Feb. 11, 1930. W. E. BAKER ET AL 1,746,574

LOW WATER CONTROL FOR STEAM GENERATORS

Filed Dec. 5, 1925

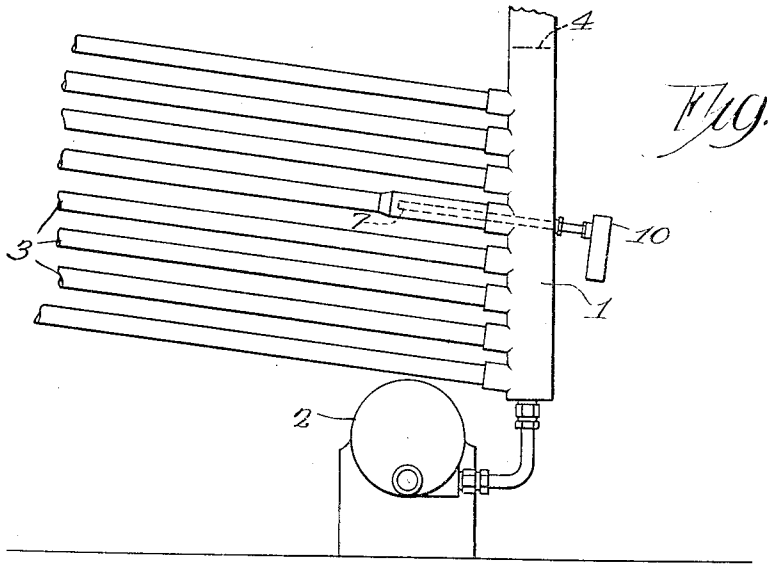


Fig. 1

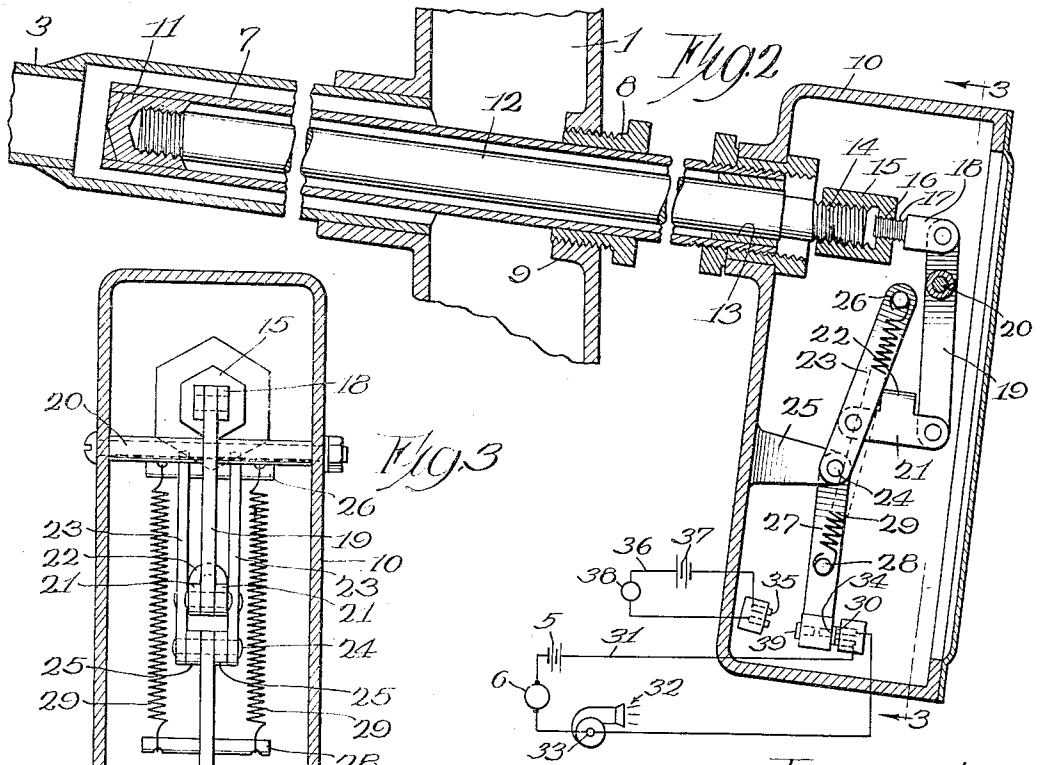


Fig. 2

Fig. 3

Inventors
William E. Baker and
Richard E. Adams
By Wm. O. Beck
Atty.

Patented Feb. 11, 1930

1,746,574

UNITED STATES PATENT OFFICE

WILLIAM E. BAKER AND RICHARD C. ALAND, OF CLEVELAND, OHIO, ASSIGNORS TO WILLIAM EDGAR BAKER AND GEORGE ALTON FRANTZ, TRUSTEES OF THE WEB ENGINEERING COMPANY, OF CLEVELAND, OHIO

LOW-WATER CONTROL FOR STEAM GENERATORS

Application filed December 5, 1925. Serial No. 73,528.

Our invention relates to novel and improved means for controlling the heat applied to a steam generator, or the like, and more specifically to means for causing the opening and closing of an electric circuit, which circuit controls the heating means. When a steam generator is employed in a vehicle, such as an automobile or a boat, the level of water therein is apt to fluctuate due to the motion of the vehicle and therefore any control operated by a float is uncertain in its action. Moreover, the use of a float necessitates the employment of considerable space, which in small generators is a marked disadvantage. Again when an expansion element of any kind is used to operate a control, it has been customary to place the same directly in the medium whose temperature governs the operation of the device. When this medium is also under high pressure, as is the case in a steam generator, a high pressure packing becomes necessary to prevent leakage at the point where the element is connected to the rest of the device disposed exteriorly of the generator. This means that the element must expand and contract through this packing, thus causing a great deal of friction and consequent resistance to the operation of the entire device.

The principal object of our invention therefore is to devise a control which may be embodied in a steam generator or the like and which shall operate without a float and by means of a thermosensitive element which is never exposed to pressure, whereby it may expand and contract freely and thereby insure that the action of the entire device shall be accurate.

Further objects are to provide a control which will operate with a snap action; which is entirely mechanical, thus avoiding the necessity of employing electramagnetic means, such as a solenoid; which shall provide means for separating electric contacts by movement in a direction substantially at right angles to the faces of the contacts; which shall embody means for making a delicate adjustment; and which shall comprise means for not only shutting off the supply of heat, but shall also give a signal when such heat is shut off.

In the accompanying drawing:

Fig. 1 is an elevation of a portion of a steam generator showing our invention as applied thereto.

Fig. 2 is a longitudinal section through a portion of the generator shown in Fig. 1.

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

Referring now to the drawing, we have shown our invention as applied to a steam generator which may be of any suitable type, but which is shown as comprising a vertical riser 1 to which is supplied water from a header 2 in a manner well known in the art. The water passes from the riser 1 to the tubes 3, the normal level being indicated at 4. Means is normally provided for keeping the water at a substantially constant level, but if such means should fail to operate, it is important to provide a device which will shut off the means heating the generator. The heating means may be of any form, but in the illustrated embodiment it is assumed that it will be some means controlled by an electric circuit, such arrangements being common. We have therefore shown our invention as applied to a device in which the heating means is controlled by a circuit comprising a battery 5 and a motor 6, such elements being diagrammatically illustrated in Fig. 2.

Disposed in one of the water tubes 3 is a receptacle in the form of a tube 7 secured to a plug 8 threaded into a boss 9 in the riser 1. The tube 7 extends through the riser 1 and supports on its outer end a casing 10 within which is received the operating mechanism of the control. Secured to a plug 11 on the inner end of the tube 7 is a thermosensitive element in the form of a rod 12 extending lengthwise of the tube and supported at the outer end thereof in a suitable bushing 13. The outer end of the rod 12 is threaded at 14 to receive the correspondingly threaded nut 15. This nut is recessed at 16 to receive the threaded stem 17 of the link 18 and it should be noted that the threads at 14 on the outer end of the element 12 are steeper than those on the stem 17, although the two threads extend in the same direction. This arrangement exemplifies means for ef-

fecting a delicate adjustment, because of the differential provided by the difference in the pitch of the two threads. Turning of the nut 15 will cause longitudinal movement of the link 18 in respect to the element 12 as will be obvious, and by proper selection of the pitch of the two threads this adjustment may be made a very accurate one.

The link 18 is preferably bifurcated at its end and received between the bifurcations is one end of a lever 19 pivoted at 20 to the casing. The lower end of the lever 19 is received between the arms 21 of a double link connected by a web 22. The double link is pivoted at its inner end to a pair of levers 23, which are pivotally mounted at 24 upon a bracket 25. These two levers 23 are connected at their free ends by a pin 26 so that they form in effect a double lever for a purpose which will presently appear. Also pivoted at 24 on the bracket 25 is a lever 27, which I have illustrated as being a single lever and which carries a transverse pin 28. Connecting the pins 26 and 28 are a plurality of springs 29.

Mounted in the casing 10 in any suitable manner are a pair of contacts 30 disposed in the circuit 31, which I shall term the heating circuit and which includes the motor 6 and battery 5. It is understood that this circuit may also contain any other usual means for heating a generator such as a burner 32 operated by a fan 33, the burner 32 being disposed beneath the generator, but being merely indicated diagrammatically in Fig. 2. The two contacts 30 are designed to be closed by a contact 34 upon the lower end of the lever 27 and disposed so that movement of the lever 27 will pull the contact 34 away from the contacts 30 in a direction substantially at right angles to their surfaces. Also secured in position in the casing 10 is a pair of contacts 35 disposed in a circuit 36 including a battery 37 and light 38. This circuit exemplifies a signal circuit of any desired kind. While a light has been selected for the purposes of illustration, it is of course understood that any other signal may be operated by any suitable means. The contacts 35 are disposed in the arc of the circle through which the end of the lever 27 moves and this lever has thereon a contact 39 adapted to bridge the contacts 35 so as to close the circuit 36.

In operation and assuming that the parts are in the position shown, the water in the generator will be at a steam generating temperature and pressure, but of course at a temperature and pressure lower than that of the steam above the water line. So long as the water covers the tube 7 the parts will remain in the position shown, but when the tube is uncovered so as to expose the element 12 to the heat of the steam, this element will expand in an axial direction causing movement of the lever 19 in a clockwise direction about its pivot. This movement will cause actuation of the double lever formed by the levers 23 in a counterclockwise direction about its pivot 24, this movement causing a tensioning of the springs 29 and a consequent increase of the pressure which these springs exert on the lever 27, it being plain that these springs insure a firm engagement between the contacts 30 and 34. However, as the double lever continues its counterclockwise movement the springs 29 will pass the center of the pivot 24 and then they will act to move the lever 27 in a clockwise direction. This movement will break the circuit 31 and close the circuit 36, as will be evident. It will also be evident that the two circuits are opened and closed respectively with a snap action at the respective contacts. Moreover, it will be seen that the springs 29 exert a tension on both sides of the center of the lever 27. The upper ends of the springs are connected to the pin 26 and therefore must move in unison, so that the force exerted on the lower end of the lever 27 is balanced, that is, it is equivalent to a force applied at the center of the lever and directly in the line of the path of travel of the lever. By using the double lever composed of the levers 23 there is no likelihood of wabbling on the pivot 24 and therefore movement of the lever 27 in its proper path is insured. The circuit 31 will remain opened so long as there is steam in the generator above the water line, which will of course be present for a considerable time after the heat is shut off. As soon as water is admitted, however, to a sufficient extent to cover the tube 7, the element 12 will contract and then the circuit 31 will again be closed and the signal circuit 36 opened.

From the above it will be apparent that we have devised a novel and improved control which may be used with advantage in connection with a steam generator or the like and which is independent of any minor fluctuations in the water level. The action is entirely mechanical and involves no complicated floats or expensive solenoids. The device may be readily applied to existing generators with a minimum of change. It is inexpensive in character, but efficient and positive in action. It will also be noted that there is no high pressure packing provided, which comes in contact with the thermosensitive element 12. The element is therefore free to expand in the receptacle 7, the bushing 13 merely having a sliding fit with the element. Moreover, a very slight expansion of the element can be easily multiplied in order to get sufficient movement of the contacts to insure a snap action. Such an action is difficult to obtain with a float operated device. Not only is a snap action obtained, but the springs 29 will also hold the contacts 34 or 39, as the case may be, securely against the contacts

30 or 35, respectively, until the lever 27 is moved to break one of the two circuits and close the other, and then the breaking and closing will take place with the snap action referred to.

Moreover, the device, while operated by changes in temperature is indirectly controlled by differences in pressure. That is, the temperature varies with the pressure and therefore when the pressure becomes dangerously great the device operates mechanically to shut off the heat and thus permit the pressure to decrease. This feature is important because of the fact that the generator and also the steam pressure control switch, which latter is actuated by pressure of steam in the generator, as fully set forth in our aforesaid co-pending application, are subjected to the pressure of steam and it is important that this pressure should be prevented from reaching a dangerously high point. While the steam pressure control switch refered to above is designed to operate upon variations in pressure of the steam, nevertheless, if it fails to do so, the increasing pressure will break it and thus the control, forming the subject matter of this application, provides a protection for the steam pressure control switch, or for any like instrument intended to operate upon changes in pressure of the steam in the generator.

While we have shown a signal circuit exemplified by the circuit 36, it is of course obvious that this circuit may be omitted if desired. However, we find it desirable to have some such signal circuit embodied in a device of this character to serve as a warning that the level of water is getting low. This warning may be in the nature of a light placed upon the dash board of a vehicle, or may be in the nature of a bell or any other known type of signal.

We are aware that changes in the form, construction and arrangement of parts may be made without departing from the spirit and without sacrificing the advantages of the invention and we reserve the right to make all such changes as fairly fall within the scope of the following claims.

We claim:

1. In combination, a thermo-sensitive element having a nut threaded on one end thereof, a link threaded in said nut, said threads extending in the same direction but of different pitch, a lever pivoted on a stationary pivot and pivotally connected at one end to said link, a double link pivotally connected to the other end of said lever, a double lever pivoted between its ends to said double link and mounted on a stationary pivot at one of its ends, a single lever mounted on the same pivot as said double lever, a plurality of springs connecting said double lever with said single lever, and a contact carried by said single lever.

2. In combination, a circuit having a pair of contacts therein, a lever having a contact adapted to bridge said contacts and mounted at one end upon a stationary pivot, a double lever mounted upon the same pivot and a plurality of springs each connected at one end to said double lever and at the other end to said single lever on opposite sides thereof, and means to impart movement to said double lever to operate said single lever.

WILLIAM E. BAKER.
RICHARD C. ALAND.