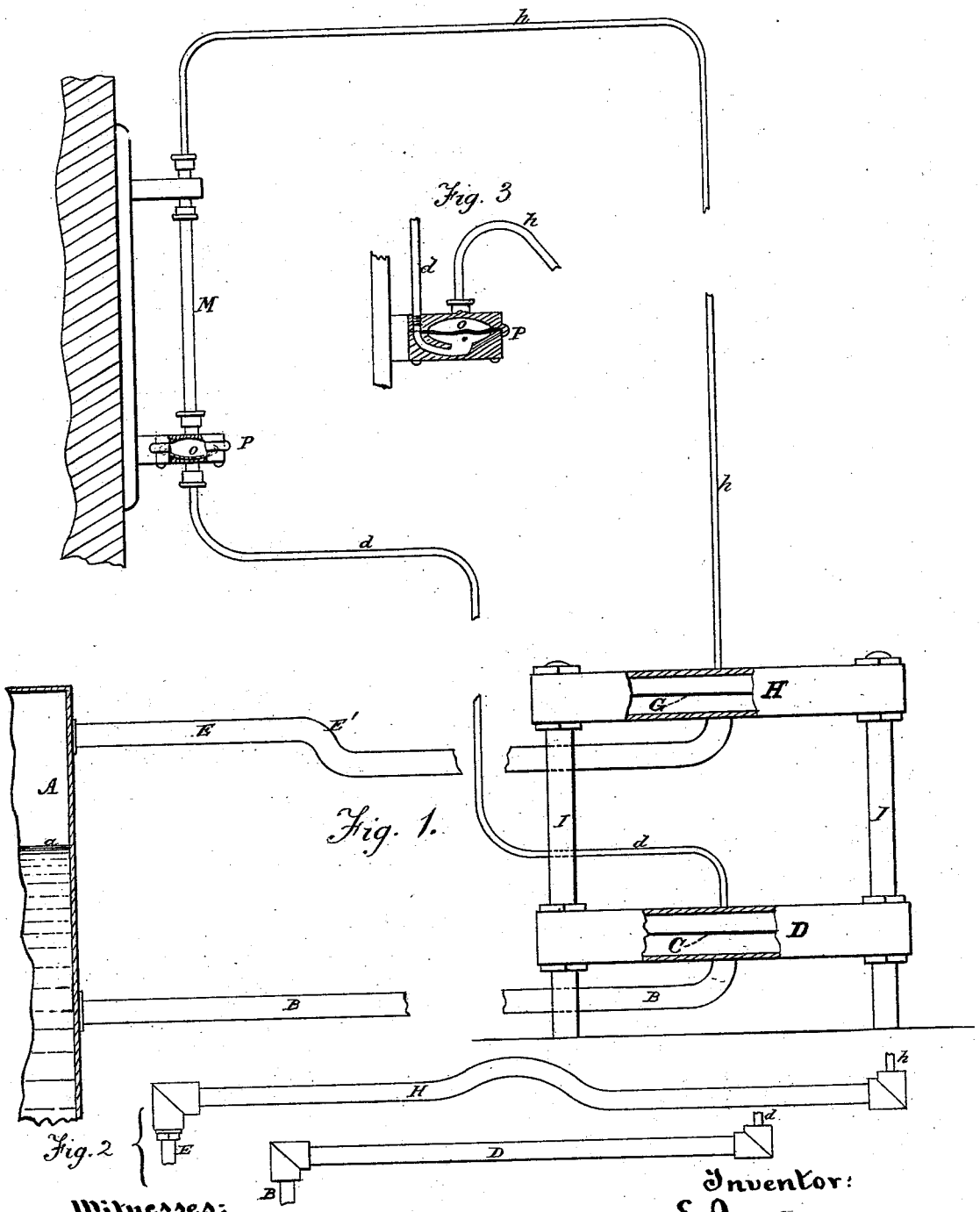
E. JEROME.

Water-Level Indicator.

No. 209,052. Patented Oct. 15, 1878.



Witnesses:

Chas. C. Stetson.

H. A. Johnstone.

Inventor:

E. Jerome

by his attorney

Thomas D. Stetson

UNITED STATES PATENT OFFICE.

EDGAR JEROME, OF ALBANY, NEW YORK.

IMPROVEMENT IN WATER-LEVEL INDICATORS.

Specification forming part of Letters Patent No. **209,052**, dated October 15, 1878; application filed March 14, 1878.

To all whom it may concern:

Be it known that I, EDGAR JEROME, of Albany, county of Albany, in the State of New York, have invented certain new and useful Improvements in Means for Indicating the Water-Level in Steam-Boilers, Water-Tanks, Ships' Holds, and the like; and I do hereby declare that the following is a full and exact description thereof.

I will describe the invention as applied to indicate the water-level in a steam-boiler.

The following is a description of what I consider the best means of carrying out the invention.

The accompanying drawings form a part of this specification.

Figure 1 is a general vertical section through the entire apparatus, certain portions of the connecting-pipes being omitted in order to bring the parts nearer together and make the drawing more compact. The remaining figures are modifications. Fig. 2 is a modification, showing substitutes in place of the extended chambers near the water-level of the boiler. Fig. 3 is a section, showing a modification of the parts near the indicating-tube.

Similar letters of reference indicate like parts in all the figures.

My apparatus will indicate at distant points and at levels above or below that of the boiler.

The device is of that class in which the pressure is transmitted through tubes containing air, the pressure of which varies as the water rises and sinks.

I provide a glass tube with a considerable reservoir in connection, which may contain colored water or other suitable fluid, to be forced up in the glass tube to different levels by the changes of pressure due to the fluctuations in the level of the water.

A diaphragm of thin india-rubber forms the bottom of the reservoir. The space below it is connected by a slender tube to a chamber of large horizontal dimensions, but of little height, which is mounted somewhat below the lowest water-level of the boiler. The water from the boiler flows into the bottom of this chamber and compresses the air above. Each change of the level of the water in the boiler induces a corresponding change in the pressure of the water in this chamber and a corresponding change in the pressure of the air, which is compressed above it, and which is felt at the other end of the tube by pressing with greater or less force on the water there, and forcing it up to a greater or less height in the glass tube. The other chamber is higher, and is above the highest water-line of the boiler. It transmits the pressure of the steam through compressed air to act on the upper surface of the fluid in the glass tube. Its function is to balance the pressure of the steam and render it of no effect. The pressure of the steam acts either directly or through a mass of water which forms by condensation as soon as the steam is admitted, and compresses the air above to a tension just equal to that of the steam in the boiler.

It will be understood that both horizontal chambers have their upper portions filled with compressed air, the upper one having always simply the pressure of the steam in the boiler, while the lower one has the same plus the pressure due to the head of water in the boiler. The latter will vary as the water-level in the boiler changes, and the effect will be manifested by forcing up the fluid in the glass tube to a corresponding height, whatever may be its distance and location.

Referring to the drawings, A is the boiler, and *a* the ordinary or medium water-level therein. B is a pipe leading from below the water-line to the base of an extended chamber, D. M is an upright glass tube located at any distance and elevation, having a length exposed to the eye equal to the length of an ordinary water-glass on the boiler.

The fluid, or water with glycerine to provide against freezing, is contained partly in the glass tube M, and the larger part in a considerable reservoir, P, having a diaphragm of rubber, O, or other suitable material, extending across it. The pressure of the air in the upper part of the lower chamber, D, is transmitted through a slender tube, *d*, from the upper part of the chamber D to the base of the reservoir P, below the diaphragm O. The pressure acting under the diaphragm O raises it and forces the fluid up the glass tube M until the gravity balances the pressure produced by the weight of water in the boiler above the low-water line.

A pipe, E, leads from the boiler A above the water-line to the under part of a chamber, H, situated over the chamber D, as shown. There is a bend, E′, in the pipe E, which causes it to collect and retain the water of condensation, so that the bottom of the chamber H is filled with water at a moderate temperature instead of hot steam. The compressed air in the upper part of the chamber H connects directly through a tube, *h*, with the top of the glass tube M, so that the pressure in the chamber H is exerted directly on the surface of the fluid in M to resist the rise of the fluid. It balances and neutralizes all that part of the pressure in D due to the pressure of the steam. It leaves unbalanced all that pressure due to the head of the water in the boiler. A rise of the water-level *a* in the boiler increases the pressure in the lower chamber, D, and thus in the base of the chamber or reservoir P, while the pressure in the chamber H, being unaffected, exerts only a constant pressure on the surface of the fluid in the glass tube M, and allows it to rise and sink freely. The pressure of the steam may obviously be increased and diminished by any cause without affecting the level of the fluid in the glass M, because it equally subtracts from the pressure both above and below.

I have shown the chambers D and H of cast-iron in two parts, with tight-fitting joints, secured by screw-bolts.

It is important that the chambers D and H be of considerable area, so that a considerable quantity of air will be contained to produce the required pressure, and so that the small quantity required to raise the fluid in M may move through the pipes *d* and *h* without much changing the level in D. Otherwise it is liable to be all forced out into the connecting-pipes *d h* when working under a strong head of steam. For the same reason the pipes *d h* should be slender. There is no necessity for any but a very slow flow of air through them, and the apparatus will serve with very minute passages through these pipes.

I prefer to mount the chamber H directly over the chamber D, and to connect the two by rigid bars or parts I I, as shown; but some of the advantages may be realized by mounting these chambers entirely independent. Their rigid connections I constitute a more compact apparatus, and make it easier to keep them in the proper level and adjustment. It is essential that the chambers D and H should be extended horizontally or nearly so.

It is theoretically necessary that the water-level in the chamber D shall change in order to induce and transmit a change of pressure in the air above it when the water-level in the boiler A rises and sinks; but by giving the chamber D a large horizontal area relatively to the capacity of the pipe *d* and of the reservoir P, I am able to reduce the amount of the change of level of the water-surface in D, so that it is almost inappreciable. Proportioned as here shown, a change of the water-level in the boiler A to the extent of an inch will result in a change of level in the chamber D in the same direction, but to an extent less than a hundredth of an inch—so small as to be inappreciable.

It is important that the chamber D shall have not only an extended horizontal area, but sufficient depth to give it considerable cubical contents. Otherwise it and the connected pipe *d* and the reservoir P will not contain sufficient air to resist by its elastic action when compressed by a strong pressure of steam, and the water from the boiler will not only flow in at the bottom and gradually compress the previously-contained air upward in the case D, but will displace the whole of such air, forcing it all out into the pipe *d* and the small reservoir P. In such case the water will fill the entire chamber D and the lower end of the pipe *d*. Thus conditioned, the apparatus will not indicate reliably.

I take care to give sufficient depth, as well as horizontal area, to the vessel D to imprison a sufficient quantity of air to allow its compression to the highest tension which is required to balance the pressure of steam without ever displacing all the air from the case D. There is no particular injury to result from giving the chamber D a too great cubical capacity; but it is important that it shall have a sufficient cubical capacity relatively to the capacity of the pipe *d* and of the reservoir P, so that when compressed to six or any other number of atmospheres there will still remain a stratum of air, and not water, in the upper part of the chamber D.

The same condition should be observed in regard to the chamber H.

The fluctuations in the water-level of a boiler are not sudden, but gradual. Small pipes may usually serve for the pipes B and E; but it is important that they be kept clear and in good working order.

Modifications may be made. Elaborate means may be applied for preventing the steam from ever, under any circumstances, entering either chamber.

The diaphragms C G in the chambers D H may be dispensed with without departing from the spirit of my invention.

Stop-cocks may and should be fitted on the pipes B and E. I prefer to have no such connections on the pipes *d h*, as such would tend to increase the chances of leakage. Stop-cocks may be introduced, connected with the bottoms of the chambers D and H, for the discharge of the water and the introduction of air to replace that lost by leakage or by escape through the water to the boiler.

The chambers D and H may be each a pipe of sufficient area extended directly, a suitable bend being always made in the upper one to enable it to retain a little water produced by the condensation. I can, if preferred in any case, make such a pipe circuitous, or in bends back and forward. Any way may be adopted which will give a considerable body of water

retained there, or rather of compressed air above the water, so that the air may be moved upward in the slender pipe and induce the required change at the reservoir P and indicating device M without much changing the level of the water in the vessel H or its equivalent.

When my invention is applied to indicate the level of the water in other devices than in steam-boilers, and where it is not subject to any pressure except the ordinary pressure of the atmosphere, the upper chamber, H, and its connections may be omitted, and in its stead there may be any convenient means for allowing the pressure of the atmosphere to act on the fluid in the indicating-tube M. Such tube may in such case be simply left open at the top, with suitable provision for preventing the access of dust or any foreign matter.

I can, if desired for any reason, conceal the lower chamber, D, or the equivalent tube or tubes—the part of the apparatus in which the compressed air is stored and exposed to the fluctuations of pressure of the water as it rises and lowers in the boiler or other vessel—by placing the chamber and its appurtenances inside of the boiler or tank. This will eminently be proper in indicating the depth of water in ships' holds, where the entire hold, or a whole section or compartment thereof, is a substitute for the boiler A in the above description.

Instead of a tube, M, of glass, through which the pressures shall be indicated to the eye by the rising and sinking of the liquid therein, which is visible through the glass, I can use a manometer composed of an aneroid barometer, or analogous device, with or without an index attached. I can use any suitable instrument to make visible to the eye the slight changes of pressure induced by the rising and lowering of the water-level in the boiler transmitted through the pipe *d;* but I esteem the glass tube M, with its reservoir P and diaphragm O, the preferable form of this part of the apparatus.

The reservoir P may, if preferred, be modified in form so as to receive the pressure above the diaphragm. A construction involving this modification is shown in Fig. 3.

I claim as my invention—

1. The combination, with a chamber, D, in which an air-pressure is produced by water flowing into it from a boiler or other vessel, of the pipe *d*, reservoir P, with its diaphragm O, and indicator M, as herein specified.

2. The combination, with a chamber, H, in which an air-pressure is produced by water flowing into it from a boiler or other vessel, of the pipe E, communicating with the boiler, and having the bend E′, pipe *h*, and the indicating device M, as herein specified.

3. The reservoir P, with its diaphragm O and glass tube M, in combination with a chamber or chambers, D H, in which an air-pressure is produced by water, and tubes *d h*, in the manner and for the purpose specified.

4. The two extended chambers D H, communicating with the boiler or other vessel by means of the pipe B and bent pipe E′, in combination with the pipes *d h*, reservoir P, with diaphragm O, and indicator M, as herein specified.

5. The combination of the rigid connections I between the horizontally-extended chambers D H, constituting a compact instrument, with their respective diaphragms C G, pipes B, E, E′, and *d h*, indicator-tube M, reservoir P, and diaphragm O, as and for the purposes herein specified.

In testimony whereof I have hereunto set my name in presence of two subscribing witnesses.

EDGAR JEROME.

Witnesses:

BERNARD ACKERMAN,

A. H. GENTNER.