(No Model.)

W. P. POWERS.

AUTOMATIC DRAFT REGULATOR FOR HOT WATER BOILERS.

No. 410,717. Patented Sept. 10, 1889.

Fig. 1.

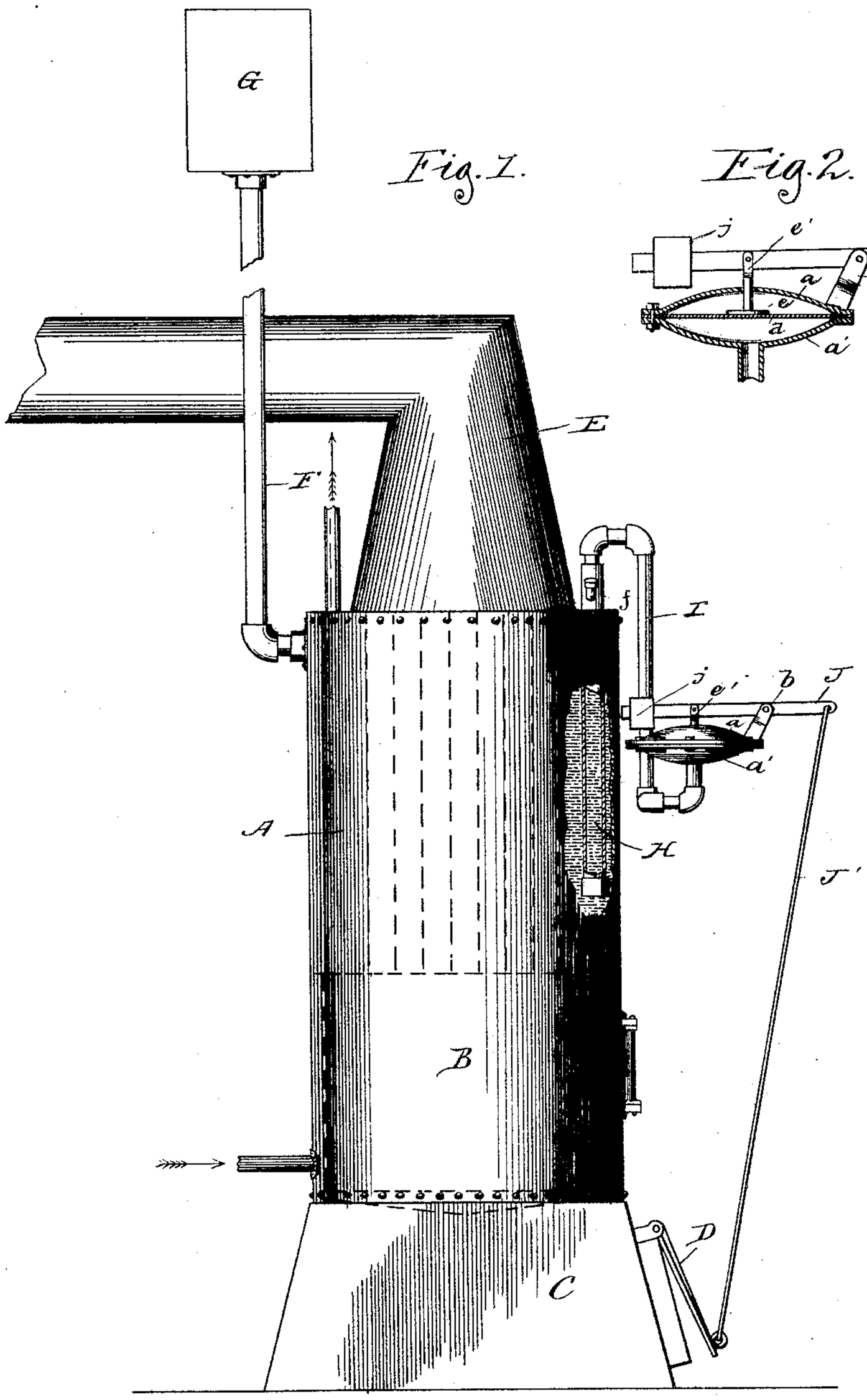

Fig. 2.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC DRAFT-REGULATOR FOR HOT-WATER BOILERS.

SPECIFICATION forming part of Letters Patent No. 410,717, dated September 10, 1889.

Application filed February 25, 1888. Serial No. 265,228. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM PENN POWERS, a citizen of the United States, residing at La Crosse, in the county of La Crosse and State of Wisconsin, have invented certain new and useful Improvements in Automatic Draft-Regulators for Hot-Water Boilers, which I desire to protect by Letters Patent of the United States, of which the following is a specification.

My invention relates to provision for automatically controlling the damper of a furnace by which heat is supplied to boilers that are used for hot-water heating. It becomes important in connection with water heated for this purpose that it should be so controlled that the temperature may not rise sufficiently for its conversion into steam, and therefore no means can be derived from the water directly for the purpose of automatically operating a damper. To the end that steam be obtained from the temperature of the water I supply a supplemental boiler or steam-generator containing water that I submerge in the water used for the heating purposes under conditions that will permit generation of steam at a temperature below that necessary for generating steam in the main boiler. This result is obtainable by the fact that the water in the main boiler, which is supplied from a source at a considerable height above, is under a very considerable pressure. My supplemental boiler I so arrange that the pressure upon the fluid therein is not above atmospheric, and will thus boil at about 212° Fahrenheit.

For the purpose of a definite description of my invention reference is had to the accompanying drawings, in which—

Figure 1 is an elevation with a portion of the boiler broken away to expose a supplemental boiler. Fig. 2 is a detail in vertical section.

Above the boiler is shown a chimney or flue E for carrying off the products of combustion and furnishing the necessary draft.

In boiler A is shown inserted a pipe F, connecting above with an expansion-tank G, located above the boiler, whereby the water of the latter is held under greater than atmospheric pressure, due to the weight of the column of water in pipe F.

While I have not shown any pipes for distributing the water throughout a building, this provision may of course be made in any suitable manner by connecting such distributing-pipes with the stubs *y y*, projecting from the boiler, with tank G necessarily at an elevation above such pipes.

The supplemental boiler by which the steam is to be generated in the present illustration consists of a tube H, inserted into the top of boiler A, where it is secured, which extends some distance at least into the water of the boiler and is closed at its lower end. This supplemental boiler I supply with water having a lower boiling-point than the water in the heating-boiler, due to the fact that the water in said supplemental boiler is not under pressure.

When the temperature of the water in the heating-boiler rises above the boiling-point of the fluid in supplemental boiler H, steam is generated therein. The steam thus generated may be utilized to close the damper in any convenient manner; but, as here shown, a continuation I of pipe H leads down and is again turned up, where at its terminal is supported a device for utilizing steam, whereby the valve may be operated. This device embraces a shell (shown in detail, Fig. 2) composed of upper and lower plates *a* and *a'*, that are provided with peripheral flanges, which form the contact-surface of one plate with another. Within this shell is placed a diaphragm *d*, preferably composed of a

pressure, its dimensions are enlarged and the diaphragm elevated.

Upon the upper surface of the diaphragm rests a plate *e*, to which is attached a stem *e'*. An extension *b* from plate *a* serves as a fulcrum for a lever J, to the outer end of which is a rod J', that connects with damper D. Stem *e'* is also attached to the other arm of lever J, and at the inner end of lever J is a weight *j*, that serves to normally depress that end of the lever and force stem *e'* downwardly.

It is designed that the action of the steam generated in tube H and conducted through pipe I shall, when sufficient, operate to raise diaphragm *d*, thereby raising lever J and thus closing the damper. When, by reason of the damper being closed, the temperature of the water in the main boiler becomes sufficiently lowered to stop the generation of steam in boiler H and permit condensation in pipe I, diaphragm *d* is allowed to subside, and the weight *j*, by depressing lever J, again opens the damper. Though water be used in this supplemental tube or boiler H, it is evident that the steam will be generated therein sufficient for the purpose designed before the water in the main boiler has reached a temperature sufficient to generate steam, owing to the pressure of the water in the pipe above in addition to the atmospheric pressure, which necessitates a temperature above 212° or the ordinary boiling-point to convert the water in the heating-boiler into steam.

The form of supplemental boiler or construction of parts may of course be varied, and the submerged supplemental boiler is not necessarily located in the heating-boiler itself, but may be placed in the hot-water system at or near the level of the boiler, and, for example, a piston may be used instead of the diaphragm. I do not, therefore, design to limit my invention to any particular form of construction, its real scope embracing the supplemental boiler submerged in the hot water of the heating system and containing water boiling at a lower temperature than that in the heating-boiler, owing to the difference in pressure.

I am aware that hot-water damper-regulators have been constructed in which reservoirs containing air and water confined are heated by being inclosed in the water of the circulating system, which air or water, as the heat rises, gradually expands, and by means of suitable mechanism closes the damper; also, that this has been done by the expansion of metallic rods when heated by the water of the boiler. These methods, however, are gradual in their operation, and there is an uncertainty about the exact time when the damper will close, whereas by my invention there is a force developed at the moment of steam-generation and when action is required, which force is positive in its operation, opening wide or completely closing the damper with a variation of only one or two degrees of heat in the heating-boiler.

I am also aware that temperature-regulators have been constructed wherein a volatile liquid has been used in connection with a metallic diaphragm for controlling temperatures by its vaporization. These, however, are designed to operate only at temperatures below 212°, the end having been accomplished by lowering the boiling-point of the liquid in the generator, while I accomplish my purpose by raising the boiling-point of the water in the heating system, thereby securing additional heat and making it practicable to carry a uniform temperature of from 212° to 220° in the heating system without any danger of passing the boiling-point. In hot-water heating apparatus as heretofore constructed it has not been practicable to carry a temperature of more than 185° or 190°, because in the ordinary fluctuations the boiling-point might be passed, which would result in discharging the water of the boiler into the expansion-tank. Hence all radiators have been proportioned in size to this temperature of 185° or 190°, and the size, unsightliness, and expense of these radiators have deterred many from adopting this system of heating. Now, by means of my improvements I am enabled to carry constantly a uniform temperature of 215° or 220° with the same degree of exactness that a low-pressure steam-heating system maintains unvarying heat and at very nearly as high a temperature, thereby effecting a great saving in the size and cost of radiators, as with my improvement an increase of at least fifteen per cent. is secured in the heat of the system, thereby enabling fifteen per cent. less radiation to be used and more uniform results secured.

In those cases where volatile liquids have been used it has been necessary to employ metallic diaphragms instead of rubber, from the fact that all volatile liquids are active solvents of rubber. In practice it has been found impossible to provide a metallic diaphragm that is sufficiently sensitive and at the same time durable, and so none of these devices have come into use, though they have been much needed. By my invention I overcome this objection, and am able to use a rubber diaphragm, making a sensitive and sure device operating at just the right time to secure the utmost heat practicable from a hot-water apparatus.

I have shown a small feed-pipe through which water or other liquid is introduced into tube H, said feed-pipe being indicated by *f* and being closed at the top by a screw-cap. It is immaterial, however, as to how the water or liquid used may be introduced into said tube H, as any suitable opening, so protected as to prevent the steam from escaping from said supplemental boiler or tube H, may be employed.

In constructing the diaphragm I make it

relatively very large as compared with the utmost possible displacement obtainable by molecular expansion under the influence of the heat applied, the intention being to accomplish the work by vaporization only and at a very low pressure with large increase of volume, and for the reason that by vaporization only can positive action be obtained at the right time; and I disclaim any combination of elements by which the purposes herein sought are accomplished wholly by the molecular expansion of liquids or gases under the influence of heat, and limit myself to such forms of construction as will produce the desired result by vaporization, the incidental molecular expansion being practically inoperative and its effect being expended upon so wide an area as to be inappreciable.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a main boiler, a pipe communicating therewith and extending above it for containing a column of water, by means of which the water in the boiler is held under greater than atmospheric pressure, a supplemental boiler or steam-generator so located as to be heated by the circulating water, containing water under a pressure lower than that in the main boiler, a pressure-chamber containing a diaphragm and communicating with the supplemental boiler, and a suitable heat-controlling device, the body of water in the supplemental boiler being in such quantity that the increase in volume when raised from the normal to the boiling-point will be less than the displacement of the diaphragm when raised to operate the heat-controlling device.

2. As an attachment for water-circulating systems, a supplemental boiler, a pressure-chamber communicating therewith containing a diaphragm and a body of water in the supplemental boiler, the quantity of water being such that the increase in volume when raised from its normal temperature to the boiling-point will be less than the displacement of the diaphragm when raised to operate the heat-controlling device.

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