lubricant flowing in the line 42. The absence or the low proportion of iron contained in this alloy avoids that the measurement by X fluorescence of the overall iron content of the lubricant be perturbed by the presence of iron in a significant amount.

However, alternatively, it is possible to provide that the casing 508 is made in stainless steel.

The casing 508 defines a volume V508 for circulation of the lubricant between the connecting elements 506A and 506B, in the direction of the arrow F50 in Fig. 3. This volume V508 has a tubular shape with a circular or rectangular section, chosen by the designer of the casing 508. A longitudinal axis of the volume V508 is noted as X508.

The casing 508 is provided with a pierced hole 508A, which is centered on an axis Y508 perpendicular to the axis X508 and which opens into the volume V508. The pierced hole 508A is with a circular section centered on the axis Y508 and provided with a tapped hole 508B.

The pierced hole 508A is obturated with a wall 510 with the shape of a disc, which may also be described as a « membrane » and which is maintained pressed against the bottom of a counter-bore 508C of the pierced hole 508A by means of a ring 512 provided with external threading 512B mating the tapping 508B and which cooperates with the latter. The wall or membrane 510 is mounted on the casing 508 by flattening it against the counter-bore 508C, and then by screwing the ring 512 into the pierced hole 508A.

The ring 512 is made in the same metal or the same alloy as the body 508.

The wall 510 forms a target window for the source 502 and for the detector 504 which allows the X-rays to pass in transit from the source 502 to a lubricant sample contained in the volume V508 and from the volume 508 to the detector 504.

The wall 510 is made in poly(terephthalate) or PET, which gives it satisfactory mechanical properties, while it may have a small thickness, of less than 200 µm, to the point that it does not perturb the X-rays which stem from the source 502 or which leave towards the detector 504.

In practice, the thickness of the wall 510, which is measured perpendicularly to the axis Y508, may be selected to be less than 150 µm, preferably of the order of 125 µm.

The source 502 and the detector 504 are mounted on a lid 514 which determines their position relatively to the cell 506, more particularly relatively to the casing 508 and to the wall 510. This lid 514 surrounds the casing 508 on the side of the pierced hole 508A, so that it insulates the window formed by the wall 510 from the outside of the sensor 50. The thickness of the 514 is noted as e514. The material of this lid 514 and its thickness e514 are selected in such a way that they form an efficient shield against the X-rays which

circulate between the source 502, the detector 504 and the cell 506. This cell allows free passing of the lubricant and gives the possibility of carrying out static or dynamic analyses of the fluid lubricant. In practice, the lid 514 may be made in stainless steel, for example of the 316 type, and the thickness e514 is selected to be greater than 5 mm, preferably greater than 8 mm, still preferably of the order of 10 mm.

On the other hand, a complementary shield 516 is mounted around the casing 508, on the side of this casing opposite to the lid 514. For the clarity of the drawing, this shield 516 is exclusively illustrated in Figs. 4 and 5.

The portions 502, 504, 506, 514 and 516 of the sensor 50 are attached on a support 518 formed by a plate which may be immobilized in the box 24 by means of screws 518A. A square 502A and a spacer 504A are used for respectively attaching the source 502 and the detector 504 on the support 518.

Thus assembled, the sensor 50 is a sub-assembly easy to handle, easily identifiable, and which may be the object of a standard exchange operation, by unscrewing the screws 518A and by separating the connecting elements 506A and 42A, on the one hand, 506B and 42B, on the other hand.

The source 502 is controlled by the electronic unit 22 by means of a signal S502 and the detector 504 delivers to the electronic unit 22 an output signal S50 of the sensor 50.

In practice, the axes X508, Y508, A502 and A504 are coplanar.

An angle measured between the axes A502 and A504 outside the casing 508 is noted as α. This angle α has a value comprised between 20 and 25°, preferably of the order of 22°.

During operation, the X fluorescence technology of the sensor 50 is used for determining the overall iron content, i.e. the content of dissolved and/or particulate iron, of an amount of oil passing in transit through the volume V508, at the outlet of the buffer reservoir 26.

The measurement of the iron content carried out by the sensor 50 when the lubricant flows into the second line 42, i.e. when the valve 44 is open. This is then referred to as a dynamic measurement.

Alternatively, this measurement may be carried out when the lubricant is static in the volume V508, i.e. when the valve 44 is closed. This is then referred to as a static measurement.

The installation 2 also comprises a first level sensor 54 and a second level sensor 56 which respectively allows detection when the amount of oil in the reservoir 26 reaches

CLAIMS

1.- An installation (2) for following up the evolution of the quality of a lubricant contained in a piece of equipment (M), this installation comprising:

- at least one conduit (4) for circulating (F1) the lubricant, this conduit being connected, upstream, to the piece of equipment and downstream, to a recovery pan (6), and
- a sensor (50) for determining, by the X fluorescence technique, the overall content in a predetermined chemical element, of a lubricant sample, this sensor comprising an X-ray source (502), an X-ray detector (504) and a cell (506) intended to contain a lubricant sample to be analyzed and equipped with a wall (510) forming a window for letting through the rays stemming from the source or going towards the detector;

characterized

- in that the installation comprises:
  - a first controlled interruption valve (20) for the circulation (F1) of the lubricant in the conduit (4),
  - a buffer reservoir (26) for accumulating lubricant,
  - a first bypass line (28), connected on the one hand to the conduit, upstream from the first valve and, on the other hand to the buffer reservoir,
  - a second controlled interruption valve (32) for the circulation of the lubricant in the first bypass line,
  - a second discharge line (42) for the lubricant, from the buffer reservoir to the recovery pan,
  - a third controlled interruption valve (44) for the circulation of the lubricant in the second discharge line
- in that the sensor (50) determines the overall content in a predetermined chemical element, of a lubricant sample, at the outlet of the buffer reservoir (26); and
- in that the wall (510), which forms a window for letting through the X-rays from the source (502) or going towards the detector (504), is made in poly(ethylene terephthalate).

2.- The installation according to claim 1, characterized in that the cell (506) comprises a metal casing (508) on which the wall (510) is added.

3.- The installation according to claim 2, characterized in that the cell (506) comprises a hollow housing (508C) for receiving the wall (510) and a threaded washer (512) for immobilization of the wall in the hollow housing.

4.- The installation according to one of claims 1 to 3, characterized in that the sensor (50) is a sensor for determining the iron content of the lubricant sample.

5. The installation according to one of claims 2 or 3, characterized in that the casing (508) is made in a metal or in a non-ferrous alloy, notably in an alloy based on aluminium.

6.- The installation according to one of claims 2 to 5, characterized in that the X-ray source (502) and the X-ray detector (504) are mounted on a lid (514) which positions them relatively to the housing (508) and to the wall (510) and in that this support forms a shield against the propagation of X-rays.

7.- The installation according to one of the preceding claims, characterized in that a targeting axis (A502) of the X-ray source (502) and a targeting axis (A504) of the X-ray detector (504) form between them an angle (α) comprised between 20 and 25°

8.- The installation according to one of the preceding claims, characterized in that the wall (510) has a thickness of less than or equal to 200 µm .

9.- The installation according to one of the preceding claims, characterized in that the sensor (50) for determining the content in a predetermined chemical element is positioned on the second discharge line (42).

10.- The installation according to one of the preceding claims, characterized in that it further comprises a sensor (48) for determining the basicity index (BN) of the lubricant, positioned on the second discharge line (42) and which allows determination of the basicity index of the lubricant at the outlet of the buffer reservoir (26).

11.- An automated method for following up the evolution of the content in a predetermined chemical element of a lubricant circulating in a piece of equipment (M), by

means of an installation (2) according to claim 9, characterized in that it comprises at least steps consisting of:

a) closing the first valve (20),

b) opening the second valve (32) and closing the third valve (44) for supplying the buffer reservoir from an amount (L ; L') of lubricant accumulated in the conduit (4), upstream from the first valve,

c) opening the third valve (44) for having the lubricant present in the buffer reservoir (26) circulate through the second discharge line (42) as far as into a cell of the sensor (50).

d) using the sensor (50) for determining the overall content in a predetermined chemical element of the lubricant at the outlet of the buffer reservoir (26).

12.- A method for following up the operation of a piece of equipment (M) loaded onboard a ship, characterized in that it comprises the determination, onboard the ship, of the overall content in a predetermined chemical element, notably in iron, of a lubricant circulating in the piece of equipment by applying a method according to claim 11.

13. The use of the method according to claim 12 for determining the overall content in a predetermined chemical element, notably in iron, of a lubricant circulating in a piece of equipment (M) of a ship, notably in a ship engine.

14. The installation according to claim 7, wherein the angle (α) between the targeting axes (A502, A504) of the X-ray source (502) and the X-ray detector (504) is of the order of 22°.

15. The installation according to claim 8, wherein the wall (510) has a thickness of less than or equal to 150 µm.

16. The installation according to claim 8, wherein the wall (510) has a thickness of the order of 125 µm.