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SIGNAL SYSTEM AND APPARATUS FOR BOILERS

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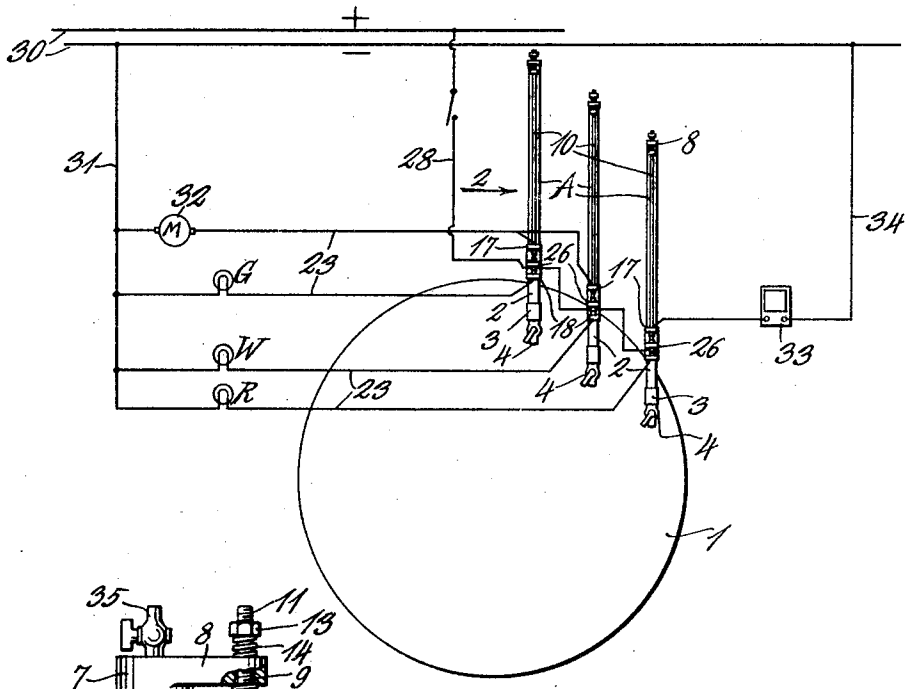


Fig. 1.

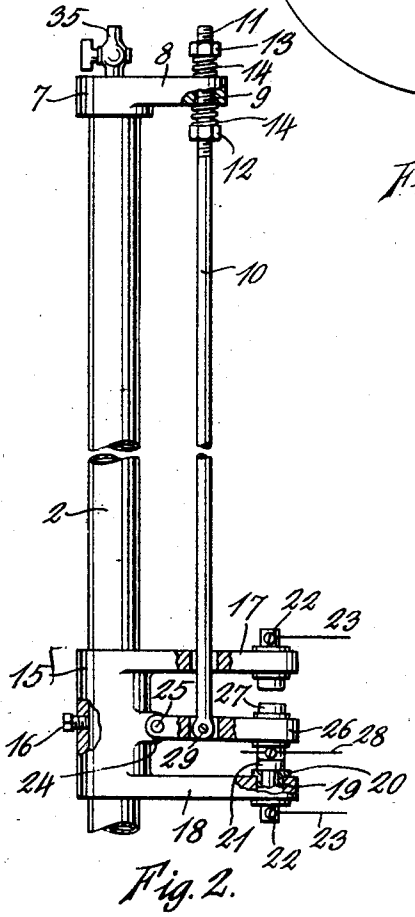


Fig. 2.

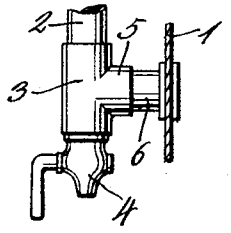


Fig. 3.

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UNITED STATES PATENT OFFICE

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SIGNAL SYSTEM AND APPARATUS FOR BOILERS

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This invention relates to improvements in signal systems and thermally operable switching mechanisms for use in connection with steam boilers for the purpose of indicating at a distance the water level within the boiler and for sounding an alarm when the water level gets below a predetermined point.

In many places, and especially, in oil fields, it is often necessary to have a steam engine in operation at a distance from houses or buildings where the people are and as it is prohibitive to employ an attendant for each of these boilers, they are often left alone for long periods of time, reliance for successful operation being had almost entirely upon the proper functioning of the different apparatus connected with the boiler. Where such boilers are used in oil fields, they are usually provided with heating apparatus burning either gas or crude oil, and with automatic means for controlling the water pumps so that if the apparatus properly functions, they will operate for long periods of time without attention.

In power plants of the type referred to above, it sometimes happens that some of the mechanism gets out of order and that the water pump ceases to function with the result that the water level falls to such an extent that the crown sheet of the boiler becomes uncovered and collapses. Such accidents are very costly even if they do not result in the loss of human life or the injury to any person, and it is the object of this invention to provide boilers with a signalling mechanism by means of which lights or other signals can be controlled at a distance and which will indicate the condition of the water level within the boiler at such a place that there will always be someone who can see the signal and be in position to take such action as is necessary to prevent any serious consequences.

This invention, briefly described, consists in applying to the boiler at different levels, three thermo responsive circuit closers, each of which consists of a tubular member, whose upper end is closed and whose lower end is connected with the interior of the boiler. Secured to each tubular member near the lower end thereof, is a switch having two spaced stationary contacts between which is located a movable contact, these contacts being insulated from the conducting parts of the switch. Secured to the upper end of each tubular member is a bracket whose outer end is provided with an opening through which a rod extends. The lower end of this rod is pivotally connected with the movable contact and the upper end of the rod is preferably held in place by means comprising springs which permits the rod to have relative movement with the bracket for a purpose which will hereinafter be more fully described. Each switch is connected to a source of electric current and to a signal so that when it operates it will control this signal, all as will be hereinafter fully set forth.

Having thus briefly described the invention, the same will now be described in detail and for this purpose reference will be had to the accompanying drawings in which the preferred embodiment of the invention has been illustrated and in which:

Fig. 1 is an end view of a boiler showing three thermally responsive circuit closers connected therewith and showing also a diagram of the wiring connections;

Fig. 2 is a view of one of the thermo responsive circuit closers showing the same to an enlarged scale; and

Fig. 3 is a side elevation of the lower end of the thermo responsive device showing the means for connecting it with the boiler.

In the drawings the circle designated by numeral 1 is intended to represent the end of a steam boiler. As the invention does not reside in the boiler, the latter has merely been diagrammatically represented. Secured to the boiler and connected with the interior thereof at different levels, are three thermo responsive circuit closers A, whose construction will now be described. Each circuit closer consists of a tube 2 whose lower end is connected with the upper end of a T 3. A cylinder cock 4 is connected with the lower end of this T and the side outlet 5 is connected with the boiler by means of a connector 6. The three thermo-responsive devices

are connected at different levels in the manner shown in Fig. 1, the upper one being connected at the average normal water level of the boiler and the lower one at a point slightly above the danger line, while the third is connected at an intermediate point. The upper end of each tubular member is provided with a cap 7 having a laterally extending bracket 8 whose outer end is provided with a transverse opening 9 through which the rod 10 extends. The opening 9 has been shown as of somewhat larger diameter than rod 10 and the latter has been shown as provided with a threaded portion 11. Nuts 12 and 13 are connected with the threaded portion, the nut 12 being below the arm 8 and nut 13 above. A spring 14 is interposed between each of the nuts 12 and 13 and the adjacent side of the bracket 8 so that the rod 10 may yield longitudinally, the purpose of this will appear as the description proceeds. Secured to the lower end of each rod is a switch having a tubular body member 15 provided with a cylindrical opening through which the tube 2 extends. This body member is held in place by means of a set screw 16 or by any other suitable means. Extending laterally from one side of member 15 are two arms 17 and 18. These arms are preferably parallel and are each provided at their outer end with an opening 19, in which an insulating bushing 20 is located. A switch contact 21 extends through the bushing 20 and is provided at one end with a connector 22 by means of which a conductor 23 may be electrically connected therewith. Body member 15 is provided with a lug 24 which is located substantially half ways between arms 17 and 18 and this lug is perforated for the reception of a pivot pin 25. A movable switch contact 26 has one end pivotally attached to the lug 24 and has its outer end provided with an opening for the reception of an insulating bushing 20 like those used in connection with arms 17 and 18. A conductor 27 extends through the bushing 20 in switch arm 26 and an electrical conductor 28 is connected to this switch member. The movable switch arm is provided with a central opening 29 into which the lower end of rod 10 projects and the latter is pivotally connected with arm 26 in the manner shown in Fig. 2. The parts are so adjusted that when the tubular member 2 is at a predetermined low temperature, which is preferably less than the boiling point of water, switch contact 27 will be held in engagement with the switch contact 21 secured to arm 18. The material of which pipe 2 is made should preferably have a very high thermal coefficient of expansion, so that its length will vary as much as possible for a given change in temperature. The parts should be so adjusted that when the interior of tubular member 2 is filled with steam at a pressure above atmospheric, it will expand to such an extent that the movable switch arm 26 will be rotated counterclockwise about its pivot 25 until the upper end of switch contact 27 comes into engagement with the lower end of switch contact 21 that is carried by arm 17. Before this occurs the lower end of switch contact 27 will, of course, be moved out of engagement with the upper end of the switch contact carried by arm 18. The function of springs 14 is to prevent undue strains on the switch arm if the length of the tubular member 2 changes more than what is actually necessary to bring the switch contacts together. The position of the switch arm 26 for any predetermined temperature can be adjusted by means of nuts 12 and 13 in a manner quite apparent from Fig. 2.

Let us now assume that three of the thermo responsive circuit closers that have just been described are attached to a boiler in a manner shown in Fig. 1, and let us further assume that they are connected with a source of electricity and with certain electrical translating devices in a manner which will now be described, reference for this purpose being had to Fig. 1. In Fig. 1 reference numeral 30 represents an electric light circuit or any two conductors of opposite polarity, one of which is connected by means of a conductor 28 to the movable switch contact 27 of each circuit closer. A conductor 31 is connected with the opposite side of the supply circuit and connected with this conductor is a motor 32, which is used for operating a boiler feed pump, and three signal lamps G, W and R, which are respectively green, white and red. A conductor 23 connects the opposite pole of the motor with the switch contact 21 of the arms 17 of the two upper circuit closers. In actual practice a relay is interposed in the motor circuit so that only the current necessary to operate the relay is made and broken by the thermo responsive switching mechanism, but as this is common practice it has not been illustrated. Other conductors 23 connect the lamps with the contacts 21 of arms 18 of each of the thermo responsive devices. Contact 21 on the end of arm 17 of the lowermost circuit responsive device is connected to one terminal of an audible signal 33, which in the drawing has been designated as an electric bell but which may be a steam whistle connected with the boiler. The other terminal of this signal is connected to the service circuit by means of a conductor 34. Each of the tubular members 2 is provided at its upper end with a small cylinder cock 35 by means of which trapped air may be released when the boiler is first put into operation. When water extends above the openings into the lower ends of the tubular members 2, and the space above the water level contains steam, it is evident, that the pressure of the steam tends to force water upwardly into the pipes 2, and if the cocks 35

are open, the tubes will soon be filled with water. As long as the level of the water remains above the openings into pipes 6, the water will remain stationary inside of the tubular members 2 and will therefore assume a temperature only slightly above that of the surrounding air. At this temperature the switches will remain in the position shown in Fig. 2 in which position all of the lamps will be burning, and at the same time the motor 32 and the audible signal 33 will remain inoperative. When the water level falls below the opening into the uppermost of the circuit closers, the water contained within the tubular members 2 will flow downwardly into the boiler and be replaced with steam. The steam is of much higher temperature than the water and therefore the temperature of the tubular member will increase whereupon it will expand and move the switch arm 26 upwardly thereby breaking the circuit to lamp G which thereupon becomes dark. When the upper end of switch contact 27 comes into electrical contact with the lower end of switch contact 21 on arm 17, the circuit will be closed to the motor 32 and the latter will therefore become operative for the purpose of pumping water into the boiler. When the water level has again been raised to a point above the entrance to the uppermost circuit controlling device, the steam will be condensed and the temperature of pipe 2 fall thereby causing the latter to contract and open the motor circuit and to again reestablish the circuit to lamp G. If, for any reason the motor should not become operative when the switch closes, the water level will continue to fall until it comes below the point where the intermediate thermo responsive device is connected with the boiler, when this will function to close the motor circuit through the corresponding switch contacts of this device. During all this time lamp G has been dark and after the level has fallen to the point of connection of the intermediate device, lamp W will also become dark. If the feed water motor now becomes operative the water level will be raised at least above the level of the intermediate device, but, if for any reason the feed water pump or motor should be defective, the water level would continue to fall until the lowermost thermo responsive device becomes operative when the audible signal 33 will be sounded and at the same time the red lamp will become darkened, thereby indicating both visually and audibly that a dangerous condition exists at the boiler. In addition to sounding the alarm 33, means can also be provided for cutting off the fuel supply to the boiler when the water level reaches this dangerous position so that accidents will be prevented, even if no one should respond to the danger signals.

In the above description the specific form of the invention has been described, but it is evident that the same results can be obtained with mechanisms constructed in a specifically different manner and the one illustrated and described should therefore be considered merely as illustrative of means for this purpose, as applicant does not want to be limited in his construction to any greater extent than made necessary by the state of the prior art.

From the above description it will be apparent that this device is especially well suited for use with steam power plants and is almost indispensible in connection with plants located at a distance from buildings and which are supposed to operate by themselves for long periods of time, as by the means hereinabove described, both visual and audible signals are operated and the fuel supply can be cut off automatically before the water level attains such a low position as to cause serious damage.

Having described the invention what is claimed as new is:

1. In a boiler means for controlling the operation of signals in accordance with the water level comprising, in combination, a tubular member having means at its lower end for connecting it with the interior of the boiler, the upper end of the tubular member being closed, and provided with a laterally extending bracket, a switch secured to the lower end of the tubular member, said switch comprising, a body member having an opening through which the tubular member extends, two spaced arms extending laterally from the body member, a switch contact secured to each arm and insulated therefrom, a movable switch arm pivotally connected with the body member at a point between the arms, the outer end of said switch arm having a switch contact secured thereto by insulating material, and a rod connected at its upper end with the bracket and at its lower end with the movable switch contact whereby when the tubular member expands and contracts the movable switch member will be rotated about its pivot.

2. In a boiler means for controlling the operation of signals in accordance with the water level comprising, in combination, a tubular member having means at its lower end for connecting it with the interior of the boiler, the upper end of the tubular member being closed, and provided with a laterally extending bracket, a switch secured to the lower end of the tubular member, said switch comprising, a body member having an opening through which the tubular member extends, two spaced arms extending laterally from the body member, a switch contact secured to each arm and insulated therefrom, a movable switch arm pivotally connected with the body member at a point between the arms, the outer end of said switch arm hav-

ing a switch contact secured thereto by insulating material, a rod connected at its upper end with the bracket and at its lower end with the movable switch contact whereby when the tubular member expands and contracts, the movable switch member will be rotated about its pivot and means for yieldingly connecting the upper end of the rod with the bracket so as to prevent excessive strains from being applied to the switch.

In testimony whereof I affix my signature.

JOHN C. JACKSON.