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INDICATOR DEVICE FOR CONTROLLING THE PERIOD OF OPERATION OF ENGINES

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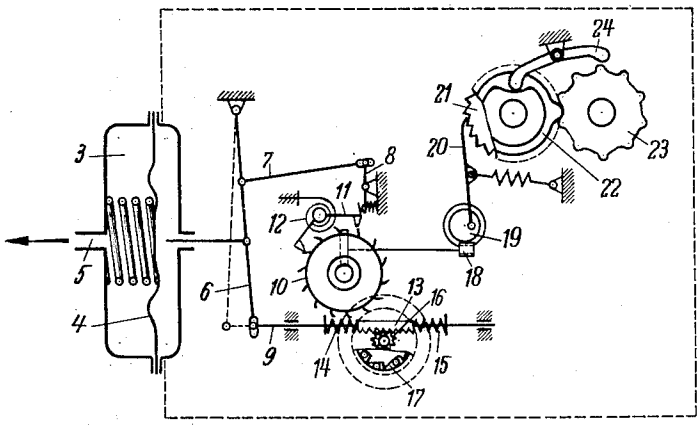


Fig. 1

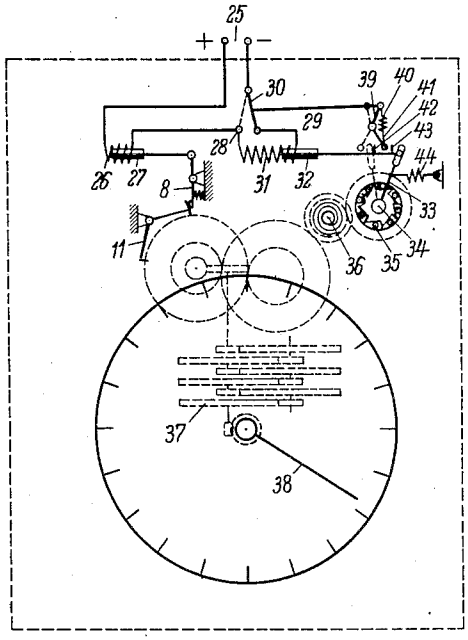


Fig. 2

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INDICATOR DEVICE FOR CONTROLLING THE PERIOD OF OPERATION OF ENGINES

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This invention relates to elapsed time indicating devices and particularly to such devices for registering and accumulating the time of operation of engines, particularly internal combustion engines.

The invention relates to such an indicator device, which is distinguished by simplicity in operation, and by accuracy and reliability, and which does not require special attendance. Through the invention above all the possibility is given to diminish the wear and tear on the engine and to increase its life by assuring overhaul, oil replacement, etc., in good time.

In accordance with the invention, it is an important characteristic of the invention that the starting and stopping of the counter is done automatically by the engine. Furthermore, also the winding of the clockwork takes place automatically, so that an incorrect indication as a consequence of forgetfulness in winding is prevented. The power required for the starting and stopping or the winding is created by the engine itself or made effective in dependence upon the operation of same.

Pneumatic or hydraulic auxiliary power can be utilized herefor, for example the vacuum in the intake conduit of the engine, the lubricating oil pressure, the cooling water pressure or the like, an electric or electro-magnetic auxiliary power, for example the current delivered by a generator or the ignition current of an engine working with ignition from other sources or another auxiliary power.

The invention is not restricted to engines in the narrow sense, but it can also be utilized with other machines or devices.

Further characteristics and details of the invention are to be taken from the following description of several examples of construction, taken in connection with the attached drawings; wherein

Figure 1 illustrates diagrammatically a device operated by the vacuum of the engine; and

Figure 2 illustrates diagrammatically such a device operated by an electric current for winding as well as for starting or stopping a counter clockwork controlling the period of operation.

In accordance with Figure 1, the container 3 is provided with the membrane 4 (or a cylinder and piston) constituting a pressure responsive device which is connected with a pipe 5 which leads to the intake pipe of an engine (not shown) (for example, between the throttle valve and the engine itself). The membrane 4 has connected thereto a lever 6 which operates a stop,

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for example, a brake or cut-off lever 8, over a system of rods 7, and also operates the winding mechanism of the clockwork. The brake or cut-off lever 8 acts hereby upon any suitable part of the clockwork, for example on the anchor 11 of the escapement working together with the escapement wheel 10 of the balance wheel (not shown), which is under the effect of the spring 12.

On the rod 9 which operates the winding mechanism of the clockwork, provision is made for a rack 13, which is coupled with the rod 9 by springs 14 and 15, and in its motion to and fro drives a pinion 16 in one or the other direction of rotation. The latter is in suitable drive connection with the winding shaft which winds the spring for the escapement wheel 10 over a one way drive connection 17.

The counter itself is, in known manner, driven in any suitable manner by the clockwork. In the example of construction in accordance with Figure 1, this is, for example, effected by means of a pawl and ratchet 20, 21, driven by a worm gear 18 and a crank 19, which drives the individual pinions for the reading of the operating hours. In the drawing, the transmission from one counter wheel to the following is by means of a pair of cam or toothed wheels 22, 23, working together in intermittent manner (preferably with a stop lever 24 for holding the toothed wheel 25 during its rest periods), is indicated diagrammatically.

The operation in accordance with Figure 1 is as follows:

Upon starting the engine (for example, a carburetor, Diesel or other engine), a vacuum is created in the intake pipe thereof which continues during operation of the engine but fluctuates in amplitude periodically or irregularly during the operation.

The membrane 4 is hereby strained to the left (possibly against the action of a spring), which effects oscillation of the lever 6 in corresponding direction. Hereby the brake or cut-off lever 8 is swung from its full line position, releasing the clockwork for operation. Simultaneously the rod 9 is moved to the left taking with it the rack 13, provided that the spring of the clockwork is entirely or partially slack. As a result of the movement of the rack 13 to the left, the pinion 16 is taken with it in a counter-clockwise direction and thereby winds up the clockwork over the freewheel 17. If the vacuum slackens in the membrane box 3, the rack 13 can return to the right under the effect of the spring 14 and the pinion 16 rotates clockwise, while the

shaft of the clockwork spring is held in the position to which it was wound previously by means of an appropriate holding dog (not shown). When the engine is started and the membrane 4 is strained while the spring of the clockwork is at full tension, the movement of the rod 9 to the left will only effect a compression of the spring 15 without the rack 13 being taken with it. The springs 14 and 15 thus act to prevent over-winding of the clockwork spring.

When the engine is stopped, the vacuum disappears and the brake or cut-off lever 8 returns to a position to stop the clockwork. If desired, a special friction brake, acting on one shaft of the clockwork, can be used for the starting and stopping of the clockwork.

In the example of construction in accordance with Figure 2, the terminals 25 serve for connection with a circuit of the engine to be controlled, which is only energized during the period of operation of the engine, for example, the circuit of a generator, the ignition circuit or the circuit of another electric aggregate suitable for this purpose. The current is at first conducted from the left terminal to a coil 26 which adjusts the solenoid armature 27 to the left, as soon as the coil 26 is energized. From the coil 26 the circuit leads to the contact 28 of a contact pair 28, 29, one of which in turn is in connection with the right terminal by means of a change-over switch arm 30. Between the contacts 28 and 29 a second coil 31 is inserted which, when energized, moves the solenoid armature 32 to the left. The armature 27 acts on the brake or cut-off lever 8 which in turn acts on the clockwork part 11, whereas the armature 32 swings a winding up lever 33, which, for example, by means of the shaft 34 and a one way clutch 35 or the like, drives the spring arbor 36 of the clockwork spring. The elapsed time indicating hand 38 is operated by the clockwork through appropriate reduction gearing 37. The change-over switch arm 30 is furthermore connected, through the link shown, with a lever 39 which is coupled by a tension spring 40 with a second lever 41 which is located on the same rotation axis in such a manner that the two levers draw each other to their final positions by the strain of the spring 40.

In the drawing the extreme right positions of the switch 30 and of the levers 39 and 41 are shown in full, while the extreme left positions are shown in dotted lines. The lever 41 is operated by projections 42 and 43 which are located on the rod which is connected to the solenoid armature 32 and take with them the lever 41 in accordance with the motion of the rod and swing it thereby into one or the other extreme position. A spring 44 draws the winding lever 33 toward its extreme right position as soon as it is released by the solenoid coil 31.

The manner of operation is the following:

The device may be in the position shown in Figure 2, i. e., the change-over switch 30 engages the contact 29. Consequently the coil 31 is included in the circuit. If now at the start of the engine current is delivered to the circuit, both the coil 26 and the coil 31 are energized. This causes the brake lever 8 to be removed from the anchor 11 of the escapement and thereby allows the clockwork to operate. At the same time the coil 31 tends to swing the lever 33 to the left. But this can only be done to the extent that the spring of the clockwork is slackened or subsequently slackens. The lever 33 is therefore slowly

moved leftward in accordance with the running down of the clockwork whereby the spring of the clockwork remains permanently at full strain. If the engine is stopped during the leftward movement of the lever 33 before the lever 41 is taken so far that the spring 40 has passed the dead center position of the two levers 39, 41, the spring 44 pulls the winding lever 33 back in its extreme right position; the return movement of the lever 33 is made possible by the one way clutch 35 while the spring of the clockwork remains under strain by means of an appropriate holding pawl (not shown). Upon interruption of the current upon stopping of the engine, the solenoid armature 27 is simultaneously released and thereby the further operation of the clockwork is prevented by the stop lever 8. When the current is switched on again, the winding-up procedure and the further operation of the clockwork can then start anew.

If the engine operates for a considerable period of time so that the lever 41 is so far moved leftward by the stop 43 that the spring 40 passes the dead center of the two levers 39, 41, then the spring 40 snaps the lever 39 and simultaneously the change-over switch 30 leftward into the dotted line position, whereby the switch 30 changes to the contact 28 and switches off the current for the coil 31. The lever 33 is then immediately swung to its extreme right final position by the spring 44, the action of which is stronger than the opposite effect of the spring 41, whereby the action described above is repeated.

As an elapsed time indicating device, in each case one or several dials can be used with one or several hands each as is common in gas meters or a counter with indication of figures or a dial with additional indication of figures.

The number of the hours to be indicated depends upon the purpose of utilization in each case. Thus, for example, provision can be made by the counter for indication of 100, 1000 or several thousands of hours. Furthermore, instead of a direct indication of time, provision can be made for an indication of the total revolutions of a shaft of the engine or the like, whereby the indication is then purposefully carried out in the manner that one scale line of the dial such as the last figure of the counter indicate 100 or 1000 or several thousand revolutions.

Instead of the drive by an auxiliary power in any case, in particular in the latter case of indication of numbers of revolution also a mechanical drive from the working engine or from the chassis of the vehicle can be utilized, whereby the drive is executed directly with appropriate transmission or, for example, in such a manner that the spring of the clockwork is wound up over a cam rib and the stoppage is released over a friction clutch. Also in other cases, for example, when an auxiliary power is utilized, provision can be made for appropriate winding devices. Furthermore, the winding can also be effected, for example, by mass action of weights or of other parts, which are moved by the vibrations of the running engine or of the running vehicle.

By means of the invention the period of operation can currently be exactly registered and controlled so that proper maintenance is assured. Eventually interference from the part of the operating personnel can be additionally excluded by sealing the mechanism.

I claim:

1. A device for indicating the elapsed time of operation of engines, comprising a counting

mechanism, a winding device for the latter, a device for starting and stopping the counting mechanism, an auxiliary force device acting in dependence on the period of operation of the engine, a movable member operated by said auxiliary force device, means connecting the winding device with said movable member, and means by which the device for the starting and stopping of the counting mechanism is connected to said movable member.

2. A device according to claim 1, in which the winding device comprises a one way drive coupling, a reciprocating member acting on said coupling in such a manner that upon the motion of the latter under the action of the auxiliary force in one direction, the clock mechanism is wound by the operation of the coupling, while the coupling idles upon motion in the other direction, and in connection with which furthermore the device for the starting and stopping comprises a locking member acting on the clock mechanism in such a manner that it releases the clock mechanism when the auxiliary force is in action and blocks the clock mechanism when the auxiliary force is not acting.

3. A device for indicating the elapsed time of operation of engines, comprising a counting mechanism, a winding device for the latter, a device for starting and stopping the counting mechanism, an electric circuit energized in dependence on the operation of the engine, in such a manner that the device for the stopping of the counting mechanism is released when the circuit is energized and is brought into locked position when the circuit is not energized, and further means associated with the circuit by which the winding device is actuated in the direction of winding as long as the circuit is energized.

4. A device according to claim 3 in which the winding device comprises a one way drive coupling, a member setting said coupling, which member upon motion in one direction engages the coupling and thus effects the winding, while in the other direction of motion the coupling is released, and in which furthermore the means for actuating this device comprise a switching mechanism so that the said setting member is moved in the direction of winding to a limiting position, thereupon released and reset, and then again set in the winding direction.

5. A device for indicating the elapsed time of operation of an engine comprising a spring actuated clock work including a spring arbor, a counter adapted to be driven by said clock work, disabling means associated with said clock work and adapted to disable the same, a mechanism coordinated to the engine and adapted to be energized by the latter while the same is running, a winding device adapted to operate said spring arbor and to be actuated by said mechanism, and means connecting said mechanism to said disabling means causing the latter to disable said clock work while said mechanism is de-energized.

6. A device for indicating the elapsed time of operation of an engine comprising a spring actuated clock work including a spring arbor, a counter adapted to be driven by said clock work, disabling means associated with said clock work and adapted to disable same, an electromagnetic mechanism coordinated to the engine and adapted to be energized by the latter while the same is running, a winding device adapted to operate said spring arbor and to be actuated by said electromagnetic mechanism, and means connecting said electromagnetic mechanism to said disabling means causing the latter to disable said clock work while said electromagnetic mechanism is de-energized.

7. The combination claimed in claim 6 in which said electromagnetic mechanism includes two solenoids having a common circuit.

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