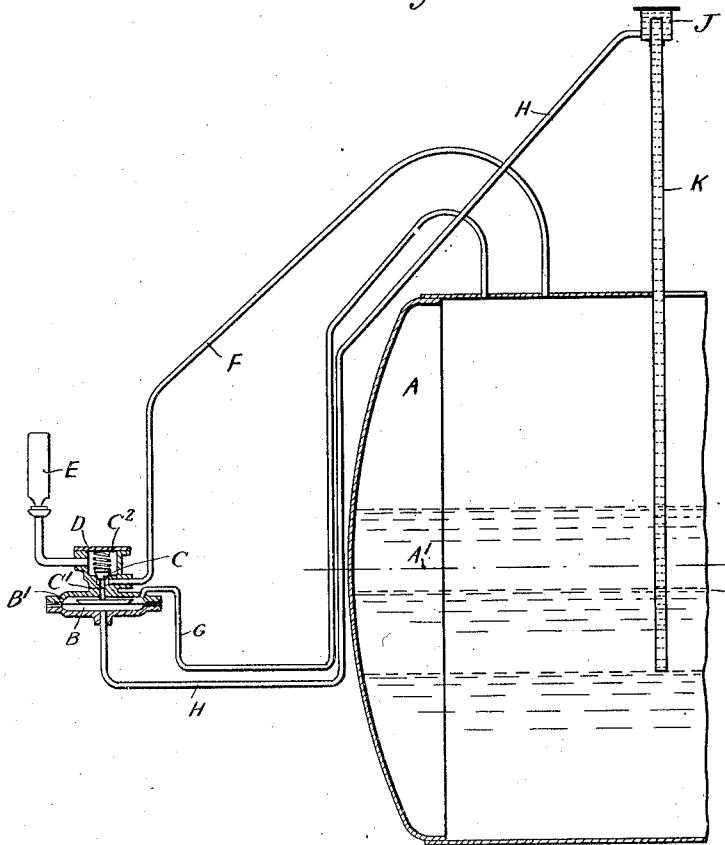


H. W. SPENCER AND R. CLARK.
WATER LEVEL ALARM APPARATUS FOR STEAM GENERATORS.
APPLICATION FILED JUNE 9, 1919.

1,338,197.

Patented Apr. 27, 1920.
3 SHEETS—SHEET 1.

Fig. 1.

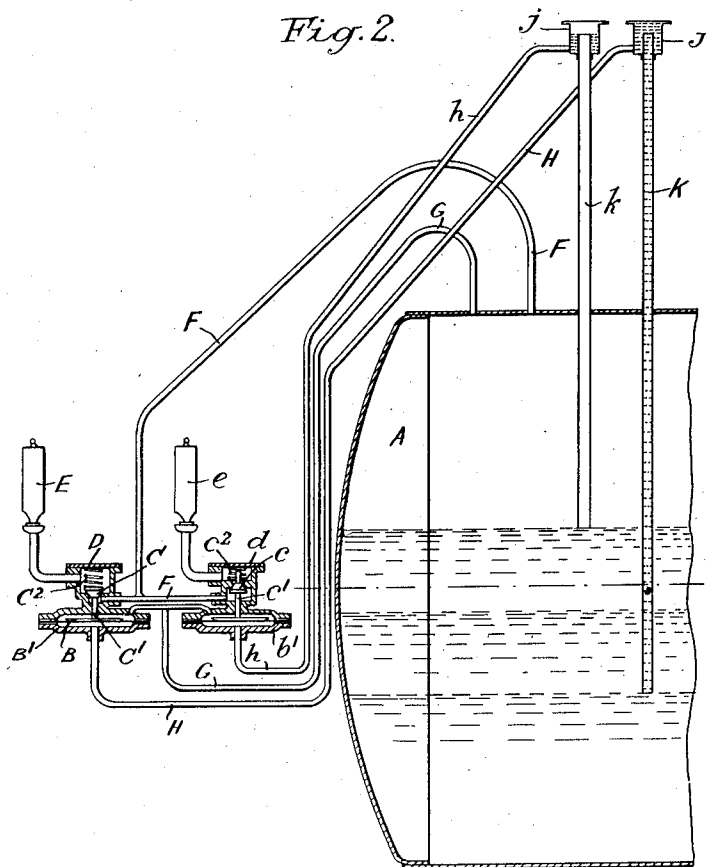


Inventors
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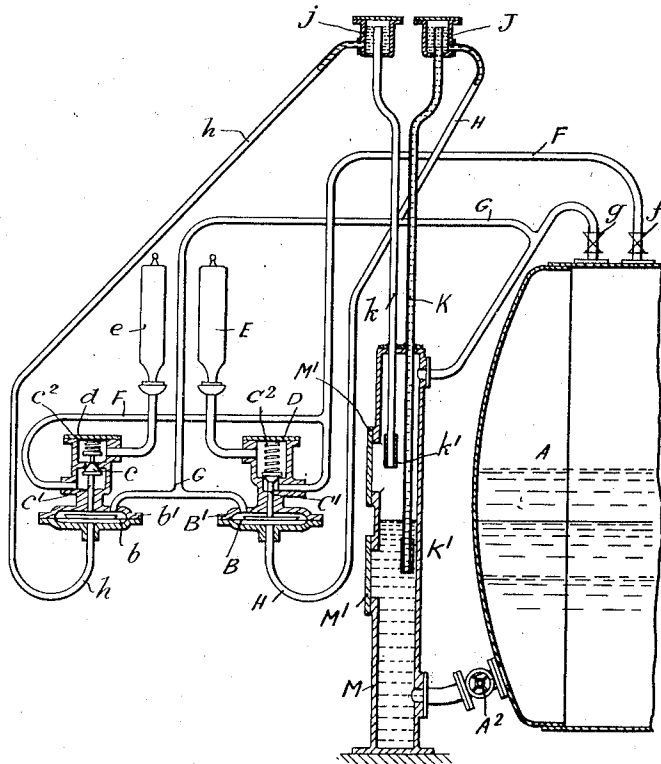
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

HENRY WILMOT SPENCER, OF LONDON, AND ROBERT CLARK, OF KEW GARDENS,
ENGLAND.

WATER-LEVEL ALARM APPARATUS FOR STEAM-GENERATORS.

1,338,197.

Specification of Letters Patent.

Patented Apr. 27, 1920.

Application filed June 9, 1919. Serial No. 302,951.

To all whom it may concern:

Be it known that we, HENRY WILMOT SPENCER, a subject of the King of England, residing at 147 Queen Victoria street, in the city of London, England, (whose post-office address is 147 Queen Victoria street, in the City of London, England,) and ROBERT CLARK, a subject of the King of England, residing at 17 Burlington avenue, Kew Gardens, in the county of Surrey, England, (whose post-office address is 17 Burlington avenue, Kew Gardens, in the county of Surrey, England,) have invented certain new and useful Improvements in Water-Level Alarm Apparatus for Steam-Generators, of which the following is a specification.

This invention relates to apparatus for sounding an alarm when the level of the water in a steam generator varies from the predetermined permissible limits, of the kind which operates by the disturbance of the pressure difference caused by the weight of a column of water on a flexible diaphragm connected with the generator.

In one form of apparatus of the indicated type it has been proposed to connect one side of the diaphragm with the generator steam space, and the other side with the high or low water-level in the generator, so that the hydrostatic pressure will be put on, or will be entirely removed, by the rise or fall of the water-level in the generator, according to whether the apparatus is adapted to high or to low-water alarm purposes. In this form of apparatus the generator steam pressure side of the diaphragm contains a valve which is operated by the diaphragm thereby allowing steam to pass to the steam whistle; consequently the variation of the hydrostatic pressure on one side of the diaphragm, which brings about the opening of the whistle valve, affects the static pressure of the steam on the other or valve side of the diaphragm.

In another form of such apparatus the high and low water-level pipes are each connected through water-traps with pipes in open communication with chambers on opposite sides of one and the same diaphragm so that the hydrostatic pressure is always on both sides of the diaphragm and is balanced or unbalanced according to the level of the water in the generator; when the pressure on both sides is equalized, as it would be when either the high or the low

water limit was reached, then the diaphragm is acted upon by a weight and caused to open a valve allowing steam to pass to the whistle from a part of the system controlling the pressure on the diaphragm thereby affecting the static character of that pressure, as in the case first referred to.

It will be obvious that the maintenance of the static generator pressure on the diaphragm is essential to the efficient working of the apparatus; and that if the whistle supply connection be taken from any vessel exterior to the boiler which is not volumetrically large enough to supply the pipe without affecting the water-level in that vessel, the hydrostatic pressure would be affected.

According to our invention we provide apparatus of the indicated type wherein the generator steam pressure is maintained at all times in a static condition on one side only of the diaphragm, the hydrostatic pressure being on the other side and balanced or unbalanced according to the level of the water in the generator; and wherein the supply of steam for sounding the alarm is taken from the generator direct and without in any way interfering with the static generator pressure on one side of the diaphragm.

Our invention may be applied as a single alarm apparatus adapted to operate a valve to allow steam to pass to a steam whistle or the like either when the water in the generator rises above or when it falls below the predetermined limit. In the case of a high-water alarm the pressure difference is normally on the diaphragm and is disturbed when the stand-pipe is submerged and thereby operates the valve; while in the low-water alarm the valve is operated by the pressure difference on the diaphragm brought about by the uncovering of the lower-end of the stand-pipe.

In some cases, however, it is desirable that both high and low water alarms should be fitted to the same boiler, one to operate when the water in the boiler is above the higher predetermined permissible level, and the other, of preferably a different tone, to operate when the water is below the lower predetermined permissible level.

To accomplish this we provide two diaphragms and two stand-pipes as described,

with this difference between them, that the diaphragm operating the "high" alarm causes the valve to open when the lower end of its stand-pipe is submerged, while the diaphragm operating the "low" alarm causes the valve to open only when its stand-pipe has the lower end uncovered; in other words the "high" alarm sounds when the stand-pipe is full of water and the "low" alarm sounds when its stand-pipe is full of steam.

The accompanying drawings show three different types of water-level alarm apparatus constructed in accordance with our invention, but we wish it to be understood that we do not confine ourselves to the details of construction or arrangement therein shown or hereafter described as these may be varied within wide limits to meet requirements.

Figure 1 is a sectional elevation showing a form of our invention adapted as a low-water alarm for a steam generator;

Fig. 2 is a sectional elevation showing both high and low water alarms applied to one and the same steam generator; and

Fig. 3 is a similar view where the two alarms are connected to a vessel in which the boiler water-level is reproduced.

Like parts are lettered to correspond in all three figures of the drawings.

In these drawings A represents the steam generator and A' the normal water-level therein. B is a flexible diaphragm fitted in the usual way in a steam and water tight chamber B' and secured on its upper side to the stem C' of a valve C normally held on its seat by a spring C² in the steam box D connected to the whistle E. F is a pipe admitting steam from the boiler to the steam box D, and G is a pipe admitting steam from the boiler to one side of the diaphragm B in the chamber B'. The other side of the diaphragm is in communication by means of the connecting pipe H with a closed vessel J through which passes the end of a stand-pipe K. The stand-pipe is open top and bottom, its upper end being above the connection of the connecting-pipe H with the vessel J so that a water trap will form around said upper end within the closed vessel J. The lower end of the stand-pipe passes into the water space in the boiler and extends to the level at which it is desired to sound the low-water alarm.

Normally the connecting pipe H and stand-pipe K are full of water and the pressure on the two sides of the diaphragm B is substantially the same, being that in the boiler, and the valve C is held closed by the spring C². But when the lower end of the stand-pipe K is uncovered the water therein falls into the boiler and is replaced by steam whereupon one side of the diaphragm B is now under the pressure of steam from the

boiler while the other side is under the same pressure plus the pressure caused by the weight of the column of water in the connecting-pipe H. This additional pressure being greater than that of the spring C² causes the diaphragm B to open the valve C whereupon the whistle is sounded by the steam admitted through the pipe F to the steam box D.

This form of our invention is adapted to be used as a high-water alarm to sound when the lower end of the stand-pipe is submerged in the rising water, instead of when uncovered as previously described; the only change requisite being to arrange for the valve to open downward instead of upward as shown in Fig. 1. Such an adaptation is shown in the double form of our apparatus illustrated in Fig. 2.

In Fig. 2 the low-water alarm E and its connected parts are the same as in Fig. 1 except that the steam pipes F and G each opens into a branch pipe to supply both of the steam boxes D and d and both of the diaphragm chambers B' and b'.

The high-water alarm apparatus is the same as that for the low-water and the parts lettered in small letters correspond with those used for the low-water apparatus, marked in capital letters, with the exception of the valve c and its spring c². As already stated the valve c is constructed to open downward, instead of upward as in the low-water alarm, and its spring c² is arranged so as to open the valve when the water column is balanced and the pressure difference on the diaphragm thereby disturbed, instead of the valve being opened by the pressure difference against the action of the spring as in the low-water type of apparatus shown in Fig. 1.

In this double form of our invention it will be observed that in the low-water apparatus the stand-pipe K is normally filled with water whereas the high-water stand-pipe k is normally filled with steam.

The modification shown in Fig. 3 differs only from that shown in Fig. 2 in the provision of the vessel M in which the boiler water-level is reproduced, and in a few constructional details. M' represent inspection doors at about the high and low-water levels; K', k' are screw ferrules on the stand-pipes whereby they may be slightly extended in length when desired; f, g, are stop-cocks and couplings for disconnecting the steam pipes F and G from the boiler; and A² is a stop-cock on a communication pipe between the boiler A and vessel M.

Having fully described our invention, what we claim and desire to secure by Letters Patent is:—

1. Water-level alarm apparatus for steam-generators of the hydrostatic pressure diaphragm type wherein the generator steam

pressure is maintained at all times in a static condition on one side only of the diaphragm and the variable hydrostatic pressure is on the other side of said diaphragm.

5 2. Water-level alarm apparatus for steam generators comprising a diaphragm chamber, a diaphragm in said chamber, a valve connected to said diaphragm, a spring to close said valve, a steam box in which said
10 valve is located, an alarm connected to said steam box, a pipe opening communication between said steam box and the steam space of the generator, a second pipe opening communication between the valve side of said
15 diaphragm chamber and the steam space of the generator, a third pipe opening communication between the opposite side of said diaphragm chamber and the lower part of a water trap, and a stand-pipe leading
20 from the upper part of said water trap to the water space of the generator.

3. Water-level alarm apparatus for steam generators of the hydrostatic pressure diaphragm type comprising two diaphragm
25 chambers each connected on one side through a water trap with an open-ended stand-pipe communicating with the water space of the generator, and on the other side with the steam space of the generator, a diaphragm

in each said diaphragm chamber, a valve attached to each diaphragm, springs to close the valves, a steam box containing each valve, an alarm on each steam box, and a pipe connecting both steam boxes with the generator steam space.

4. Water-level alarm apparatus for steam generators of the hydrostatic pressure diaphragm type comprising two diaphragm chambers each connected on one side through
35 a water trap with an open-ended stand-pipe communicating with the water space of a vessel in open communication with the water and steam spaces of the generator and on the other side with the steam space of the
40 generator, a diaphragm in each said diaphragm chamber, springs to close the valves,
45 a valve attached to each diaphragm, a steam box containing each valve, an alarm on each steam box, and a pipe connecting both steam boxes with the generator steam space.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses this 26th day of May, 1919.

HENRY WILMOT SPENCER.

ROBERT CLARK.

Witnesses:

J. W. PATCHING,

W. F. MORLY.