United States Patent [19]

Nilson et al.

[11] **3,837,567**

[45] **Sept. 24, 1974**

[54] **LOCKING DEVICE FOR MACHINE FRAME COVER**

[75] Inventors: **Carl-Goran Nilson**, Tullinge; **Sven Olov Olsson**, Farsta, both of Sweden

[73] Assignee: **Alfa-Laval AB**, Tumba, Sweden

[22] Filed: **Apr. 9, 1973**

[21] Appl. No.: **349,552**

[30] **Foreign Application Priority Data**

Apr. 12, 1972 Sweden 4695/72

[52] **U.S. Cl.** ..... **233/1 B**, 220/46 P, 210/146, 417/44

[51] **Int. Cl.** **B04b 7/06**

[58] **Field of Search** ..... 417/31; 49/477, 496, 31; 220/46 P; 233/1 B, 1 R, 1 A; 210/146, 148

[56] **References Cited**

UNITED STATES PATENTS

2,325,406	7/1943	Johnson	233/1 B
2,836,186	5/1958	Guth	220/46 P
2,919,910	1/1960	O'Leary	417/44 X
3,142,234	7/1964	Maloon	220/46 P

Primary Examiner—George H. Krizmanich

Attorney, Agent, or Firm—Cyrus S. Hapgood

[57] **ABSTRACT**

The frame and cover have supporting surfaces engageable by a hose in an expanded condition thereof to lock the cover in its closed position. Control means are provided for maintaining the hose filled with fluid to hold it in its expanded position, such means being operable to discharge fluid from the hose so that it contracts to a condition in which said supporting surfaces permit movement of the cover to an open position.

7 Claims, 5 Drawing Figures

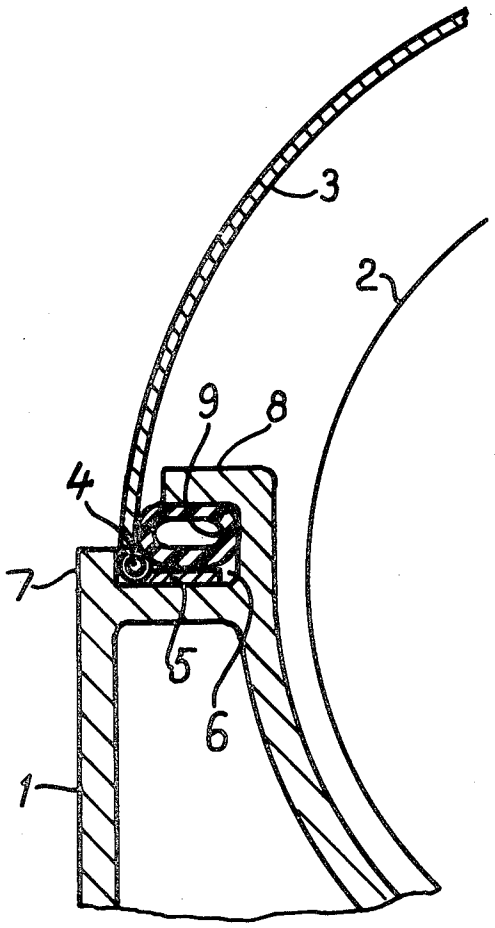


Fig. 1

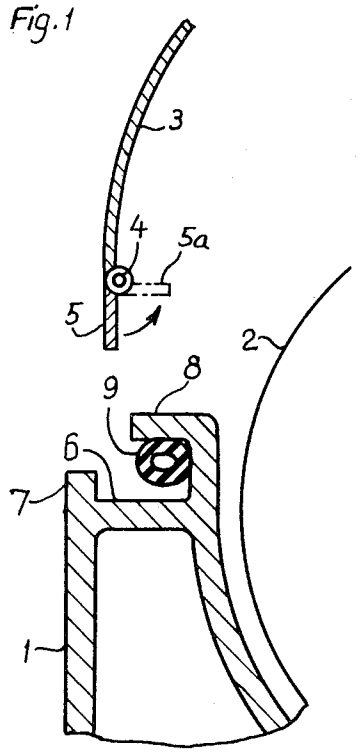
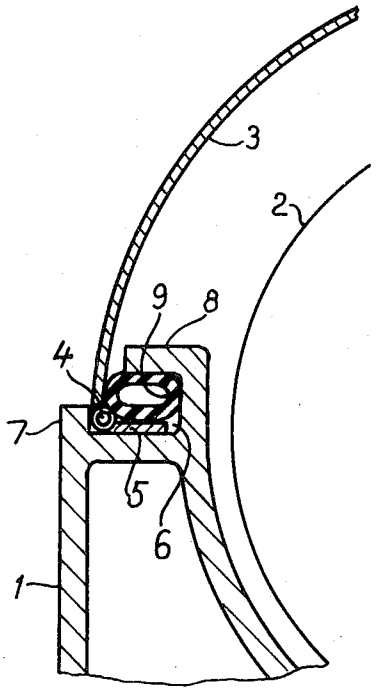


Fig. 2



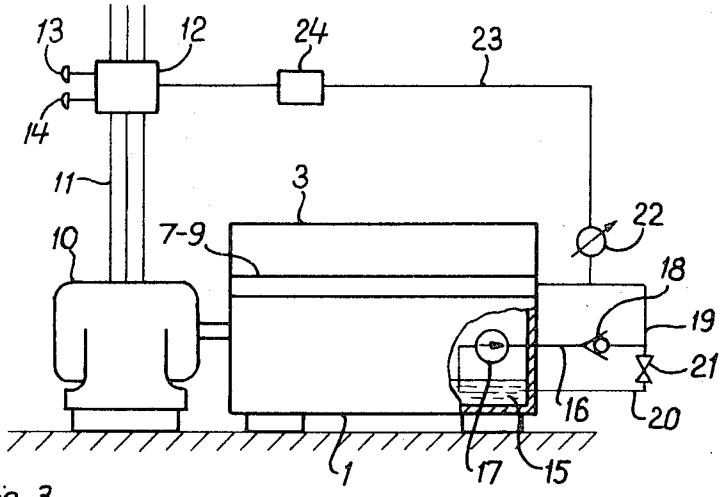


Fig. 3

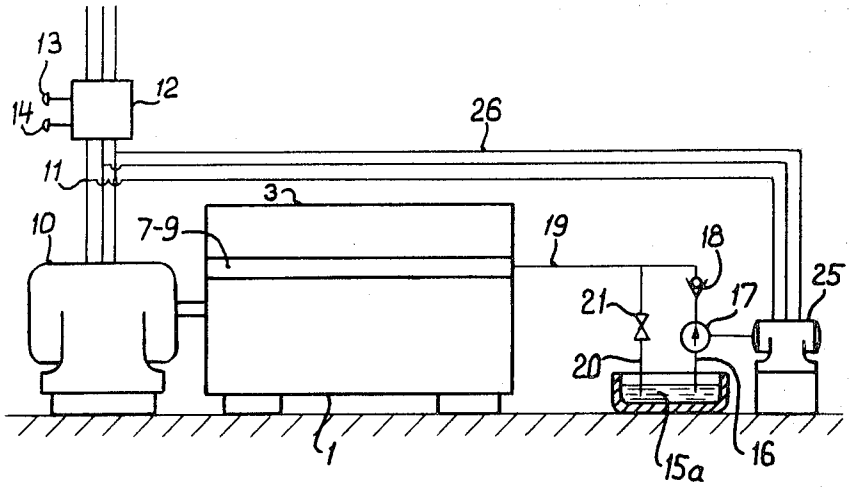

13
12
14
26
11
3
10
7-9
19
18
25
21
17
20
1
15a
16

Fig. 4

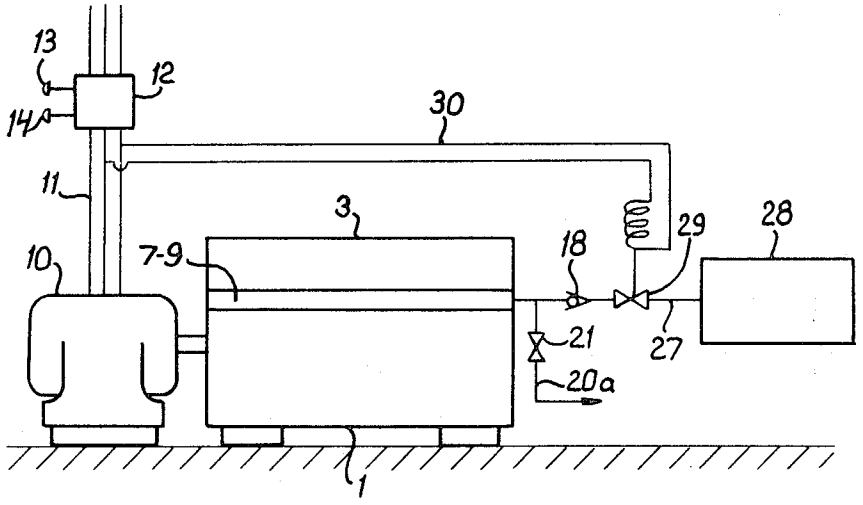

13
12
14
30
11
3
29
28
10
7-9
18
21
27
20a
1

Fig. 5

LOCKING DEVICE FOR MACHINE FRAME COVER

The present invention relates to cover-locking devices for machines having a rotor, such as a centrifuge rotor, enclosed by a frame and a movable cover coacting with the frame. More particularly, the invention relates to such a locking device of the type having a hollow member which is provided with a cavity expansible under the influence of a pressure therein and which is arranged to lock the cover to the frame while the cavity is in an expanded condition, the cavity being kept filled with a fluid and thus expanded at least as long as the machine is running.

It is desirable that the rotor of the machine be stopped before the cover can be opened. Otherwise, the rotor can cause injuries to persons. For example, the operating personnel can be forced to wait 10 minutes to open the cover of the machine frame after the driving motor has been switched off. However, such a method has certain risks. A device of the type described has been proposed for this purpose, as disclosed in German patent No. 336,851. This prior device, however, provides only a point by point locking, which is disadvantageous from a strength point of view and results in the locking means being easily deformed by the load.

The present invention has for its object to eliminate this disadvantage and to effect a locking of the cover to the frame along a long distance of the cover edge, while pressing the latter against the frame. For example, when centrifugally separating a liquid under an atmosphere of an inert gas, or when centrifugally separating a liquid emitting gases which form explosive mixtures with air, a locking action which extends along the whole cover edge and at the same time effects a seal would be particularly adavantageous. According to the invention, this problem is solved by making the hollow member in the form of a hose, preferably of elastic material, which is arranged to lie in an expanded condition against supporting surfaces on the cover as well as on the machine frame, which surfaces are so shaped that removal of the cover from the frame is prevented while the hose is thus expanded.

To maintain the hose filled with fluid and thereby keep the cover locked even during the space of time between the switching off of the driving motor of the machine and the complete stopping of the machine, a non-return valve is preferably inserted in the supply pipeline for the fluid.

The mechanical locking of the cover of the machine frame, according to a preferred embodiment of the invention, is characterized in that a supporting surface on the cover (or the machine frame) is movable, as by being pivotable, and under the influence of the expansion of the hose cavity is caused to lie against a stop on the machine frame (or the cover).

If the machine is provided with at least one auxiliary system, which operates with a pressure liquid, such as a lubricating oil system, the pump of the auxiliary system can advantageously be the source of the supply of the pressure fluid.

If the fluid pressure for some reason should disappear during the running of the machine and the locking of the cover thus cease, a measure of security can be effected according to the invention by providing a means which senses the pressure of the fluid and, when the pressure disappears, initiates stopping of the machine. With the use of a delaying relay, for example, the impulse for stopping the machine can be suppressed so that in spite of missing pressure in the cavity, starting of the machine is made possible.

The invention is described more in detail below, reference being made to the accompanying drawings in which

FIGS. **1** and **2** are vertical cross-sectional views of parts of a machine frame and cover provided with one form of the new locking device and showing the cover when released from the locking device and when locked by this device, respectively; and

FIGS. **3, 4** and **5** are schematic side elevational views of machines having three different arrangements for supplying fluid to the locking device. In the different figures, corresponding details have the same reference numerals.

The drawings show the illustrated form of the invention in connection with a centrifuge; but it will be understood that this is merely by way of example and that the invention is applicable to other types of machines as well.

Referring to FIGS. **1** and **2,** a centrifuge frame is shown in part at **1,** and reference numeral **2** indicates schematically part of the centrifuge rotor which is mounted in the frame for rotation about a horizonta axis. The frame **1** is provided with a cover shown in part at **3** and which can be unlocked for upward movement from the frame (FIG. **1**), to permit access to the rotor and the interior of the frame, or locked to the frame (FIG. **2**). The left-hand edge of the cover has at least one flap **5** which is pivotable about a horizontal pin **4** on the cover and which, when the cover is locked to the frame, takes the position shown by broken lines at *5a* in FIG. **1.** It can be assumed that the cover **3** has the shape of the upper half of a horizontal hollow cylinder; and its right-hand edge (not shown) can be designed in the same way as the left-hand edge or can be fixed pivotably to the underlying right-hand part (not shown) of the machine frame. In the latter case, of course, the locking arrangement shown in FIGS. **1** and **2** is not duplicated at the right-hand parts of the cover and frame.

The flap **5** may extend a substantial distance along the straight left-hand side of cover **3,** which coacts with the underlying straight side of frame **1,** or a series of short flaps may be provided on the cover.

Along its left-hand side, the upper part of frame **1** is provided with a groove or furrow **6** having a vertical outer wall **7** and a horizontal flange **8** extending outwardly from the rotor **2** and the inner wall of the furrow **6.** The flange **8** is located above the level of the top of wall **7** and is substantially narrower than the furrow **6** so as to provide an entrance gap for the flap **5,** as will appear presently. A rubber hose **9** is located in furrow **6** and extends along the furrow below the flange **8.**

As shown in FIG. **1,** hose **9** is in its contracted condition so that it permits the flap **5** to enter the furrow **6** and swing inwardly below the hose as the cover is lowered toward the frame, this condition of the hose also permitting withdrawal of the flap from the furrow as the cover is raised from the frame. However, with the hose in its expanded condition as shown in FIG. **2,** it presses the flap **5** against the bottom of furrow **6** and at the same time presses the edge of cover **3** against the furrows's outer wall **7,** thereby ensuring the desired

locking action to prevent displacement of the cover from its closed position in FIG. 2.

FIG. 3 shows an electric three-phase motor 10 which drives the centrifuge rotor about its horizontal axis of rotation. The supply of current to the motor is effected by means of a three-phase cable 11, in which there is inserted a contactor 12 with start and stop buttons 13 and 14. The wall of frame 1 is shown broken away at the right-hand lower corner of the frame. In this corner an oil sump 15, belonging to the lubrication system of the centrifuge, is visible. Extending from the sump is a pipeline 16 in which there is inserted a pump 17, shown symbolically and driven by the centrifuge rotor. A non-return valve 18 is also inserted in this pipeline. The pipeline 16 opens into a pipeline 19 for the supply of lubricating oil to the hose 9, and a return pipeline 20 leading to the oil sump 15 is in turn connected to the pipeline 19. In the return pipeline there is inserted a pressure-unloading valve 21, which in opened position has a small through-flow area. The pipeline 19 is provided with a contact manometer 22 which, when indicating a pressure loss in the hose 9, actuates via an electric cable 23 a control circuit of the contactor 12 so that the latter switches off the current supply to the motor 10. In the cable 23 is a relay 24, which delays for a suitable space of time the switching-off impulse of the manometer.

The arrangement according to FIG. 3 operates in the following way. Before a start of the centrifuge, the valve 21 is closed and the hose 9 is without pressure and consequently unexpanded, as shown in FIG. 1. As soon as the centrifuge begins to rotate at the start, lubricating oil is forced by the pump 17 into the hose, so that the latter swells (see FIG. 2) and locks the cover to the frame. After completion of the centrifuging and the current supply to the motor 10 has been switched off, the centrifuge rotor continues rotating for a while. The effect of the pump 17 decreases, but due to the non-return valve 18 a desirable locking pressure is still maintained in the hose 9. When a revolution counter (not shown) for the centrifuge rotor shows that the latter has stopped, the valve 21 can be opened manually, so that the lubricating oil in the hose 9 flows back to the oil sump 15. If desired, the revolution counter can be arranged to initiate, in its zero position, opening of the valve 21. Preferably, the latter in its opened position has so small a through-flow area that if the valve 21 is inadvertently opened during the running of the centrifuge or before it has stopped, the pump 17 despite the draining of oil through the valve 21 will keep the hose 9 filled with oil.

In FIG. 4, a container 15*a* for oil or water is shown situated outside the machine frame. This container has the same purpose, as regards the locking device, as the container 15 in FIG. 3. The pump 17 in FIG. 4 is driven by a separate electric motor 25, which via a three-phase cable 26 is switched on and off by the contactor 12. In this embodiment, the pump 17 stops when the motor 25 is switched off. The necessary locking pressure in the hose 9, after the switching-off of the contactor, is maintained in this case only by the non-return valve 18.

According to FIG. 5, the hose 9 is connected via a pipeline 27 to a separate pressure source 28, such as a municipal water pipeline, which thus maintains a permanent pressure whether or not the centrifuge is running. In the pipeline 27 there is inserted an electromagnetically operated valve 29 which, via an electric cable 30, iws opened when the contactor 12 is switched on and is closed when the contactor is switched off. Here again the necessary locking pressure is maintained in the hose 9 only by the non-return valve 18, after the contactor has been switched off. If water is used as pressure fluid, it can discharge to drain through a pipeline 20*a*, when the valve 21 is opened.

We claim:

1. In combination with a machine having a rotor rotatable at a working speed and also having an enclosure for the rotor, said enclosure including a frame and a cover movable generally vertically from a closed position to an open position relative to the frame, a locking device comprising an expansible hose having a cavity, said frame and cover having supporting surfaces engageable by the hose in an expanded condition thereof to lock the cover in said closed position, said supporting surfaces including a surface of the frame engaging the hose from above and a surface of the cover engaging the hose from below in said closed position of the cover, and control means for maintaining said cavity filled with fluid to hold the hose in said expanded condition during rotation of the rotor at said working speed, said means being operable to discharge fluid from said cavity and thereby contract the hose to a condition in which said surfaces permit movement of the cover from said closed position.

2. The combination of claim 1, in which said hose is of elastic material.

3. The combination of claim 1, in which said control means include a supply pipeline for said fluid, and a non-return valve in said pipeline.

4. The combination of claim 1, in which said supporting surfaces also include a stop fixed to said frame, said surface of the cover being displaceable relative to the cover and being movable against said stop by expansion of the hose to said expanded condition.

5. The combination of claim 1, in which said control means include an auxiliary system of the machine containing a liquid and including a pump for delivering liquid under pressure to said cavity.

6. The combination of claim 5, in which said system is a lubricating oil system.

7. The combination of claim 1, comprising also a device for sensing the pressure in said cavity, and means operable by said device for initiating stopping of the rotor in response to decrease of said pressure.

* * * * *