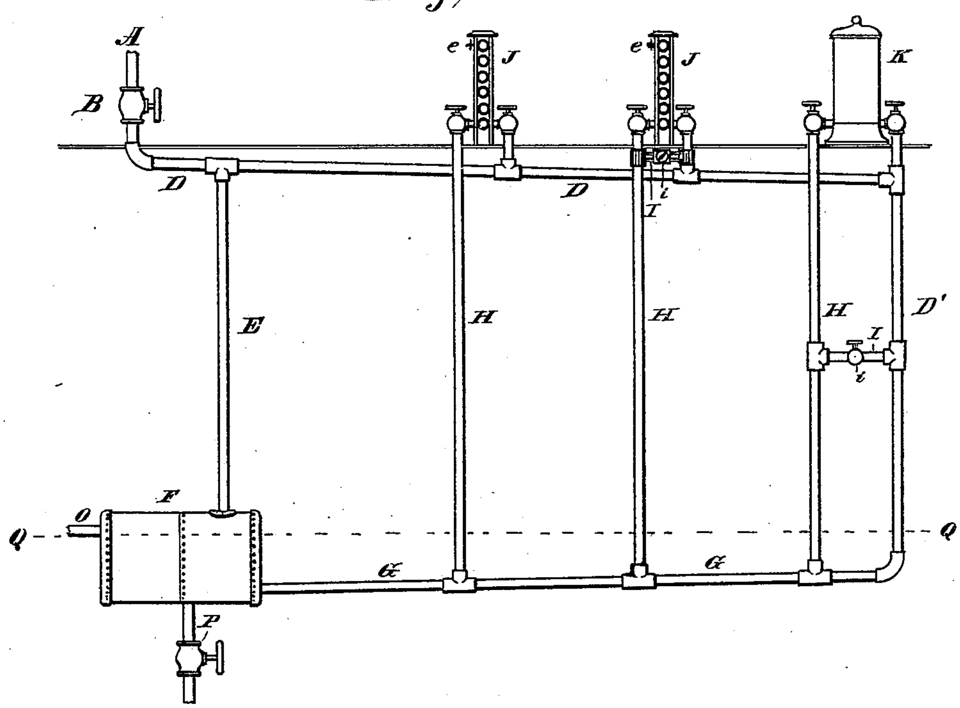
3 Sheets—Sheet 1.

E. F. OSBORNE.

Steam-Piping for Heating, Cooking, &c.

No. 212,320. Patented Feb. 18, 1879.

Fig. 1



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3 Sheets—Sheet 2.

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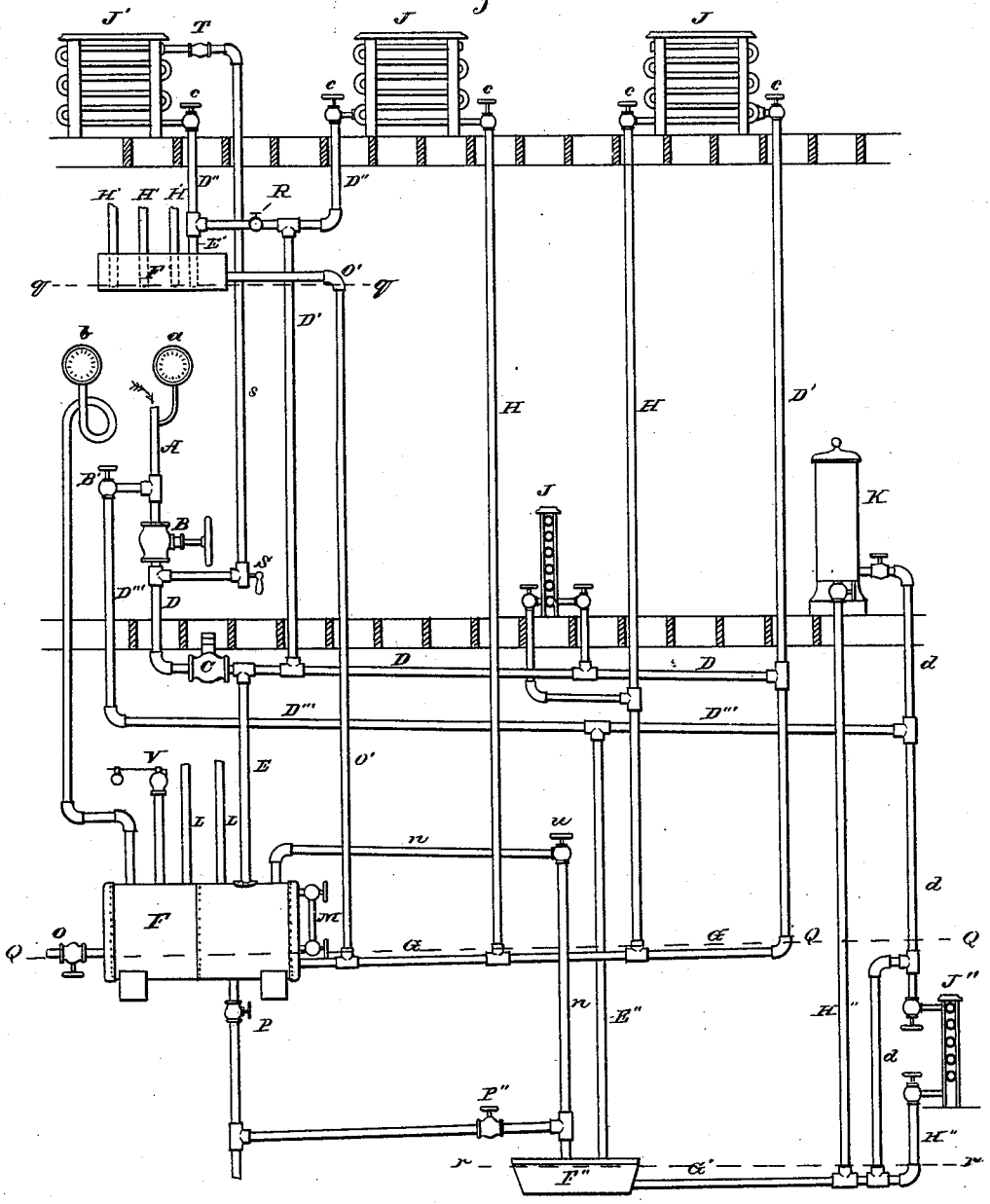
No. 212,320. **Patented Feb. 18, 1879.**

Fig: 2



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Steam-Piping for Heating, Cooking, &c.

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Fig: 3

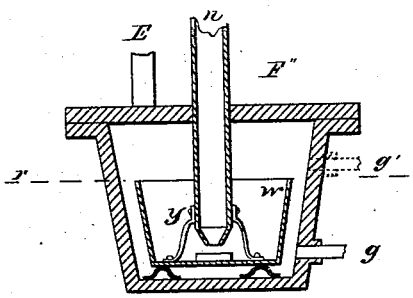


Fig: 4.

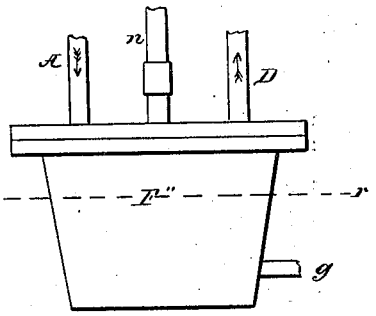


Fig: 5.

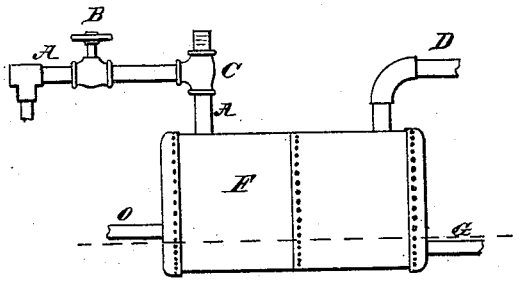
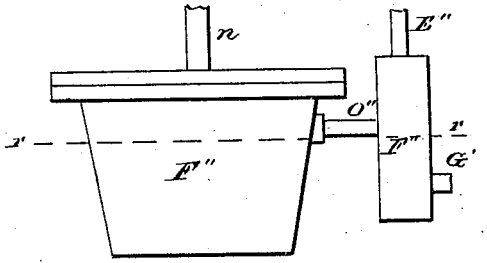


Fig: 6.



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UNITED STATES PATENT OFFICE.

EUGENE F. OSBORNE, OF ST. PAUL, MINNESOTA.

IMPROVEMENT IN STEAM-PIPING FOR HEATING, COOKING, &c.

Specification forming part of Letters Patent No. **212,320**, dated February 18, 1879; application filed October 15, 1878.

To all whom it may concern:

Be it known that I, EUGENE F. OSBORNE, of the city of St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Steam-Piping for Heating, Cooking, and other Purposes; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The improvements herein described as my invention have reference to the piping of steam heating, cooking, and drying apparatus for hotels, manufactories, and public and other buildings, and are more especially intended and adapted for those situations in which high-pressure steam is to be employed.

The objects of my invention are, first, to combine in a single system adapted to high-pressure use the advantages of both high and low pressure methods or systems of applying steam to the purposes named, and, second, to connect and combine in a single general or extended system several divisions or minor systems, each embodying the novel features by which my first object is attained, and having either the same or widely-differing pressures, as may be required.

Advantages of my invention will be found in avoidance of hammering in the pipes, greater cheapness in construction, economy in fuel, and in simplicity of operation.

As will more fully appear from the following description and from the claims, my invention consists, first, in a system of steam-circulation independent of the boiler, except that the latter is the source of supply, and arranged so that a uniform pressure is preserved in all the members of the circuit; second, in a system of steam-circulation independent of the boiler except as a source of supply, and a seal tank or reservoir into which the several members discharge their water of condensation, and whereby a uniform seal is maintained in the several members of the circuit; third, in a system of steam-circulation, a connecting or bridge pipe extending between the feed and escape pipe, so as to cut off the radiator and prevent water from being backed up into the radiator when not in use; fourth, in connection with a steam-generator as a source of supply, two or more steam-circuits independent of each other and of the generator except as a source of supply, and capable of maintaining different pressures; fifth, in connection with two practically-independent steam-circuits capable of maintaining different pressures, a trap whereby one is enabled to discharge into the other; sixth, in a combined trap and seal-tank.

In order to more clearly explain my method of applying the principle of equalized steam-pressure in the supply and return pipes by forming a circuit embracing them both, I have in Figure 1 of the drawings illustrated a single division or a simple system of piping and apparatus. In this figure, A is the induction-pipe or supply-main leading from the boiler or other steam-source. (Not here shown.) B is the main valve. D is a continuation of the supply-main, with which are properly connected the several radiators and other working appliances J J K, provided with air-valves *e*, and requiring substantially the same degree of heat or pressure. D′ is a vertical extension of the supply-main D, leading down to the horizontal return-main G and draining D into the latter. H H are the several return branches leading from J J K to the pipe G. The return-main G terminates in the tank or trap F, entering the same near the bottom, as shown. O is the outlet of the tank F, located somewhat above the entrance of G, so that when the apparatus is in working order water will fill G and stand in the several return branches H H proximately on the line Q Q. P is a "blow-off," by which the water of the entire system illustrated may be discharged when required. I I are pipes connecting the several return branches with the main or branch supply, each having the stop-valve *i*. Finally, E is a pipe connecting the supply D with the return G through the tank F, completing the open circuit F E D D′ G.

By means of the pipe E, connecting D and F, as described, a substantially equable pressure is established throughout the entire division between the supply and return pipes, giving obviously varying and variable elevation of water-seal in the several returns H H,

which rises above the line Q Q in direct proportion to the reduction of steam-pressure above it from the work performed in the several working appliances J K, with which they connect.

The tank F is so proportioned to the extent of the entire division of piping that an ample volume of water is available to supply this varible seal to all the returns, under all circumstances, without impairing the seal of any.

To prevent the rise of water in a return-pipe of a radiator not in operation to an undue height when it might be exposed to freezing, the connection I is introduced, which is closed by the cock *i* when the radiator is in operation, but is opened when the radiator is not in operation.

It is obvious that in the system of piping described there can be no "hammering" or "pounding" in the pipes when steam is let on, since the complete seal in all cases provided in the return-pipes prevents the admission of steam to the radiators by these pipes and the consequent massing of water therein, which, as might be at length explained, is the occasion of such hammering.

In a limited apparatus or division of apparatus, a reservoir like that illustrated in tank F would be unnecessary. The pipe E might connect directly with G, the outlet having the same relative position, as shown; but in nearly every case the use of a tank or reservoir will be found advantageous.

The outlet O may connect with the boiler-feed, or with any other appliance giving suitable resistance to the passage of steam.

Having thus explained my invention so far as exemplified in a single division of apparatus, I proceed to describe my method of combining and connecting several similar divisions to complete a general system adapted to the varied requirements of a large building. In Fig. 2 such a general system is illustrated embracing three divisions, one of which may have a working pressure higher than the others.

Through the rising branches D′ D′ from the supply-main D of division already described steam is conducted to the radiators J and J′ upon the upper floor. The returns H H of J J on this floor are shown to connect with the return-main or seal-pipe G; but they may (sometimes preferably) connect with a pipe corresponding to G, discharging into the secondary tank F′; or, if conveniently situated for the purpose, these returns may discharge directly and immediately into the tank F′, as indicated by H′ H′, which are shown by dotted lines to extend within the tank below the level of its outlet O′. In this case the tank F′ unites the functions of tank and seal-pipe, and the division becomes more clearly distinct from the main or central division having the tank F than it is now shown to be in the drawing.

The tank F′ is connected with the tank F by its outlet or discharge pipe O′, and E′ is the equalizing-pipe for all apparatus having return connection with F′. By means of these several connections the two divisions so far described will obviously have substantially the same pressure, and from the illustration they afford it is plain that generally in the combination of two or more divisions having the same pressure the supply and return pipes of working appliances belonging to them may be connected with either indifferently.

The third division, which I next describe, is the lower one in the drawings, and is intended, say, for cooking, laundry, or other purpose requiring higher pressure. It has its supply-main or feed-pipe D‴ connected with A at a point back of the valve B, and is provided with its own valve B′. Through *d* any number of working appliances J″ and K may be supplied therefrom, H″ H″ being thin return-pipes discharging through G′ into tank or trap F″, and E″ being the equalizing-pipe of the division.

I have shown in this division my modification of a trap, F″, whereby it is adapted to serve both as a trap and sealing-tank. It is generally of the ordinary construction—such, for example, as I have illustrated in detail in Fig. 3—the principal modification for the purpose specified consisting in locating the induction at *g*, Fig. 3, instead of at *g′*, as hitherto constructed.

A pipe, *n*, gives discharge to the trap into the tank F, whither, in the relative positions shown, the water is forced by the higher pressure in the lower division. As O of tank F usually connects with the boiler-feed (through suitable trap or other appliance) by means of the common discharge of the several divisions through the tank F, as described, no steam or heat is wasted. When a suitable variation of pressure exists between pressures in the boiler and the tank F, exhaust-steam from an engine connected with the boiler may be similarly discharged into tank F and utilized. Connections for this purpose are shown at L.

The pipe *n* is provided with the valve *u*, by which and the valve B′ the cooking division may be operated separately from the other divisions; but when this is done other discharge-connection of the trap-tank will be required. An open discharge is shown through the valve P″.

Having given above an explanation of the mode of constructing and operating a single division or several combined divisions of my improved apparatus, from which its principles of operation are clear, it will be readily understood that, instead of connecting the supply D with the tank F by means of the equalizing-pipe E to produce the substantial equilibrium of pressure sought and described, it will be practicable, and, in most cases, preferable, to lead the pipe A directly into the tank F, (or trap-tank, as the case may be,) as shown in Figs. 4 and 5. The tank is thus made the

starting-point and the termination of the steam-circulation.

This mode of connection is intended to obviate any difficulty growing out of a possible difference in pressure between tank and supply when remote from each other, and also to prevent the passage of water from a "foaming" boiler into the feed D. When water from such a boiler enters with the steam the tank F of Fig. 5, it is therein separated from the steam, and only "dry saturated steam" is allowed to pass onto the feed-pipes of the system.

The equalizing-pipe E, when introduced as seen in Fig. 1 or the central division of Fig. 2, is usually adequate to the second purpose last above mentioned, but not always.

It is sometimes necessary or desirable to connect a radiator so that the steam will enter and the water condensed therefrom will emerge through the same pipe, as seen at J′, Fig. 2. For this purpose the air-pipe *s* is introduced and connected, as shown. It is provided with the check-valve T, opening outwardly from the radiator, and the three-way valve S, the latter being arranged to discharge the upper pipe and radiator into the sewer or elsewhere. To fill the radiator with steam, (valve *c* being open,) S is turned to discharge the air when the entering steam has forced the air out of radiator J and pipe *s*. S is turned to give passage with D. In an air-pipe thus connected no water can mass and freeze, and the equable pressure allows the single pipe D″ to serve both as supply and return drip to the radiator J′. It may be incidentally remarked that by making such connection of *s* with D as is shown, and locating valve S with reference to the object in view, the operator is enabled to let steam onto the radiator of an upper floor from his position on a lower one.

In Fig. 2, besides the several connections described, I have shown many auxiliary appliances of great use in the proper construction and successful operation of an extended system of steam-piping. Thus, V is a safety-valve attached to the tank F, equally desirable whether steam is taken directly from the boiler, as in Fig. 5, or from the supply-main, as in Fig. 2. At a convenient point for observation are gages *a* and *b*, showing pressure in A and in the tank F, respectively. The several tanks may advantageously have these attachments. C is a pressure-regulator applied to the supply-main D, if necessary, to regulate pressure throughout the system connected therewith, and M is a water-gage attached to the tank F.

In Figs. 3 and 4 I have shown forms of combined trap and tank.

In Fig. 3 the usual point of induction is indicated by dotted lines at *g*′, and *g* shows it as located by me below the low-water line, to give proper seal in the return or seal pipe *g*. E represents the equalizing-pipe through which the circuit first described is established, and *n* the escape or outlet, already fully explained.

In Fig. 4 suitable connections are shown for making the trap-tank the starting-point and terminus of the circuit, as also amply described above, A representing the boiler-connection, and D the supply-main or feed-pipe of the division to which it belongs, *n* being the outlet, as in the other figure.

Fig. 6 shows an ordinary trap, F″, retained in the alteration of the old to my system of piping, F‴ being a supplemental tank introduced with equalizing-pipe E″ to give the equal pressure and seal required.

The novel feature of an induction-pipe of a trap located below the low-water line, whereby, in connection with the equalizing-pipe or its equivalent, a water-seal may be obtained in the several returns discharging thereinto, is plainly adapted or applicable to all forms of float or intermittent discharge-traps.

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

1. In a system of steam-piping for heating and similar purposes, the combination of the following elements, namely: the feed-pipe D, the return-main G, having elevated outlet O, as described, the connections D′ and H, and the equalizing-pipe E, or its equivalent, together arranged and connected to give equable direct and back pressure with variable water-seal in all return branches H, interposed between opposing steam currents or bodies, substantially as set forth.

2. In combination with a system of steam-piping arranged to give substantially equal direct and back pressure with variable water-seal, as described, a tank or reservoir connected with the seal-main and subject to the steam-pressure of the supply-main, whereby the depth of water in one or many of the return branches may be greatly increased without impairing the seal of others, substantially as described.

3. In combination with a system of steam-piping having equable direct and back pressure and variable water-seal, as described, the pipe I, having valve *i*, and connecting the feed and return branch of a working appliance in the connection, substantially as and for the purpose set forth.

4. The combination, in a steam-heating apparatus, of two or more distinct steam-circuits, each circuit being complete independently of the boiler except as a source of supply, and each provided with a seal-tank or seal-main, as described, connected with each other by the pipes O′ and *n*, uniting the several tanks or mains, substantially as and for the purposes specified.

5. In the combination of two or more divisions of a steam-heating apparatus, adapted, as herein set forth, to work under different pressures, the trap F″, and the pipe *n*, uniting

the divisions and operating to discharge one into the other, substantially as described.

6. A combined tank and trap having its inlet below the low-water line therein, and adapted, substantially as herein set forth, to be connected in an equalized pressure system of piping to give water-seal in the return-main and branches thereof, substantially as described.

In testimony that I claim the foregoing as my invention I hereunto affix my signature in presence of two witnesses.

EUGENE F. OSBORNE.

Witnesses:
WM. M. STANLEY,
M. E. DAYTON.