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(54) Fluid flow monitoring device

(57) Device for detecting an interuption in flow comprises a cylinder (8) provided with an inlet (9) at a first end (10), an orifice (11) at the second end (12) and a lateral outlet orifice (13), and a piston (14) adapted for movement from a no-flow position, abutting the first end (10) under the action of a spring (15) to a flow position in which the piston opens up at least a part of the lateral orifice (13), and means for detecting the first position. A device is used to monitor the supply of additives to oil and gas pipelines.

Fig.1

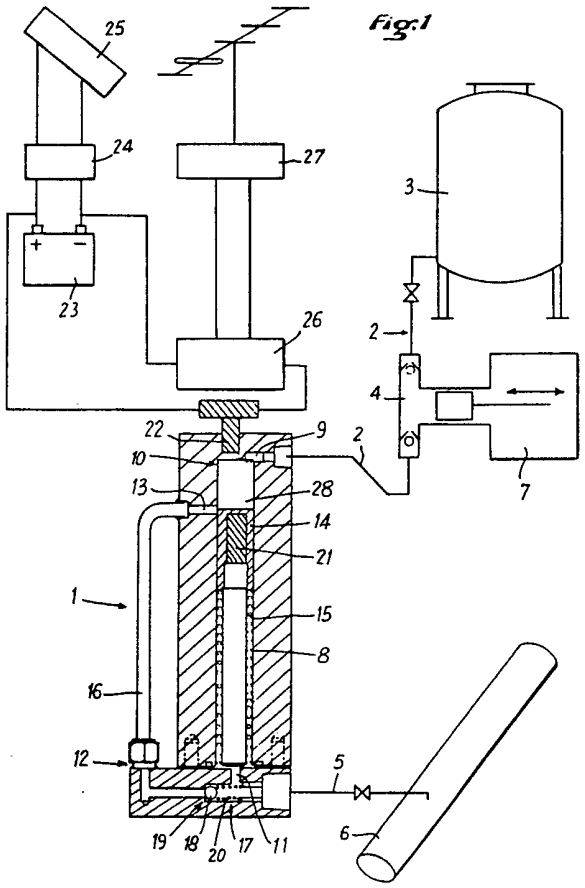

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Fig.1

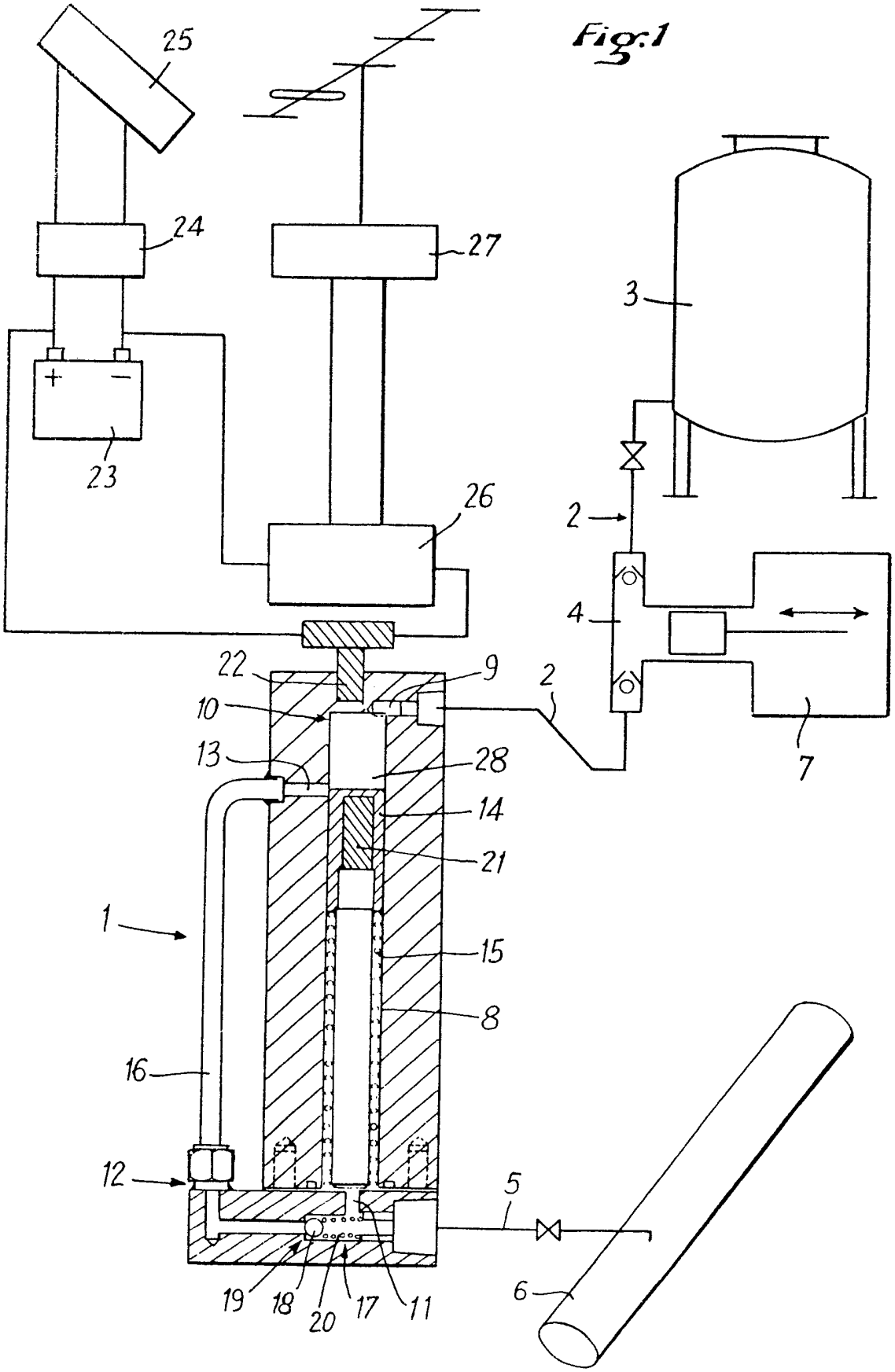
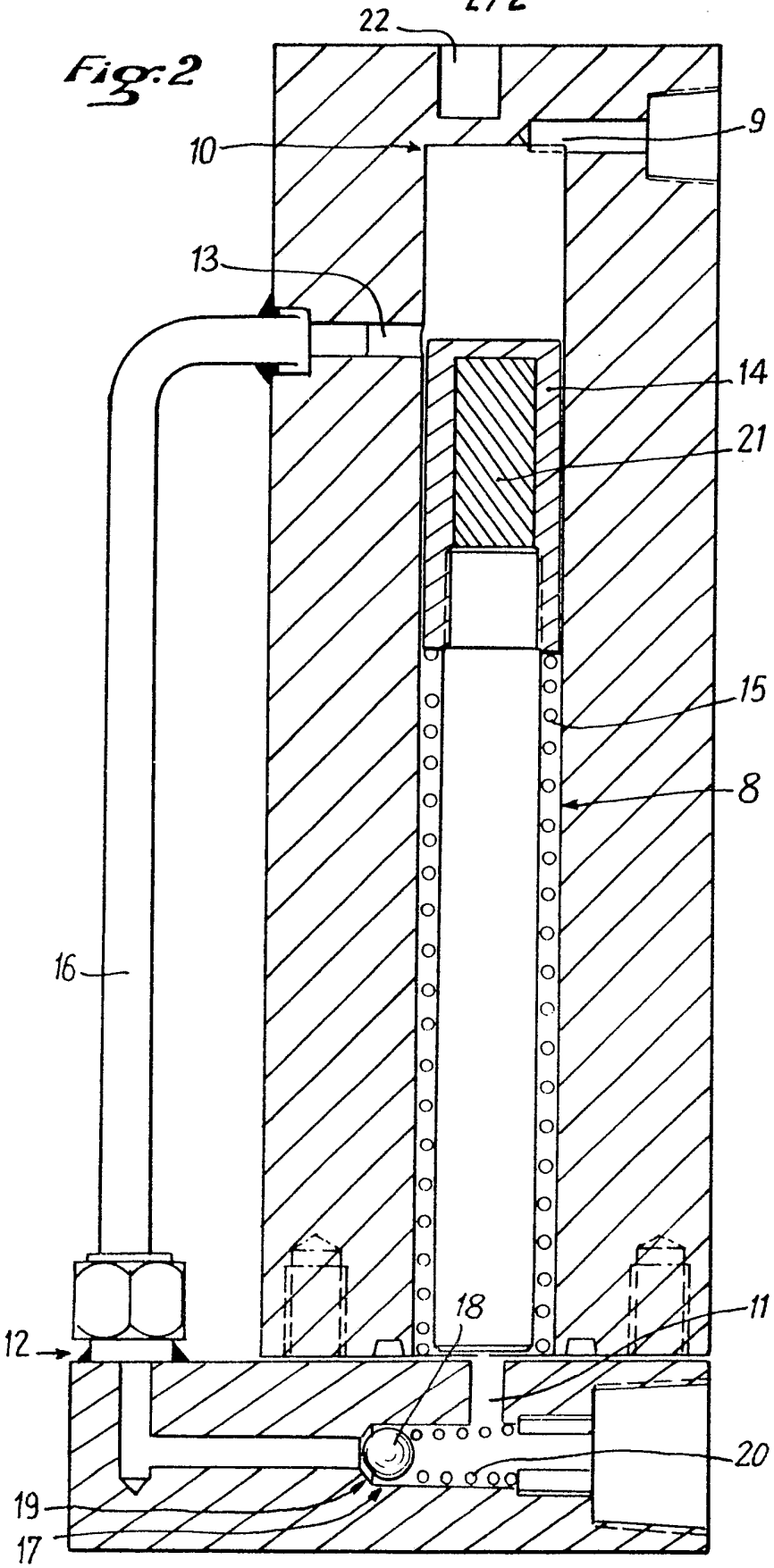


Fig:2



SPECIFICATION

Fluid flow monitoring device

The present invention relates to a device for monitoring fluid flow and in particular for detecting the stoppage of such flow, which is important where additives are concerned which are injected continuously at points distributed over the length of a pipeline for conveying petroleum, gas or some other chemical product.

Treatment of crude petroleum during its transfer from the production site to the storage location is of capital importance since the products injected make it possible to obtain an oil which complies with commercial specifications.

The detection of a stoppage of injection and the tele-transmission thereof will make it possible to avoid expensive incidents such as might immobilise storage or reveal loads which are not in accordance with specifications.

The product is generally injected by means of an alternating pump driven by a motor supplied with gas or electricity. Faults in injection emanate either from a stoppage of the supply of gas or electricity or from a lack of product to be injected.

Flow monitors are known which are installed in a sleeve so that they can be mounted in a pipeline. A valve oscillating in the pipeline indicates the excess or lack of flow. However, these devices are designed to monitor considerable flow levels at pressures which are not very high and they are not suitable for clearly and manifestly detecting any absence of flow and do not therefore constitute a solution to the problem posed.

Flow meters are known which have a float and which comprise a vertical measuring cone of upwardly increasing cross-section and inside which there is a float. When fluid is flowing from the bottom upwards through the cone of measurement, the float rises and assumes such a position that the ascending force due to the flow balances the weight of the float. A level of flow through this instrument corresponds to every position of the float. It the tube is transparent, graduations are marked on the tube and make it possible directly to read the rate of flow. If the tube is opaque, a magnetic bar is placed in the float and a detector is provided to read any modification in magnetic field, translating these indications into a dial reading by means of a movable needle.

Float-type flow meters are fragile and are rather more laboratory instruments rather than work site equipment.

It is to offset the difficulties encountered with these various items of equipment that it has been proposed to have a compression spring work under the action of the pressure developed by the flow fluid, which will permit of high pressures.

A device according to the invention, for monitoring a fluid flow, consists of a cylinder (8) provided with an inlet orifice (9) on a first end (10), a circulating orifice (11) on a second end (12) and a lateral orifice (13) referred to as the outlet, and a piston (14) adapted for translatory movement in the cylinder (8) from a first position referred to as the no-flow position, in which the piston (14) is maintained abutting against the first end (10) of the cylinder (8) by a spring (15) bearing on the second end (12) of the cylinder (8), to a second so-called flow position in which the piston (14) compressing the spring (15) under the pressure of fluid arriving through the orifice (9) in the first end (10), opens up at least a part of the lateral outlet orifice (13), the cylinder (8) and the piston (14) being provided with associated means for detecting the first position of the piston. In such a device, the lateral orifice (13) is connected to an oil pipeline (6) successively through a pipe (16) provided with a non-return valve (17) and a connecting pipe (5), the orifice (11) of the second end (12) of the cylinder (8) being connected to the pipe (16) beyond the non-return valve (17).

According to a preferred embodiment, the piston (14) and the first end (10) of the cylinder (8) are provided with means whereby the arrival of fluid through the inlet (9) on the first end (10) applies the pressure of the fluid to the entire end of the piston (14) abutting on the first end (10) of the cylinder (8). These means consist in particular of the substantially spherical cup-shape given to the end of the piston (14) co-operating with a first flat end (10) of the cylinder (8).

According to various embodiments, the means for detecting the first position of the piston consist of the association of a magnetised bar disposed within the piston and coaxailly of the latter, and a magnetic contactor disposed on the plate constituting the first end of the cylinder, this magnetic contactor co-operating with a signal emitting device.

In such installations, the magnetic contactor is generally of the flexible blade switch type and is often linked to a signal emitting device through a time delay relay.

The invention will be more clearly understood from the emsuing description given by way of non-limitative example and referring to an embodiment illustrated in the accompanying drawings, in which:

Figure 1 shows a general diagram of the installation, and

Figure 2 shows a cross-section through the flow failure detector.

If reference is made to Fig. 1, this shows a flow monitoring device (1) incorporated between a pipe (2) connecting it to a tank (3) through an alternating pump (4) and a pipe (5) connecting it to an oil pipeline (6).

The alternating pump (5) is driven by a motor (7) driven either by electricity or by a liquid or gaseous fuel.

The flow monitoring device (1) consists of a cylinder (8) provided with an inlet (9) on a first end (10), a circulating orifice (11) on the second end (12) and a lateral so-called outlet orifice (13), and a piston (14).

The said piston (14) is adapted for translatory movement in the cylinder (8) from a first position, not shown but referred to as the no-flow position, in which the piston is maintained abutting the first end (10) of the cylinder (8) by a spring (15) bearing on the second end (12) of the cylinder (8), to a pisition shown in the drawing and referred to as the flow position, in which the piston (14) compressing the spring (15) opens up at least a part of the lateral orifice (13).

This lateral orifice (13) is connected to the pipe (3), itself terminating at the gas pipeline (6), by duct (16) comprising a non-return valve (17) consisting of a ball (18) bearing on an annular seat (19) under the section of a spring (20).

The circulating orifice (11) on the end (12) of the cylinder (8) is connected to the pipe (16) downstream of the non-return valve (17).

The piston (14) comprises a coaxial magnetised bar (21).

Housed in the wall of the cylinder (8) bounded by the first end (10) is a magnetic contactor (22) of the flexible blade switch type.

This magnetic contactor (22) is supplied with electric power by a source such as a battery (23) which is itself connected to a solar panel (25) through a regulator (24).

The magnetic contactor (22) is connected to a radio emitter (27) via a time delay relay (26).

The piston (14) has its end (28) abutting the first end (10) of the cylinder (8), which, although it cannot be seen in the drawing, has the shape of a spherical cup allowing it to withstand the pressure of the liquid arriving through the orifice (9) and over its entire surface area.

The piston (14) is adapted for movement in the cylinder (8) with a clearance determined as a function of the viscosity of the liquid in order to permit of a certain leakage flow through the annular space which is thus defined.

By way of example, for viscosities comprised between 100 and 5000 centiposes, a clearance of 1/10th millimetre may be envisaged, while a smaller clearance must be observed for viscosities below 100 centipoises.

The stopper (14) is made from a material which has as great a resistance to corrosion as the body of the cylinder but which is slightly different from the latter either in terms of its hardness or with regard to its surface condition, so that it can easily slide and avoid any seizure.

Its various parts of the detection device (1), with the exception of the magnetised stopper (21), are made from non-magnetic steel and offer excellent resistance to corrosion.

Operation of the device

The liquid arrives through the orifice (9) and immediately pressurises the assembly at the end of the piston (14).

The piston (14) is pushed back until the lateral orifice (13) is exposed at least partially to allow passage of the liquid through the pipe (16) towards the oil pipeline (6) via the non-return valve (17).

Under the effect of the pressure exerted by the liquid on the piston (14), despite the outflow through the pipe (16) and despite the leak tolerated by the annular space between the piston (14) and the cylinder (8), the piston (14) comes to rest in a position butting on the second end (12) of the cylinder (8), the effect of this being to stop the leakage through the annular space and to stabilise this position. The piston (14) is then in the flow position.

If there is a failure in injection, whatever, the cause may be, the non-return valve (17) closes and, under the action of the spring (15), the piston (14) moves until it abuts the end (10) of the cylinder (8).

By virtue of the tolerated leakage between the piston (14) and the cylinder, the non-return valve (17) closes prior to complete stoppage of fluid flow, the effect of this being to moderate the speed of displacement of the piston.

When the piston (14) approaches this position of abutment against the end (10), the magnetic bar (21) actuates the magnetic contactor (22) so initiating the alarm process.

Bearing on the end (10), the piston (14) is then in the no-flow position, in which it will remain until such time as the injection means feed to the orifice (9) in the cylinder a flow of fluid of sufficient pressure to overcome the thrust of the spring (15) on the piston (14).

The time delay relay (29) blocks the emission of a radio alarm by the device (30) for a lapse of time corresponding to a limited irregularity of amplitude in the operation of the pump (5).

Once this time lapse has passed, the radio alarm operates and a maintenance crew can be sent to attend to the station where additive is injected into the oil pipeline (8).

Under conditions of normal operation of the injection station, the electrical consumption of the no-flow detection device is nil. This constitutes a considerable advantage, allowing supervision from one battery, essentially supplied by a solar receiver, and in any case independently of variations in supply by an electrical mains system.

CLAIMS

1. Device for monitoring a fluid flow, consisting of a cylinder (8) provided with an inlet (9) on a first end (10), a circulating orifice (11) on the second end (12) and a lateral so-called outlet orifice (13), and a piston (14) adapted for translatory movement in the cylinder (8) for a first position referred to as a no-flow position, in which the piston (14) is maintained abutting on the first end (10) of the cylinder (8) by a spring (15) bearing on the second end (12) of the cylinder (8), into a second position referred to as a flow position, in which the piston (14), compressing the spring (15) under the pressure of fluid arriving through the orifice (9) in the first end, opens up at least part of the lateral orifice (19), cylinder (8) and piston (14) being provided with associated means for detecting the first position of the piston.

2. A device according to Claim 1, in which the lateral orifice (13) is connected to an oil pipeline (6) in succession by a pipe (16) provided with a non-return valve (17) and a connecting pipe (5), the orifice (11) of the second end (12) of the cylinder (8) being connected to the pipe (16) downstream of the non-return valve (17).

3. A device according to Claim 1, in which the piston (14) and the first end (10) of the cylinder (8) are provided with means whereby fluid can arrive through the orifice (9) in the first end (10) and apply fluid pressure to the entire end of the piston (14) abutting this first end (10).

4. A device according to Claim 1 in which the piston (14) and the first end (10) of the cylinder (8) are provided with means so that the arrival of fluid through the orifice (9) on the end (10) applies the pressure of the fluid to the entire end of the piston (14) abutting the end (10), the said mean consisting of the substantially spherical cup-shape given to the end of the piston (14) co-operating with a first flat end (10) of the cylinder (8).

5. A device according to Claim 1, in which the piston (14) is adapted for fluid-tight movement in the cylinder (8).

6. A device according to Claim 1, in which the piston (14) is adapted for movement in the cylinder (8) with a clearance which permits of a certain flow of fluid.

7. A device according to Claim 1, in which the means of detecting the first position of the piston consists of the association of a magnetised bar (21) disposed in and coaxial with the piston (14), and a magnetic contactor (22) disposed on the plate constituting the first end (10) of the cylinder (8), this magnetic contactor (22) co-operating with a signal emitting device (27).

8. A device according to Claim 1, in which the means of detecting the first position of the piston (14) consists of the association of a magnetic bar (15) disposed in and co-axially of the piston (14), and a magnetic contactor (22) of the flexible blade switch type, disposed on the plate constituting the first end (10) of the cylinder (8), this magnetic contactor (22) co-operating with a signal emitting device (27).

9. A device according to Claim 1, in which the means of detecting the first position of the piston consists of the association of a magnetised bar (15) disposed in and coaxially of the piston (14), and a magnetic contactor (22) disposed on the plate consituting the first end (10) of the cylinder (8), the magnetic contactor (22) co-operating with a signal emitting device (27) through a time delay relay (26).

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