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LOCKING DEVICE FOR MOVABLE ROD

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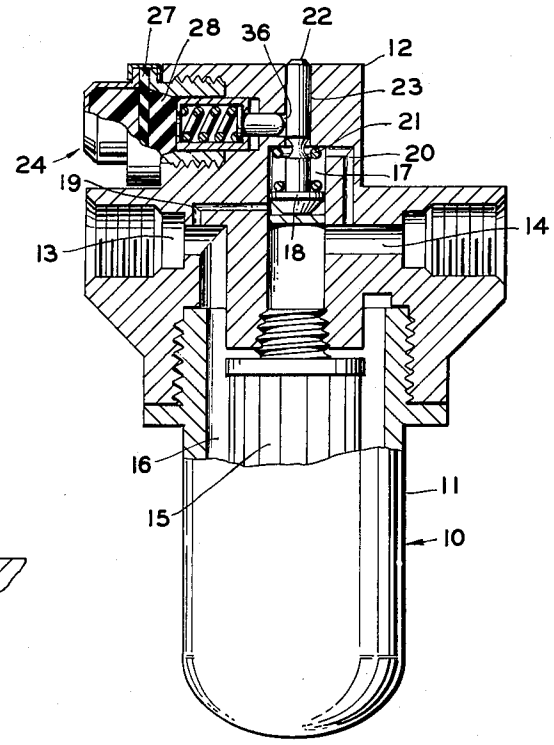


FIG. 1

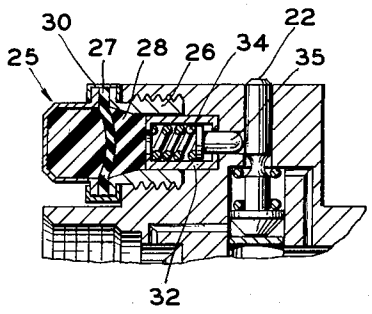


FIG. 2

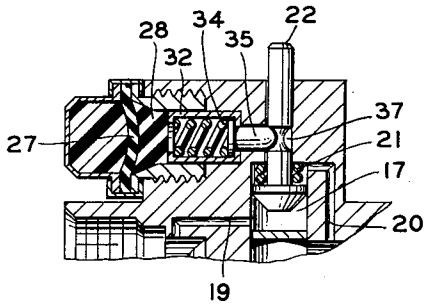


FIG. 3

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LOCKING DEVICE FOR MOVABLE ROD

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The present invention relates to a locking device, and more particularly, to a locking device that is thermostatically controlled.

In accordance with the present invention, an object of the present invention is to provide a pin type detent locking device with thermostatic control means to prevent it from becoming prematurely actuated. The device has a numerous range of uses where it is desired to lock or unlock a movement such as a catch, pawl, dog, click, shaft or the like. The invention will be illustrated in an embodiment of a movable shaft locked in a fixed position once the shaft has moved from its initial position, and particularly with respect to a signal device for indicating when a filter element has become clogged with dirt. Such a filter device having a movable shaft which is actuated into a signalling position is disclosed and claimed in U.S. Patent No. 2,878,936 granted March 24, 1959 to W. J. Scavuzzo, et al.

Another object of the present invention is to provide a filter unit having signal means therein to enable the operator to know when the filter unit must be cleaned, but which signal means will not be prematurely locked in a signal position falsely, indicating the filter needs cleaning upon cold starting of the engine with which the filter is used.

Another object of the present invention is to provide a signal device for a filter unit that will be locked in signalling position only upon the filter actually becoming clogged with contaminants.

Other objects and advantages of the invention will be apparent from the following detailed description, when considered in connection with the accompanying drawing forming a part thereof and in which:

FIG. 1 is a vertical sectional view of a filter unit with a signal device shown and the thermostatic controlled locking device in an inoperative position should the signal device falsely move to a signal position due to cold starting of the engine with which the unit is used.

FIG. 2 is a fragmentary view similar to FIG. 1 showing the thermostatically controlled locking device in an operative position, to lock the movable shaft of the signal device when it signals the filter element has become clogged.

FIG. 3 is a fragmentary view, similar to FIG. 2, showing the thermostatic locking device in operative position, actually locking the filter signal device shaft into position to indicate the filter element needs servicing.

Referring to the drawings, the reference numeral **10** generally designates an oil filter unit or assembly comprising a cylindrical casing **11** and a hollow head **12** threadably secured thereto. Head **12** is provided with an oil inlet passage **13** and a discharge passage **14** therein. A conventional cylindrical wire mesh or sintered metal filter element **15** is threaded into the lower end of passage **14**, so that the interior or downstream side of the filter element communicates therewith, while the upstream side or

inlet side of the filter element communicates with inlet passage **13** through the annular channel or space **16** defined between the filter and casing **11**.

A vertical cylinder **17** is disposed in the upper portion of head **12** and has a reciprocating piston **18** therein. The lower side of piston **18** communicates with inlet passage **13** through a small passage **19** provided in the head while the upper end or opposite side of piston **18** communicates with discharge passage **14** through another small passage **20** disposed in the head. A compression spring **21** is disposed in cylinder **17** to normally maintain piston **18** positioned adjacent the lower end of the cylinder. A shaft or rod **22** is secured to piston **18** and disposed for slidable movement in a vertically drilled passage or bore **23** extending through the head and forms the indicator or signal rod which signals when the filter element has become clogged due to contaminants being deposited on the outer surface of the filter element **15**.

Piston **18** is actuated in response to the differential pressure across the filter element since oil pressure on the upstream side of filter element **15** is also transmitted to the lower end of the cylinder and acts against piston **18** through passage **19** while the downstream oil pressure is transmitted against the opposite side of the piston through passage **20**.

When the filter element **15** becomes clogged, due to contaminants removed from the oil blocking the upstream side of the filter element it causes the oil pressure to increase while the oil pressure on the downstream side of the element remains the same or decreases. This increase in pressure differential is also registered on opposite sides of the piston **18** through passages **19** and **20**, and when sufficient pressure differential builds up on the upstream side of the filter element to overcome the force in spring **21**, normally holding the piston in the lower end of the cylinder, the piston and indicator rod **22** will move upwardly until the indicator rod extends above the filter housing, signalling the filter requires cleaning. When a new element is replaced in the casing, the pressure differential across the filter element will again be less than the force in spring **21**, urging piston **18** toward the lower end of the cylinder and the rod will move downwardly and return to its non-signalling position.

In accordance with the present invention, locking means are provided with thermostatic control means to lock the movable shaft **22** in a signalling position upon the pressure differential across the filter element increasing above a predetermined value due to the filter element becoming clogged from contaminants, but which locking means will not prematurely lock the shaft in this position upon cold starting of the engine. This is accomplished by providing a horizontal cylinder in the head in which is threadably disposed a thermally-controlled movable piston device **24**. The device **24** comprises a cylindrical cup or head **25** and a threaded sleeve or piston guide **26** between which is a fixed disc type rubber diaphragm member **27** having a rubber frustroconical plug **28** thereon. Cup **25** is filled with a conventional solid thermostatic material, not forming part of the invention, which expands when the material changes from a solid state to a liquid upon application of heat. The cup is sealed by a retainer ring **30** disposed over complementary lips on the cup and sleeve. A hollow cylindrical piston or piston cage **32** is freely disposed in the horizontal

cylinder and piston guide 26 for slidable movement therein, as shown in the drawings. Piston cage 32 is pushed or moved toward indicator shaft 22 to the right, looking at the drawings, by plug 28 which decreases its diameter and increases its length while passing through the piston guide 26 as the thermostatic material in cup 25 expands due to a change in temperature. The thermostatic material used in the cup is substantially fully contracted in the temperature range of 10 to 50° F., and is substantially fully expanded above 50° F., so that the control device is inoperative upon cold starting of an engine on which the filter unit is used.

A compression spring 34 is disposed in piston cage 32 to bear against a slidable pin-locking member 35 and maintain it against the shaft end or right end, as seen in the drawings, of the piston cage with a portion of the pin disposed in a bore 36 that extends between the end of the cylinder and indicator rod passage 23.

The indicator rod 22 is provided with a circumferential groove or recess 37 therein adapted to receive the end of pin 35 to lock the movable indicator rod in a fixed position when it moves to its signalling position above the piston housing when the filter element becomes clogged with contaminants and requires servicing.

The thermostatic control device is inoperative when the engine with which the filter unit is used is started cold because the expansible liquid within the control device is fully contracted due to low temperatures, and the piston cage 32 is positioned as shown in FIG. 1, so that pin 35 cannot be locked in recess 37 and cannot affect the movement of indicator shaft 22. Thus, upon cold starting when the oil is viscous and causes a differential pressure to move shaft 22 to a signalling position, the pin locking device will not go into action and the shaft can return to its non-signalling position when the oil becomes heated to move from its false signalling position.

When the thermostatic control device is sufficiently heated by the filter unit housing becoming heated by oil passing therethrough, the thermostatic material expands and the piston cage 25 is moved to the right in the cylinder by the expansion of plug 28, thereby permitting the spring locking pin 35 to move to an operative position in contact with the side of shaft 22 thereadjacent. Thereafter, when the pressure differential in the filter element increases above a predetermined valve due to clogging of the filter element and causes rod 22 to move to its signalling position, the force in spring 32 will snap the pin into recess 37 of shaft 22 and permanently lock the signal device into its signalling position, indicating that the filter element needs servicing.

It is thus apparent that the present invention provides a thermally-controlled spring detent locking device for permanently locking a movable shaft after it has moved from its initial position to another position, which is of simple construction, and which is inoperative at low temperature and operable at higher temperature, to thereby thermally control the movement of the moving shaft.

Inasmuch as various changes may be made in the form, location and relative arrangement of the several parts without departing from the essential characteristics of the invention, it will be understood that the invention is not to be limited except by the scope of the appended claims.

What is claimed is:

1. An indicator device for use with a filter comprising a housing, a piston therein actuated by differential pressure across said filter exceeding a predetermined value to indicate a clogged filter, a signal rod movable with said piston to a signal position, biasing means normally maintaining the piston in a non-signalling position, said rod having a recess therein, pin means disposed to enter said recess to lock the rod in a signal position, and thermostatic control means operatively connected to said pin means to maintain said pin means in a non-operative position when the temperature is below a predetermined value and to maintain it engaged in said recess when the temperature is above a predetermined value, whereby said signal rod is locked in a signal position only when the differential pressure across the filter increases because of a clogged filter.

2. An indicator device for use with a filter comprising a housing, a differential pressure piston therein actuated in response to the differential pressure across the filter to indicate a clogged filter, a signal rod fixed to said piston for movement above the housing to a signal position, biasing means normally maintaining the piston in a non-signaling position, said rod having a recess therein, a locking pin adapted to enter said recess when said rod is in a signal position, a piston cage, said locking pin being slidably disposed in said cage, biasing means constantly urging said pin adjacent one end of said cage toward said rod, and temperature responsive means maintaining said piston cage away from said rod to hold said pin in a non-operative position when the temperature of said housing is below a predetermined value and urging said piston cage toward said rod to engage said pin in said recess when the temperature of said housing is above a predetermined value, whereby said signal rod is locked in a signal position only when the differential pressure across the filter increases because of a clogged filter.

3. An indicator device for use with a filter comprising a housing having a cylinder with a movable piston therein, passage means extending through said housing in communication with said cylinder, a signal rod disposed in said passage means and movable with said piston, said rod being adapted to move to a signal position and extend above the housing when the differential pressure across the piston exceeds a predetermined value, biasing means normally maintaining said piston in a non-signalling position, recess means in said rod, bore means in said housing communicating with said passage means, piston cage means slidable in said bore means, pin means carried by said cage means adapted to be engaged in said recess means to hold said signal rod in a signal position, biasing means urging said pin adjacent one end of said cage means toward said rod, and thermostatic control means engaging said piston cage means for maintaining said piston cage away from said rod to hold said pin means in a non-operative position when the temperature of the housing is below a predetermined value, and to hold said cage means adjacent one end of said bore means so said pin means are held in said recess means when the temperature of the housing exceeds a predetermined value, whereby said signal rod is locked in a signal position only when the differential pressure across the filter increases because of a clogged filter.

4. The indicator device of claim 1 wherein said differential pressure piston is disposed for vertical movement and said locking pin is positioned for horizontal movement.

5. The indicator device of claim 1 wherein said thermostatic control means maintain said pin means in a non-operative position in the temperature range of 10 to 50° F.

6. A locking device for use with a movable rod comprising a housing, a reciprocating piston disposed therein movable by differential pressure exceeding a predetermined value thereacross, a signal rod secured to said piston for movement above the housing to an exposed position, said rod having a recess therein, biasing means normally maintaining said piston for moving and maintaining said rod in a non-exposed position, a locking pin disposed normal to said rod for engagement in said recess to lock said shaft in an exposed position when the differential pressure across the piston and the temperature of the housing exceed a predetermined value, and temperature responsive means maintaining said pin in a non-operative position when the temperature is below a predetermined value and for moving said pin into an operative position to engage in said recess when the temperature exceeds a predetermined value.

7. The locking device of claim 6 wherein said temperature responsive means includes a slidable piston cage, said

pin is disposed in said cage, and biasing means maintaining said pin adjacent one end thereof.

8. The locking device of claim 6 wherein said temperature responsive means includes an expansible member having an expansible medium therein operatively connected to said pin to move it toward said rod when the temperature exceeds a predetermined value, and to move it away from said rod when the temperature decreases below said predetermined value.

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