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ALARM APPARATUS.

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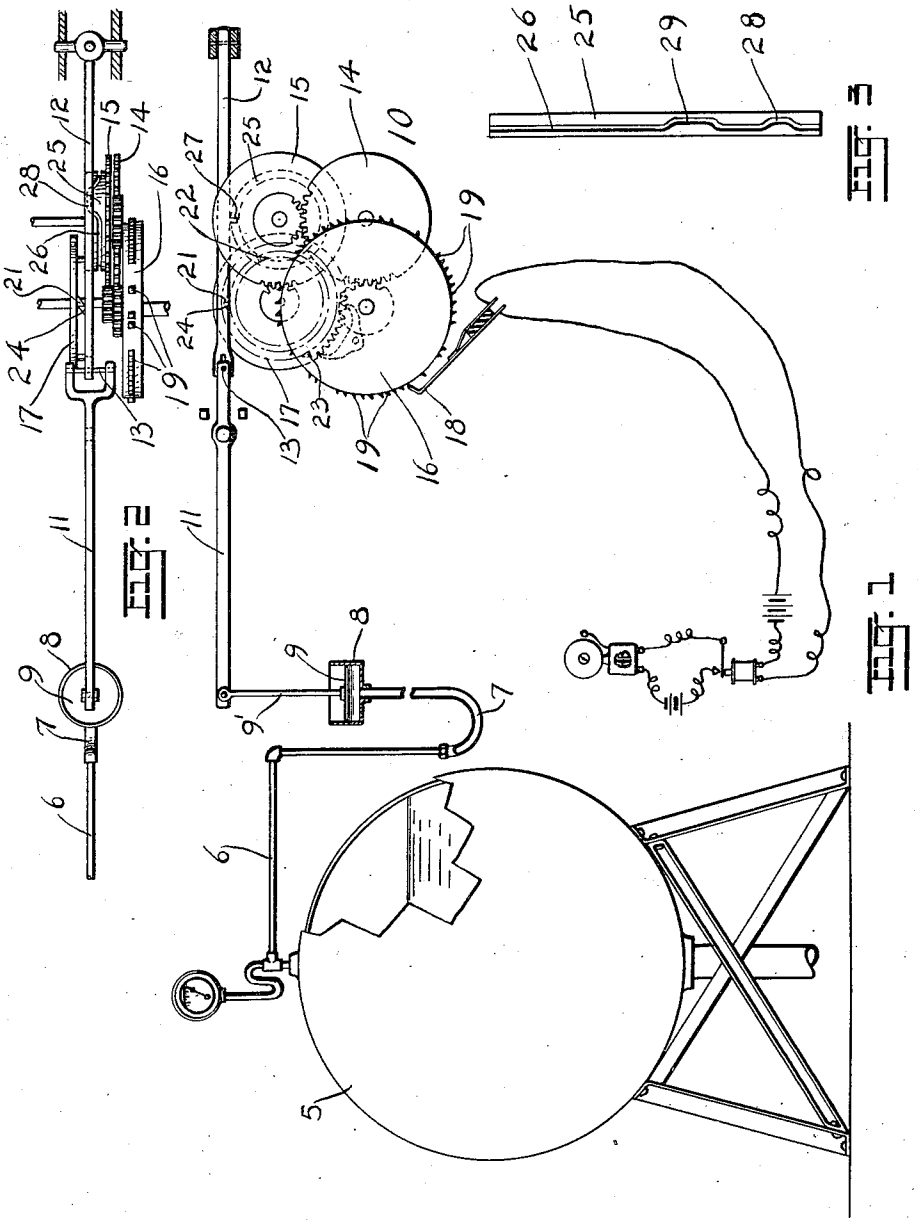

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ALARM APPARATUS.

1,022,497. Specification of Letters Patent. Patented Apr. 9, 1912.

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To all whom it may concern:

Be it known that we, JAMES D. NELSON and EDWARD F. SMITH, citizens of the United States of America, and residents of Cincinnati, Hamilton county, State of Ohio, have invented certain new and useful Alarm Apparatus, of which the following is a specification.

This invention relates to alarm apparatus and has for an object to produce a mechanically actuated alarm device for automatically giving distinguishable signals for the purpose of indicating variations, in the conditions of an apparatus to which it is applied.

While our invention is applicable to various apparatus in which it is essential to notify an observer of either a pressure, temperature or other change, it is particularly applicable to pressure distributing systems for automatic fire extinguishing sprinklers. In such a system it is necessary to maintain a definite pressure in the pressure tank of the system, and it is essential that variations from this pressure should be immediately brought to the attention of an observer. In addition to this, it is essential that the observer know whether the pressure in the tank has increased above or fallen below normal, and also that it is returned to normal after an abnormal condition has existed.

A further object, therefore, of our invention is to produce an alarm device, which will operate automatically to indicate varying conditions in, for example, a pressure tank, and which will give distinguishable signals to indicate a rise or fall in pressure, and a return from abnormal to normal pressure.

In the drawings accompanying this application, we have illustrated an embodiment of our invention, in connection with a pressure tank of a sprinkler system, but we desire it to be understood that we do not limit ourselves to the details of construction illustrated, nor to the application of our invention to pressure tanks.

In the drawings, Figure 1 is a side elevation of a pressure tank, in connection with a diagrammatic illustration of an alarm device embodying our invention. Fig. 2 is a plan view of the alarm device illustrated in Fig. 1. Fig. 3 is a developed peripheral view of a cam, which forms a detail of the illustrated apparatus.

The device shown as embodying our invention is in operative connection with a pressure tank 5, and is so constructed that it will automatically send distinguishable telegraphic alarm signals when the pressure in the tank rises above or falls below the normal pressure, and send an O. K. or all right signal when the pressure conditions are changed from abnormal back to normal.

The tank 5 communicates through piping 6 with a pressure responsive agent, such as a mercury column. The mercury column is contained in a U-tube 7, one end of which communicates with the piping 6, and the other end with a mercury receptacle 8, in which a float 9 is located. The height of the mercury in the receptacle 8 varies in response to variations of pressure within the tank 5 and the float is moved up and down, in response to the fluctuations of the mercury column.

The float is adapted to operate an automatic signaling device 10, and is secured to the long arm of a lever 11, by means of a link 9′. The short arm of the lever is bifurcated to receive a pin 13, which is located between the forks of the bifurcated end of a cam-controlled lever 12. The automatic signaling device includes a spring-actuated driving wheel 14, a distinguishing wheel 15, a signaling wheel 16, and an escapement wheel 17, and a sending pen 18, which contacts with the signaling wheel 16 and is actuated by it to send telegraphic signals to indicate changes in the pressure conditions of the tank.

The device illustrated is adapted to repeat the signal "1—2—9" as an alarm signal, to indicate a fall in pressure in the tank 5, to repeat the signal "1—2—9," and in addition to add "4" as an alarm, to indicate a rise in pressure in the tank, and to give the single signal "1—2—9" to indicate a return from abnormal to normal conditions. The signals are a matter of discretion, as the apparatus may be designed to send any alarm and O. K. signals. The signaling wheel 16 is provided on its periphery with lugs 19, which are adapted to contact with the sending finger 18, as the wheel revolves. These lugs are so arranged that a single signal "1—2—9" will be given by the de-

vice, while the wheel 16 is revolving through one-third of a revolution, and the signal "1—2—9" will be repeated and an additional signal "4" added, while the wheel is turning through the remaining two-thirds of a revolution. With this arrangement it is necessary to provide means for causing the wheel 16 to turn through two-thirds of a revolution, when the conditions in the tank 5 have changed from normal to abnormal, and to turn through one-third of a revolution when the conditions have changed from abnormal to normal. In addition to this, it is necessary to provide means for causing the device to distinguish between the high and low pressure alarms. This is accomplished as follows: The escapement wheel 17 is provided with three stops 21, 22 and 23, one or the other of which, under certain conditions, is adapted to contact with a stop 24 provided on the lever 12, and maintain the alarm device inoperative. The lever 12 is moved by the float 9, through the agency of the lever 11, to release one or the other of the stops, 21, 22 or 23, from the stop 24, and is also shifted to an outward or inoperative position by means of a cam 25, carried on the wheel 15, to hold the stop 24 out of the path of the stops carried by the wheel 17, while the alarm device is operating to send in either an alarm or O. K. signal. The cam 25 is provided with a groove 26, into which a pin or lug 27 on the lever 12 projects, and which is so arranged that the lever 12 will be shifted outwardly, while the pin 27 is in engagement with it. Offsets 28 and 29 are provided on the cam and connect with the groove 26, so that the stop 24 is moved back into the path of the stops on the wheel 17 twice during one revolution of the cam 25, and, consequently, of the wheel 15.

The stops carried by the wheel 17 are located at different distances from the center of the wheel; the stop 21 being located in an intermediate position; the stop 22 being closest to the center and the stop 24 farthest from the center of the wheel. During the normal pressure conditions in the tank 5, the mercury in the receptacle 8 is maintained at a normal level and the float 9, through the agency of the lever 11, holds the lever 12 in such a position, that the stop 24 will contact with the stop 21, when the stop 21 is in the normal position and the lever 12 is moved to the operative or inner position by the cam 25.

A variation in the pressure within the tank 5 will cause a variation in the level of the mercury in the receptacle 8, and will either raise or lower the float 9. This motion of the float will release the stop 21, by moving the stop 24 out of engagement with it, and thereby permit the alarm device or clock mechanism 10 to operate. As soon as the stop 21 is released, the wheel 15, with the other wheels of the device, start to revolve, and the pin 27, is moved out of the offset 28, into the groove 26 of the cam 25. This shifts the lever 12 to the outward position, so that the stop 24 moves out of the path of the stops on the wheel 17, and the wheel 17 revolves freely, while the device 10 is sending in the alarm signal. Since the signal wheel 16 must turn through approximately two-thirds of a revolution to send in an alarm signal, the gears 16 and 15 are geared in the same ratio to the gear 14, and the offset 29 in the groove 26 is located 240 degrees or two-thirds of a circumference around the cam from the offset 28.

If a fall in pressure occurs in the tank 5, the mercury in the column will drop, thus causing the float 9, through the agency of the levers 11 and 12 to raise the stop 24 and release the stop 21. The device will then operate until the lever 12 is again shifted to its normal position by the pin 27, entering the offset 29, and until the stop 23 on the wheel contacts with the stop 24 on the lever. Since a fall in pressure is indicated by a repetition of the signal "1—2—9", the stop 23 must be so located on the wheel, that it will contact with the stop 24, prior to the time that the additional signal "4" is given by the device. In other words the stop 23 must be so located, that it will engage the stop 24 and stop the device immediately after the finger 18 has been engaged by the second set of lugs arranged to give the alarm signal "1—2—9", and prior to the time that the lugs arranged to give the signal "4" contact with the finger.

If the abnormal condition in the tank 5 results from an increase in pressure above the normal, then the lever 12 will be depressed by the lever 11 and the float 9, and held in such a position that the stop 24 will contact with the stop 22, when the lever is shifted to its normal position. The stop 22 must be located in such a position that it will permit the wheel 16 to turn far enough, after the lever 12 is moved to the normal position by the cam 25, to permit the alarm mechanism to send the signal "4", and the offset 29 must be so long that the lever 12 will not be moved to the outward position, before the stop 22 contacts with the stop 24. With such an arrangement, a rise in pressure in the tank 5, will cause the device to give a distinct alarm signal consisting of "1—2—9"----"1—2—9"----"4".

After an alarm signal has been sent in, the alarm device will remain inoperative until the pressure in the tank is either increased or decreased to return it to normal. This change in the pressure condition will actuate the float 9, so that it will again release the alarm device, and the cam 25 will operate to move the stop 24 out of the path

of the stops on the wheel 17, while the wheel 16 turns through the remainder of a revolution and the O. K. signal is being transmitted. During this operation, the wheel 16 turns through approximately one-third of a revolution, and, consequently, the wheel 15 and the cam 25 turn through one-third of a revolution, which brings the lug 27 of the lever 12 again into engagement with the offset 28, and shifts the lever to its normal position. While in the normal position, the stop 24 stops the device by contacting with the stop 21. If the previous alarm signal indicated a fall in pressure in the tank 5, then the O. K. signal will be preceded by the signal "4", since the four lugs on the wheel 16, adapted to give that signal, must pass under the pen 18, prior to the passing of the lugs adapted to give the O. K. signal. If, however, the previous alarm signal indicated a rise in pressure, then the additional "4" signal will not be given prior to the O. K. signal. The escapement wheel 17 is illustrated as driven by the wheel 15. Any ratio of gearing may be employed, so long as the stops 21, 22 and 23 are so located that they will engage the stop 24 at the proper time. The location of the stops is merely a matter of design and can be determined after the ratio of the gear 17 to its driving wheel is determined.

We find it preferable to so proportion the dimensions of the U-tube 7 and the mercury receptacle 8 and to so adjust the mechanical mechanisms operated by the float 9, that the alarm device 10 will be released by a variation of 10 per cent. either above or below the normal pressure. By proportioning the size of the receptacle 8 to the cross-sectional area of the tube 7, we are enabled to reduce the effect of the fluctuations of the mercury column on the float 9, so that the float moves a relatively small amount for a comparatively large variation in the length of the mercury column. In order to make the float action more uniform and steady we preferably weigh it to the extent of about one-half pound, and then proportion the length of the power arm of the lever, so that the available energy is capable of releasing the alarm device and performing the necessary function. The sending finger 18 may be included in any well known signaling mechanism, such as the ordinary fire alarm or district telegraph systems. In the mechanism illustrated, the finger 18 is included in a relay circuit, the relay of which operates the signaling device.

One of the principal features of our invention is that the alarm device, or clock work mechanism 10 is controlled without the intervention of electrical, or electro-magnetic apparatus. With our device the alarm is controlled by mechanical means, which is directly actuated by the pressure responsive agent, that is, by the mercury column, and the float 9. Such an arrangement eliminates the difficulties ordinarily encountered with the batteries and battery circuits when electro-magnetic or other electrical relays are employed between the pressure-responsive agent, and the alarm device, and moreover, renders the apparatus more positive and reliable in operation.

What we claim is:

1. The combination of a pressure tank, an electrical circuit, a circuit breaker in said circuit, a signaling device adapted variably to actuate the circuit breaker to indicate the various conditions in the pressure tank, a mechanical means for locking and for releasing the signaling device, an agent responsive to the pressures in the pressure tank, and mechanical connections between the agent and said mechanical means.

2. The combination of an apparatus subject to varying conditions to be observed, an alarm device comprising an electrical mechanism for transmitting telegraph signals, a spring actuated device for operating said mechanism and capable of giving distinguishable signals, an agent responsive to variations in the apparatus to be observed, mechanical means actuated by said agent, for controlling the operation of said device, and a cam operating in conjunction with said agent in actuating said mechanical means, whereby said device is caused to give distinguishable signals.

3. The combination of an apparatus subject to varying conditions to be observed, an alarm device comprising an electrical mechanism for transmitting telegraph signals, a spring actuated device comprising a driving wheel, an escapement wheel provided with stops, a signal wheel for operating said electrical mechanism, an agent responsive to pressure variations in the apparatus to be observed, means actuated by said agent for moving into and out of engagement with the stops of said escapement wheel to control the operation of said device, and a cam actuated by said driving wheel and operating in conjunction with said agent for controlling the operation of said means, whereby said device is caused to send either alarm or signals indicating normal conditions, in response to pressure variations in the apparatus to be observed.

4. In combination with a pressure tank, a mercury column communicating therewith and adapted to fluctuate in response to variations of pressure in said tank, a mercury receptacle connecting with said column, a float located within said receptacle and controlled by the fluctuations of said column, an alarm device, and means for controlling the operation of said device comprising a lever actuated by said float, a cam-actuated

lever secured thereto and actuated thereby, and a cam for controlling the operation of said cam-actuated lever.

5. The combination of an apparatus to be observed, an alarm device, an agent responsive to variations of conditions in said apparatus, a lever actuated by said agent for controlling the operation of said alarm device, and a cam for shifting said lever, whereby said device is caused to give distinguishable signals.

6. The combination of a pressure tank, an alarm device, an agent responsive to variations of pressure within said tank, mechanical means actuated by said agent for releasing said alarm, and means operating in conjunction with said mechanical means for causing said alarm device to give distinguishable signals to indicate an increase or decrease in pressure within said tank, and a return from an abnormal to a normal pressure.

7. The combination of a pressure tank, an alarm device, an agent responsive to varying conditions in said tank, a mechanism actuated thereby for releasing said alarm device, and means operating in conjunction with said mechanism for causing said alarm device to give distinguishable signals to indicate an increase or decrease in pressure within said tank, and a return from an abnormal to a normal pressure.

8. The combination of an apparatus to be observed, an alarm device, an agent responsive to varying conditions in said apparatus, a mechanism actuated by said agent for releasing said alarm device, and means operating in conjunction with said mechanism for causing said alarm device to give three distinguishable signals to indicate various conditions in said apparatus.

9. The combination of an apparatus to be observed, an agent responsive to varying conditions in said apparatus, an alarm device, comprising a clock mechanism provided with an escapement wheel, stops located on said wheel, a stop for engaging one or another of the stops on said wheel, mechanical means operated by said agent for actuating said stop, and means operating in conjunction with said mechanical means for causing said alarm device to give three distinguishable signals to indicate various conditions in said apparatus.

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