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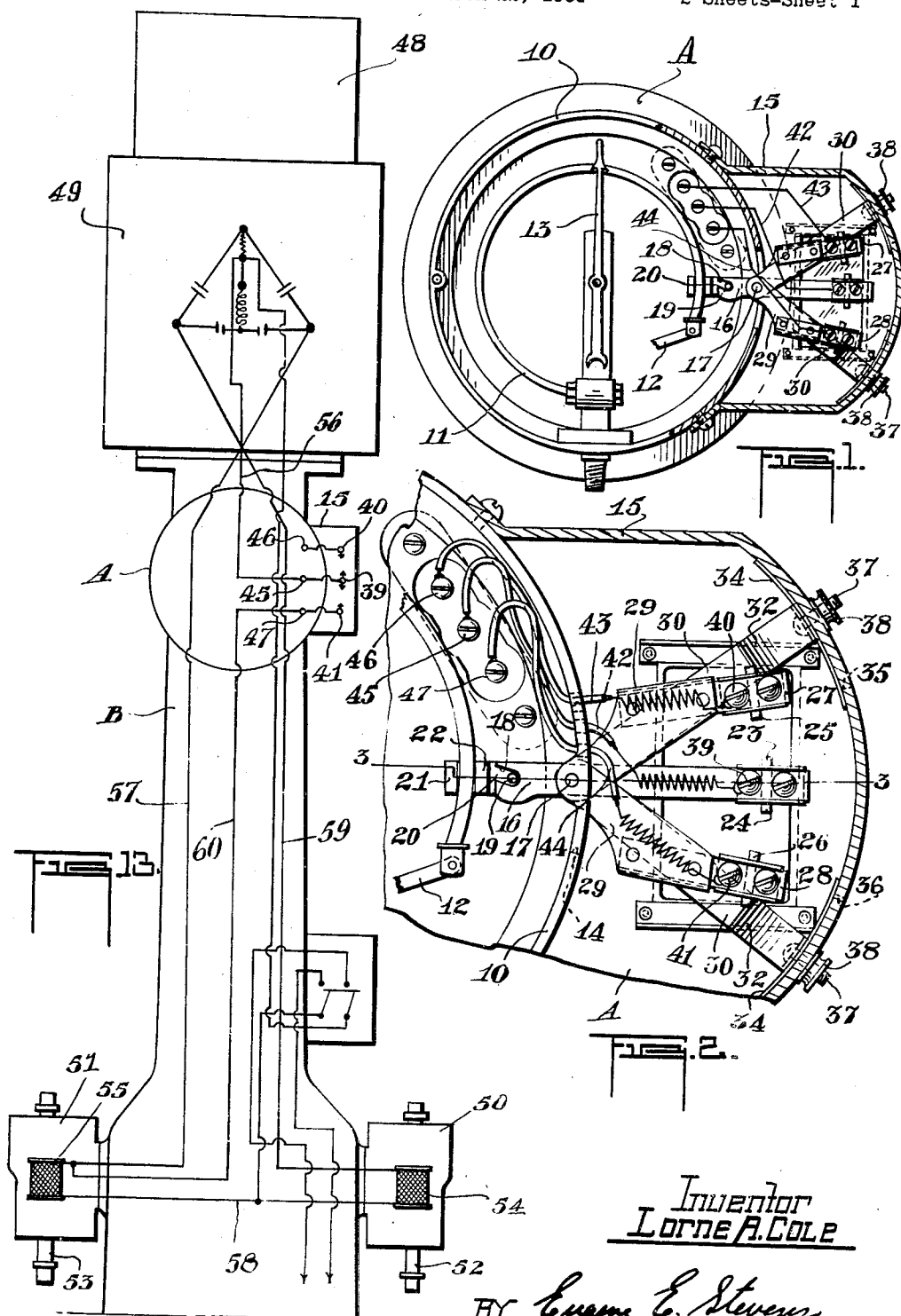
L. A. COLE

2,211,052

PRESSURE LIMITING DEVICE

Filed March 22, 1938

2 Sheets-Sheet 1



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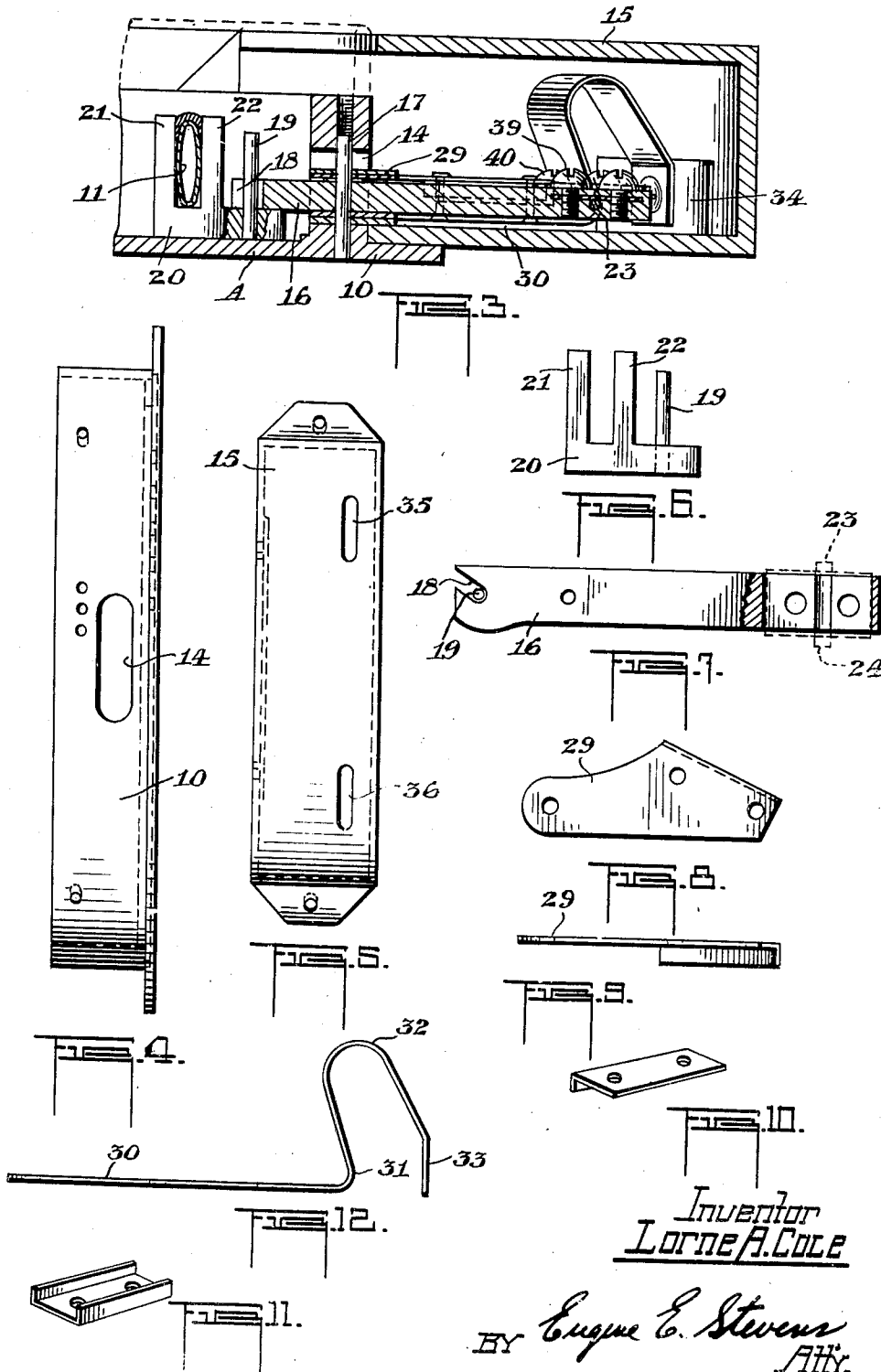
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UNITED STATES PATENT OFFICE

2,211,052

PRESSURE LIMITING DEVICE

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Application March 22, 1938, Serial No. 197,535

3 Claims. (Cl. 200—56)

This invention relates to a pressure limiting or pressure control device.

Throughout the various industries, pressure systems and pressure devices are employed, operated hydraulically and pneumatically, and in many cases there is danger of the creation of excess pressure, and likewise pressure drops which are disadvantageous, particularly excess pressures where as a result, breakage of machine parts and improper operation of the machinery may result.

The present invention is designed to obviate disadvantages of this character by providing a simplified form of pressure limiting or control device which will give a warning signal when the pressure tends to rise above or drop below a given range and may also function to prevent the application of excess pressure and prevent a drop in pressure below a given point.

The invention will be fully apparent through the following specification and accompanying drawings, the novel pressure limiting apparatus being described by way of example as applied to control hydraulically operated wood pulp grinders and employed as part of the controlling mechanism of a governor for wood pulp grinders.

Referring to the drawings:

Figure 1 is a front elevation of the pressure limiting apparatus, partly in section, which is combined with a pressure gauge of the Bourdon type, the front face of the gauge and the associated apparatus being removed to show the working parts of the device.

Figure 2 is an enlarged fragmentary sectional view of the working parts of the apparatus.

Figure 3 is a section taken on the line 3—3 of Fig. 2.

Figure 4 is a side elevation of the pressure gauge casing showing the opening through which the working parts connect with the Bourdon tube.

Figure 5 is a side elevation of the casing for connecting with the pressure gauge casing and enclosing the apparatus, illustrating the slots through which the stationary contacts may be adjusted from one position to another.

Figure 6 is a side elevation of the connecting link for connecting the working parts with the Bourdon tube.

Figure 7 is a plan view of the movable contact arm, the end of the arm carrying the contact being shown partly in section.

Figure 8 is a plan view of one of the connecting links for holding one of the stationary contact arms.

Figure 9 is a side elevation of the link shown in Figure 8.

Figure 10 is a perspective view of an angle plate used on the stationary contact arms.

Figure 11 is a perspective view of a channel plate used in the contact portion of the contact arms.

Figure 12 is a side elevation of an adjusting bracket used in conjunction with the stationary contact arms, and

Figure 13 is a schematic view of a governor construction for pulp grinders showing the position of the pressure limiter and its connection with the pilot valves for controlling the flow of pressure medium.

Referring to the drawings, A indicates the pressure limiting or control device generally, which include a gauge casing 10 housing a Bourdon tube 11 designed to operate through the usual link 12 and other associated mechanism, the pressure indicating needle 13 of the gauge. The gauge as a whole may be of conventional construction.

According to the preferred form of construction the gauge casing is orificed as at 14 to permit additional parts to project into the interior of the gauge casing, while an auxiliary casing 15 is secured on the outside of the gauge casing to enclose the additional parts. In this instance a swingable arm 16 of insulating material is pivoted on the gauge casing as at 17, the inner end of the arm being slotted as at 18 to receive a pin 19 projecting from an operating member 20 which is designed to be rigidly attached to one end of the tube 11. The operating member 20 is shown in detail in Figure 6 and it may include a pair of spaced apart arms 21 and 22 between which the tube 11 is disposed and a rigid connection may be made by soldering the arms to the tube.

The opposite end of the swingable arm 16 projects into the auxiliary casing 15 and is provided with opposed contacts 23 and 24 which project on each side of the arm. These are designed to cooperate with contacts 25 and 26 disposed in the ends of adjustable arms 27 and 28 which have the same pivot point 17 as the swingable arm 16 and are formed from insulating material. The arms 27 and 28 are pivoted on the pivot 17 by means of metal plates 29 (see Figs. 8 and 9) which are secured to one side of the arms, while on the opposite side are disposed metal plates 30, the inner ends of the plates 29 and 30 being spaced apart the depth of the arms 27 and 28 to provide in effect a bifurcated metallic fitting which will straddle the swingable arm 16 at the pivotal point.

The outer ends of the plates 30 form adjusting levers for the arms 27 and 28 and are bent upon

themselves as at 31 and 32 to provide a resilient projection having a flat bearing surface 33 which will engage with slotted plates or the like 34 disposed on the interior curved wall of the auxiliary housing 15 and positioned below slots 35 and 36 formed in the curved wall of the auxiliary housing. Bolts or screw threaded pins or other means 37 may project through the end of the adjusting levers and through the slots 35 and 36 respectively in the auxiliary housing 15 to be engaged by the knurled nuts or the like 38 which will hold the adjusting levers in a set position, whereas, upon loosening the nuts the adjusting levers may be moved backward or forward to move the arms 27 and 28 towards or away from the swingable arm 16 to the extent of the length of the slots 35 and 36 in the auxiliary housing 15.

The contacts 23 and 24 and 25 and 26 are connected with terminals 39, 40 and 41 respectively, each being disposed on the arm carrying the contacts in question and these terminals are suitably connected by lead wires 42, 43 and 44 with terminals 45, 46 and 47 within the gauge casing, the latter terminals being connected in the electrical system as will be later referred to, to provide for the proper operation of the pressure limiter.

It will be apparent that if the swingable arm 16 is swung about its pivot it will move its contacts 23 and 24 towards or away from the contacts 25 and 26 on the arms 27 and 28, according to the direction in which arm 16 is swung and it will also be apparent, in view of the connection between the swingable arm 16 and the operating member 20 carried on the Bourdon tube, that movement of the tube, as a result of increased or decreased pressure therein, caused by the pressure system to which it is attached, will have the result of operating the swingable arm 16 in a manner such as above described. Moreover, by reason of the fact that the slot 18 is inclined to the longitudinal axis of the arm 16 and longitudinal axis of the operating member 20, the arm 16 will be caused to swing with accuracy in response to movement of the tube 11 as the pin 19 of the operating member 20 will always contact with either of the side walls of the slot 18 during the arcuate movement of the tube 11 in one direction or the other.

It will be obvious of course, that if the contact 26 of the arm 28 is positioned a selected distance from the contact 24 of the swingable arm 16, the movement of the arm 16 towards the arm 28 by reason of the movement of the end of the Bourdon tube outwardly towards the auxiliary casing, owing to increase of pressure in the system, will finally cause the contact 24 to engage the contact 26 at the selected point which corresponds to the maximum pressure desired. Engagement between contacts 24 and 26 may cause a signal to be given that a given maximum pressure has been reached and/or cause operation of certain elements in the system to reduce the pressure. On the other hand, the contact 25 on arm 27 may be set in the same way and may be used, if desired, to cause a signal to be given when the pressure has dropped below a desired point and/or cause operation of certain elements in the system to increase the pressure. In some cases, however, the arm 27 may only be used to effect the required adjustment as between the arms 16 and 28, as will later appear.

In order to demonstrate a practical application of the pressure limiter, it has been shown diagrammatically in Figure 13 as applied to an elec-

trical governor for wood pulp grinders, which is one field in which it may operate advantageously. Referring particularly to Figure 13, B indicates the governor as a whole, which is provided with an indicating wattmeter 48 and a governing wattmeter of the Kelvin balance type 49 which is connected with the grinders to control their operation in response to the load on the motor operating them, as has been referred to in a co-pending application and of similar character to that disclosed in United States Patent No. 1,719,952.

The governor includes a main water valve for supplying hydraulic pressure for operating the pistons in the hydraulic cylinders of the grinders. This main water valve is opened and closed completely, or to varying degrees by means of two pilot valves 50 and 51, with pipe connections 52 and 53 for operating the main valve. The pilot valve 50 may be termed an increasing pilot valve operating to open the main valve by supplying sufficient pressure for this purpose and the pilot valve 51 may be termed a decreasing pilot valve for closing the main valve. These pilot valves are operated by solenoids 54 and 55, the operation of which is ordinarily effected through the governing wattmeter of the governor directly in accordance with the load requirements of the grinder motor so that by variation in the control pressure through the pilot valves 50 and 51, as they are selected by the governing wattmeter, the volume of water fed to the pulp grinders is directly controlled. However, conditions may arise which will not permit of smooth operation. For instance, if for any reason one or more of the pockets of the grinders stopped grinding, the load on the motor would drop and the wattmeter on the governor would signal for more load. Thus, through the pilot valve 50 the main water valve would be caused to open wide and place the entire pressure available on the stones all at once. This naturally is undesirable and might cause breakage. However, the pressure limiter as above described, functions to eliminate such possibility. For example, assume that normal grinding pressure is 125 pounds to maintain a load of 2,000 kilowatts on the motor and that 190 pounds pressure is available through the inlet to the main valve of the governor. Under such conditions, and in the case where one or more of the pulp grinder pockets stop grinding, the load might drop to, say, 1000 kilowatts which would result in the main valve being opened wide, as above referred to and the entire 190 pounds would be exerted upon the grinder stones. However, if the pressure limiter was set to say 175 pounds it would be impossible for the maximum load to be applied to the grinder, and impossible also for more than 175 pounds to be applied on the stones, because the limiter would function to open the decreasing pilot valve and thus oppose and overpower the increasing valves which is provided with a smaller orifice than the decreasing.

As shown in Figure 13 the terminal 45 for the swingable arm 16 is connected with the terminal 65 of the swinging contact of the wattmeter by the line 56. This mechanism through one stationary contact is ordinarily connected with the solenoid 55 by the lead 57, whereas the solenoid 55 is directly connected with the solenoid 54 by the line 58, and the latter solenoid in turn connected through the line 59 with the other stationary contact of the wattmeter so that one or the other of the pilot valves is operated in accordance with load requirements as transmitted through the bal-

ance mechanism. However, the terminal 47 of the swingable arm 28 is connected by the lead 60 with solenoid 55 so that in the event of contact between the contact 24 of the swingable arm 16 and contact 26 of arm 28, the solenoid 55 is operated so as to cause decreasing valve 51 to open when a pressure of 175 pounds has been reached in the system. Operation of the solenoid at this point is caused by initially separating arms 16 and 28 only to the extent which will permit contact when 175 pounds pressure has been reached in the system. At the same time, through a separate circuit, for example tapped in at the terminals 45 and 47, a warning light or signal light may be employed to advise the operator as to the conditions obtaining. Moreover, if it is desired to increase the pressure in the system when it has dropped below a minimum, the contact 46 may be connected with solenoid 54 of the increasing valve 50 so that it can be brought into operation when the swingable arm 16 causes contact 23 to engage contact 25 of adjustable arm 27.

To set the pressure limiter to operate at the desired maximum pressure, the knurled nut 38 associated with the arm 27 may be loosened so that the adjusting lever may be pulled downwardly until the needle of the gauge registers the correct maximum pressure desired. At this point the knurled nut 38 associated with arm 28 may be loosened and the adjusting lever for the latter moved upward until contact is made between contact 26 of arm 28 and contact 24 of swingable arm 16. The knurled nut or other means employed for fastening the adjusting lever of arm 28 is then tightened at this point and the upper adjusting lever is swung to its upper limit until it is out of the way. Arm 28 may be used as an adjusting means for arm 27 in the same way.

When using the pressure limiter to operate for the maximum pressure only, the upper adjusting lever and arm 27 are used merely for setting the limiter to operate at the desired pressure and these members are then moved to their extreme upper position out of operation. This is true for any grinder system or the like using two pressures and wherein a minimum pressure setting is not necessary. In the case of single pressure systems, as used on pocket grinders, the upper arm 27 and its contact 25, may be used to operate an additional increasing magnetic pilot valve to effect quicker opening movement of the main valve when a heavy volume of water is required to retire the pocket. In such a case this pilot valve comes into action when the pressure falls below a predetermined point which is governed by setting the top arm to the required minimum operating pressure.

The device, may of course, be employed to signal and/or correct abnormally low pressure conditions alone or abnormally high pressure conditions alone, or both.

While in the disclosure adjusting levers have been shown for effecting the adjustment of arms 27 and 28, it will be obvious that the arms themselves might be formed with extensions to project out to the inner surface of the defining walls of the auxiliary casing so that they may be connected with means projecting through the auxiliary casing such as the screw threaded pins 37 and nuts 38 through which adjustment may be effected.

It will be apparent from the foregoing that the pressure limiting means, as described, may

be generally embodied in pressure systems of various kinds to operate at a given pressure and to control apparatus to avoid pressure peaks and troughs as well as to signal as to specified pressure variations. It will be realized also that the apparatus involved is of relatively simple construction and durable in construction particularly having regard to the fact that the operation of the pressure limiting or control mechanism is effected directly through the tube 11 which is of sturdy construction. Furthermore, as will have been appreciated the swingable and adjustable arms form a unit having the advantage principally of adaptability as an accessory. The unit is, therefore, described as such in the appended claims. Moreover, due to the fact that the slot formed in the end of the swingable lever 16 is included so as always to present its said walls to the pin 19 of the operating member 20 which moves in a substantially arcuate path in one direction or the other in response to pressure variations in the system, the swingable arm 16 will respond accurately in accordance with the movement of the gauge needle 13.

As it is apparent that the device operates to correct abnormal pressure conditions in a pressure system and/or functions if desired as a signal to advise as to abnormal conditions, it will be appreciated that the device is referred to as a pressure limiting or control device and also as a pressure indicator. It is to be understood therefore, that in the appended claims where a pressure indicator is defined, the structure claimed applies equally to a pressure limiting or control device.

Various modifications may be made in this invention without departing from the spirit thereof or the scope of the claims, and therefore the exact forms shown are to be taken as illustrative only and not in a limiting sense, and it is desired that only such limitations shall be placed thereon as are disclosed in the prior art or are set forth in the accompanying claims.

What I claim is:

1. For use with a pressure gauge which includes a movable tube operable in response to pressure variations in a pressure system, a pressure indicating device a portion of which is designed to be projected through a slot in the gauge casing, comprising a unit bodily mountable on the casing embodying a plurality of arms pivotally mounted from the casing including a swingable arm designed for articulated connection with said tube to swing said arm through an arc on movement of the tube, and an adjustable arm pivotally connected with the swingable arm on the pivotal axis thereof, means in connection with said unit for positively adjusting and retaining said adjustable arm in predetermined relation to the swingable arm, and contacts on said arms designed to engage when the swingable arm has been moved to a predetermined position by said gauge tube.

2. For use with a pressure gauge which includes a movable tube operable in response to pressure variations in a pressure system, a pressure indicating device a portion of which is designed to be projected through a slot in the gauge casing, comprising a unit bodily mountable on the casing embodying a plurality of arms pivotally mounted from the casing including a swingable arm designed for articulated connection with said tube to swing said arm through an arc on movement of the tube and an adjustable arm pivotally connected with the swing-

able arm on the pivotal axis thereof, said arms having contacts thereon designed to engage with one another on predetermined movement of the tube, a detachable casing enclosing said arms and mounted on the gauge casing, and means in connection with the adjustable arm extending through said casing for positively adjusting and retaining it in predetermined relation to the swingable arm to permit contact only upon predetermined movement of the gauge tube.

3. A pressure indicating unit as claimed in claim 2 in which there is provided a second adjustable arm disposed on the opposite side of the swingable arm and having means in connection

therewith extending through the detachable casing for positively adjusting and retaining it in predetermined relation to the swingable arm, said swingable arm being movable towards one adjustable arm and away from the other on an increase in pressure in the system and vice versa, said second adjustable arm having a contact designed to engage with a contact on the swingable arm when the latter is moved to a position adjacent to the second adjustable arm, said contacts being connected in an electric circuit and functioning to close the circuit when they engage.

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