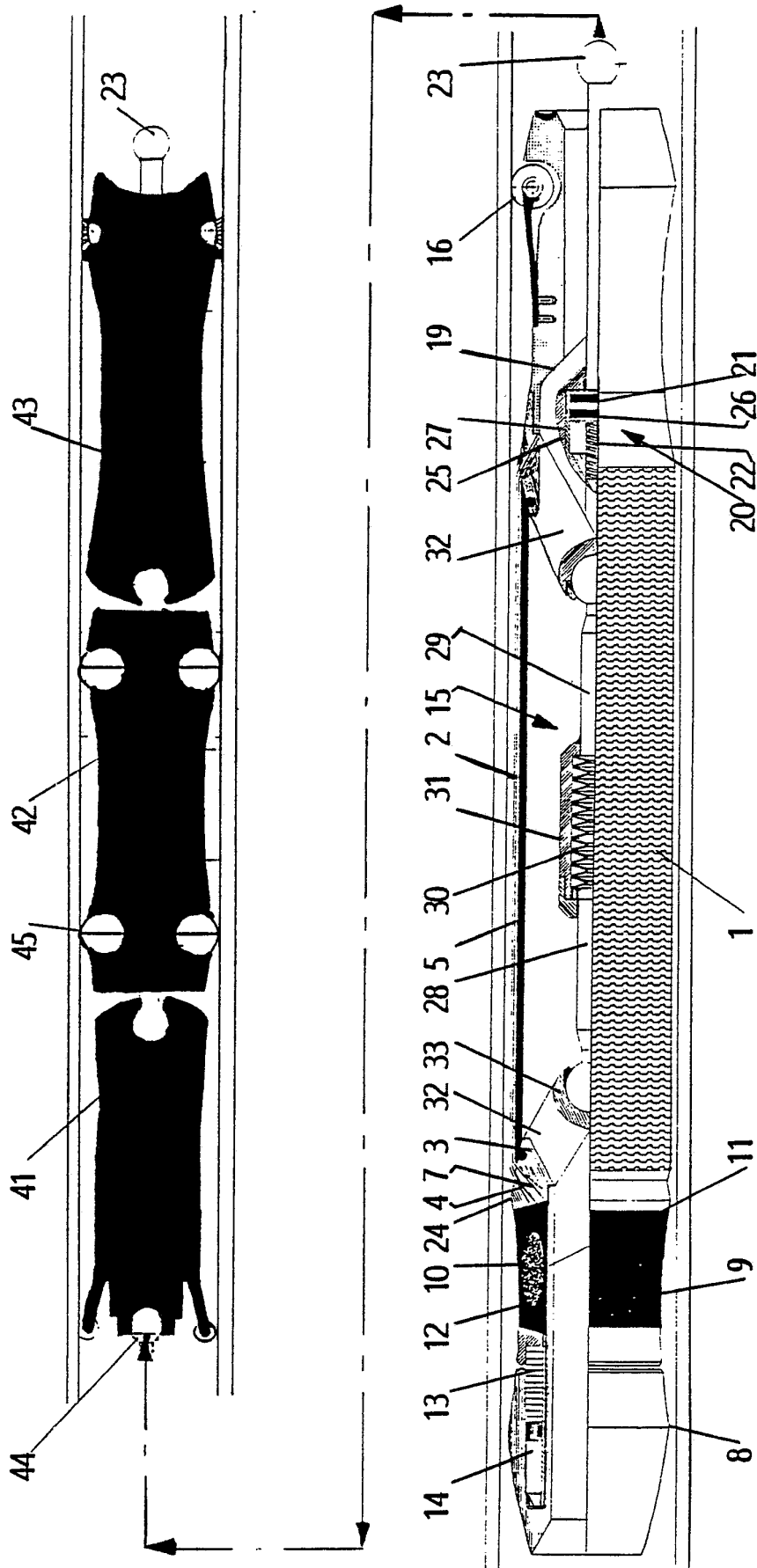
11. Device according to claim 10, characterized by the shaft (15) comprising two tubes (28, 29) located centrally in the axial direction of the device, a spring (30) installed at the middle section of the shaft (15) between the tubes (28, 29), a sleeve (31) which encloses the middle section of the shaft and spring (39), and is connected with a rigid stay (32) which connects the ends of the shaft (15) with the first and second section.

10 12. Device according to claim 9, characterized by elastomers (33) being installed between the shaft ends (15) and stays (32).

13. Device according to claims 1 and 9, characterized by the location in the shaft cavity (15) of a wireless-operated activator in the cavity of the shaft (15) which controls the parking brakes/packer seal unit actuator (9).

14. Device according to claim 1, characterized by couplings being installed at one or both ends of the device for coupling to a transport vehicle.

15. Device in accordance with claim 12, characterized by the transport vehicle being pivotally coupled to the device and consisting of a first unit which contains a coupling and communication carriage (41), a motor and driving carriage (42), and an energy and generator carriage (43), and where the carriages of the transport vehicle are pivotally coupled to each other.



SUBSTITUTE SHEET

fig 1

INTERNATIONAL SEARCH REPORT

International Application No. **PCT/N087/00054**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC <div style="display: flex; justify-content: space-between;"> F 16 L 55/10 4 </div>		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC 4 US C1	F 16 L 55/10, /12, /16, /18 <u>137</u> : 315; <u>138</u> : 97, 98	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched *		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT *		
Category *	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	DE, C2, 3 142 768 (COMPAGNIE FRANCAISE DES PETROLES S.A.) 26 April 1984	1
A	EP, A1, 0 087 867 (HALLIBURTON COMPANY) 7 September 1983 description page 9, lines 6-16.	1-3
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search 1987-10-06		Date of Mailing of this International Search Report 1987-10-09
International Searching Authority Swedish Patent Office		Signature of Authorized Officer Christian Westberg L.E.