(No Model.) 2 Sheets—Sheet 1.

T. HENNESSY.

COMBINED HOT WATER AND HOT AIR RADIATOR.

No. 584,357. Patented June 15, 1897.

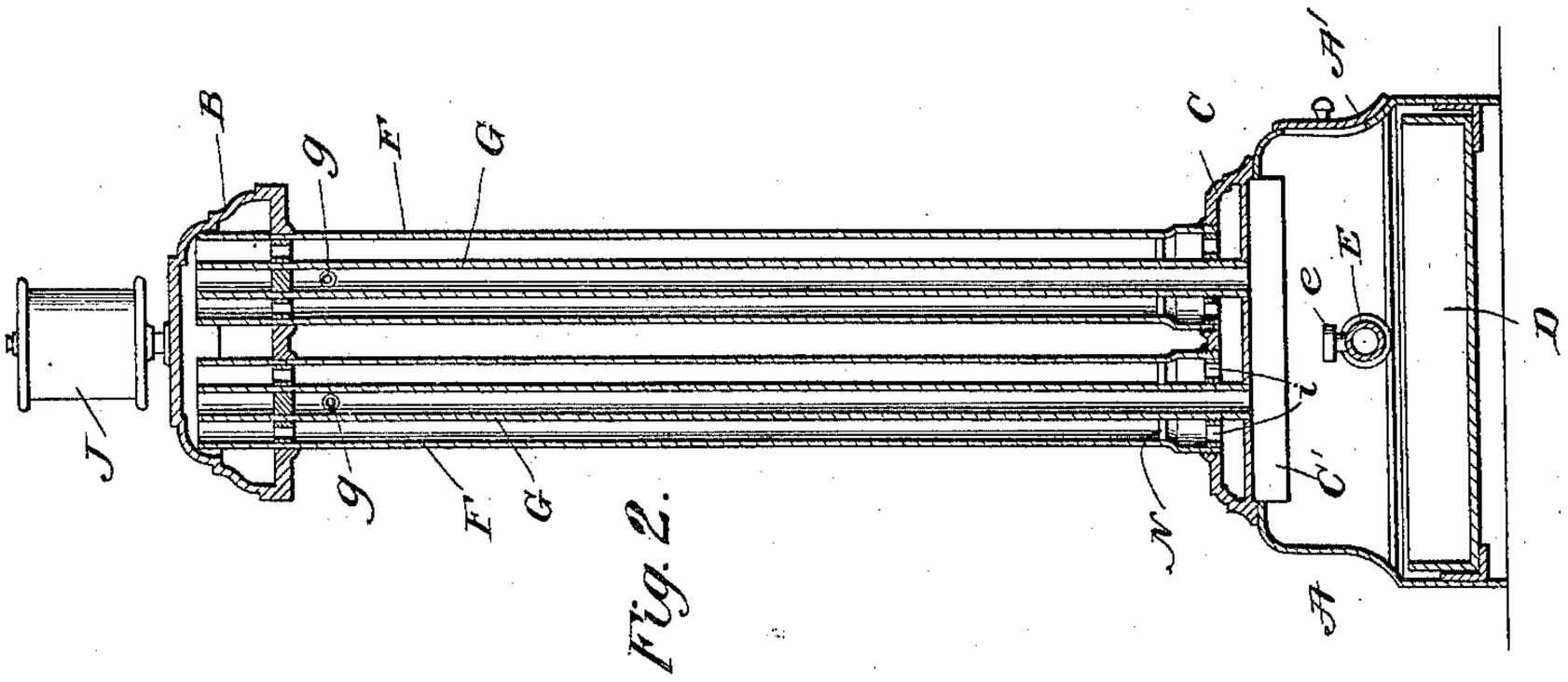

Fig. 2.

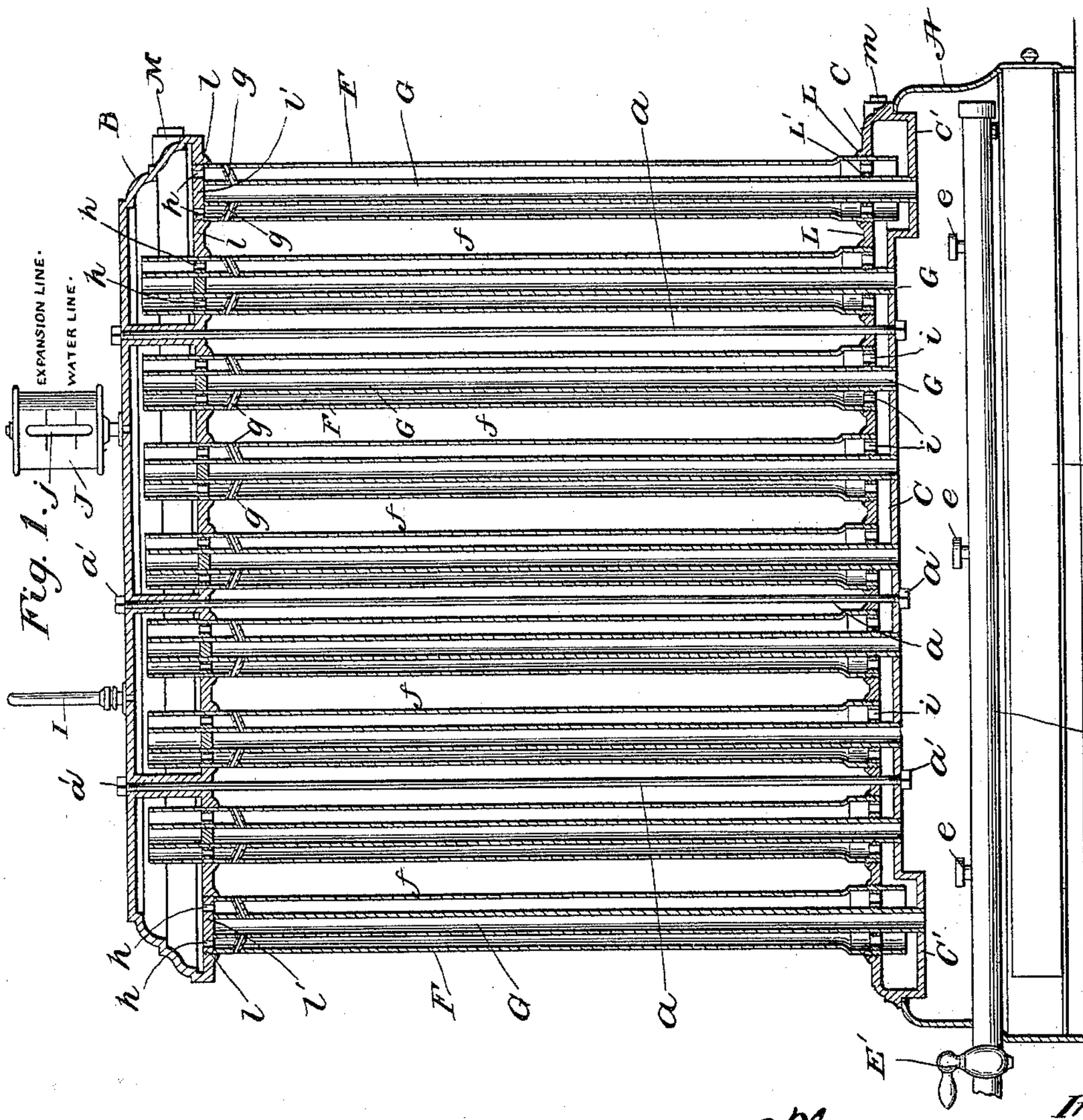

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

T. HENNESSY.

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Fig. 4.

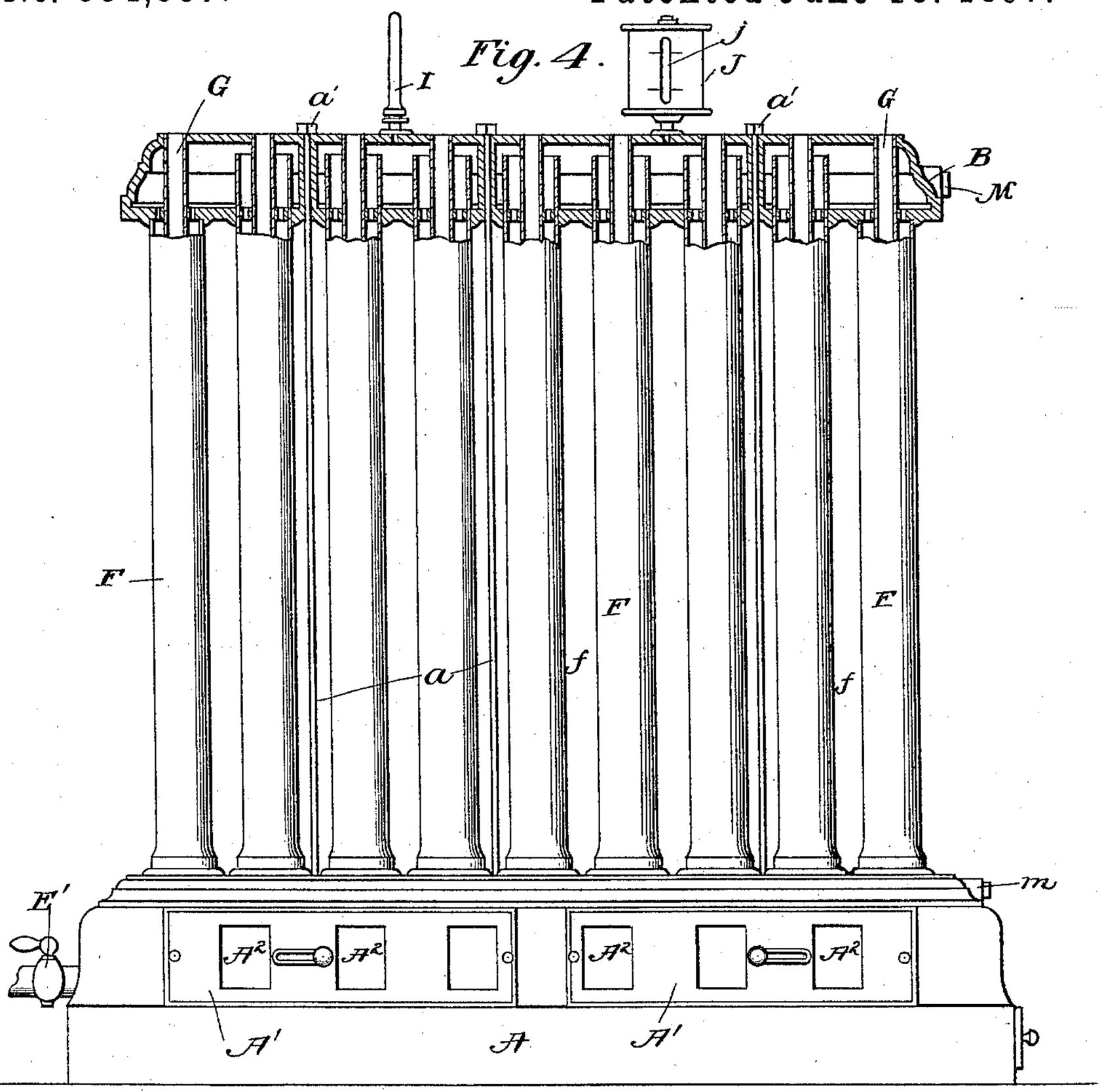


Fig. 3.

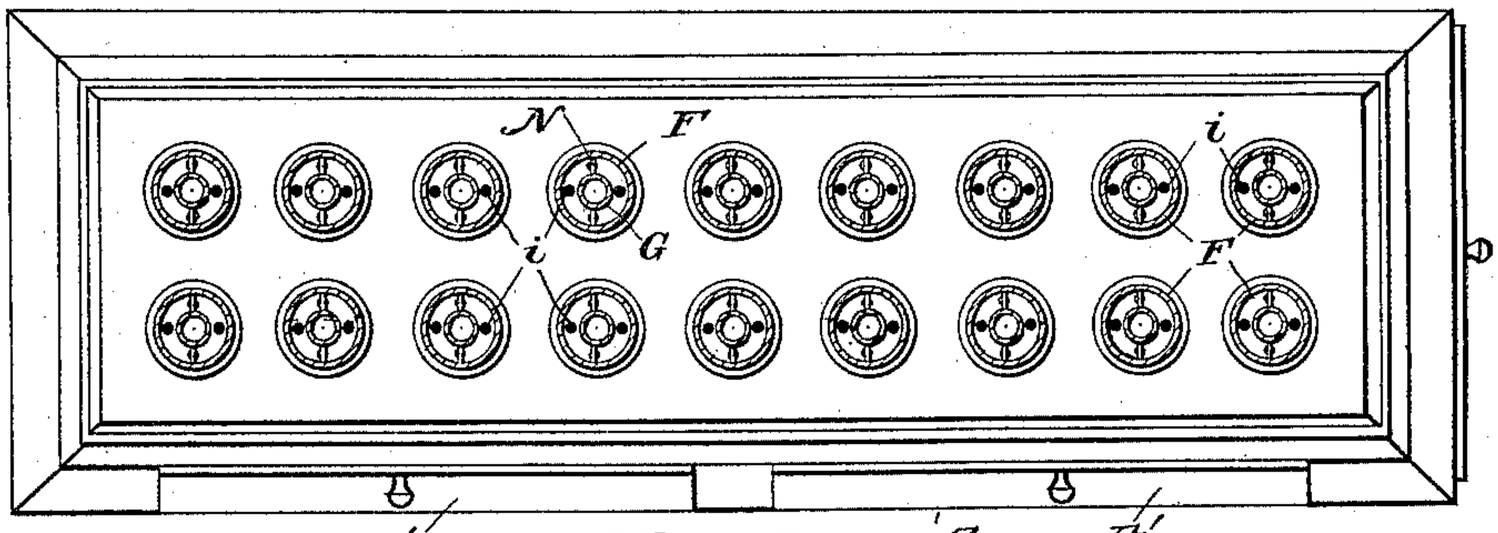
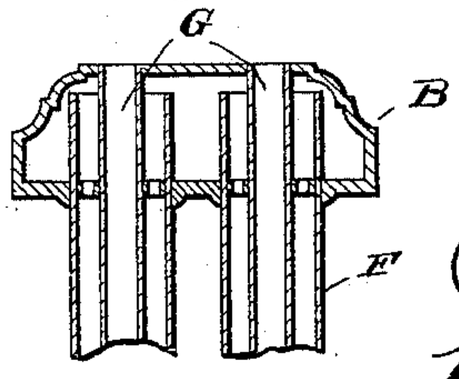


Fig. 5.



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Edw. D. Duvall Jr.
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UNITED STATES PATENT OFFICE.

THOMAS HENNESSY, OF EXCELSIOR SPRINGS, MISSOURI.

COMBINED HOT-WATER AND HOT-AIR RADIATOR.

SPECIFICATION forming part of Letters Patent No. 584,357, dated June 15, 1897.

Application filed November 21, 1895. Serial No. 569,691. (No model.)

To all whom it may concern:

Be it known that I, THOMAS HENNESSY, a citizen of the United States, residing at Excelsior Springs, in the county of Clay and State of Missouri, have invented certain new and useful Improvements in a Combined Hot-Water and Hot-Air Radiator; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to a heating mechanism for apartments and buildings, the same consisting of a combined hot-water and hot-air radiator with which gas, oil, or any other inflammable agent may be employed to furnish the requisite heat at the base of the radiator.

The object of my invention is to provide an improved construction of radiator by means of which a higher efficiency may be attained than is possible with other forms of radiators now in common use.

The invention therefore consists essentially in the construction, arrangement, and combination of parts, substantially as will be hereinafter described, and then more fully pointed out in the claims.

In the annexed drawings, illustrating my invention, Figure 1 is a longitudinal vertical sectional view of my improved combined hot-water and hot-air radiator. Fig. 2 is a transverse section of the same. Fig. 3 is a horizontal sectional plan view. Fig. 4 is a side elevation showing a modification in the arrangement of the heating-pipes. Fig. 5 is an enlarged detail cross-section of the same arrangement shown in Fig. 4.

Similar letters of reference designate corresponding parts throughout all the different figures of the drawings.

A denotes a hollow radiator-base, which may be constructed in any suitable shape and of any desired material. Within this hollow base A is situated the horizontal gas-supply pipe E, which is provided with a suitable number of burners *e e e*, and which is also provided at a point external to the base A with a shut-off or regulating valve E′. The heat generated at the burners *e e e* is used obviously for the purpose of heating the water in the radiator and causing the same to circulate through the water-tubes.

Within the bottom of the hollow base A is a water-pan D, adapted to contain water. The water-pan D is located below the gas-supply pipe E, as shown in Fig. 1.

Although in the present example of my invention I have herein illustrated and described a gas-supply pipe provided with burners, yet it should be distinctly understood that this is given simply as an example of heating means and that in lieu thereof other kinds of burners using other heating agents might be employed with equal efficiency and equally valuable results.

The side of the hollow base A is provided with openings which are covered by the plate or plates A′, having therein openings A^2, which serve as dampers, being furnished with slide-pieces or otherwise equipped so that the supply of air can be made greater or less, and by this means I am enabled to provide an air-inlet into the hollow base A, whereby air is furnished for the purpose of assisting in heating the water in the water-tubes, said air passing upward through certain tubes, as I shall hereinafter more particularly specify, and coming in contact with the hollow top of the radiator, after which it is discharged into the room, apartment, or building to be heated, whereby said air assists in the radiation of the heat for heating the apartment wherein the radiator is located.

Immediately above the hollow base A is a water-chamber C of greater or less size, as may be desired, and preferably of such dimensions that it will extend from end to end of the base A, but in a vertical direction will have a somewhat narrow width, as shown in Figs. 1 and 2. At one or both ends of this water-chamber C it is preferably made thicker at C′ than throughout the balance of its length for the purpose of enabling the circulation of the water to take place more thoroughly and easily in the manner to be hereinafter more clearly pointed out.

My improved radiator is also provided with a hollow top B of greater or less size and having any preferred shape. The top B, the hollow base A, and the water-chamber C, which rests on the hollow base A, are securely con-

nected together by means of the vertical tie-rods *a a*, which are provided at each end with nuts *a' a'*, and also between the top B and the bottom chambers extend the series of water-tubes and hot-air tubes, to which I shall presently refer in greater detail. The hollow top B is adapted to contain water, and the water passes downward therefrom through the water-tubes to the chamber C.

F F F denote water-tubes. Centrally within each water-tube is an air-tube G, which is smaller in diameter and concentric therewith. Between the water-tubes F are the open spaces *f*, the said water-tubes being a convenient and proper distance apart, so that the air of the room can freely circulate through these open spaces *f* and thereby be heated by contact and radiation. The upper and lower ends of the water-tubes F are properly screwed into the walls of the top water-chamber B and the lower water-chamber C.

Perforations or orifices *h h* in the bottom of the top water-chamber B permit the water to pass from the chamber B into the water-tubes F, and perforations or orifices *i i* in the upper plate or side of the water-chamber C permit the water which passes down through the water-tubes F to enter into the chamber C. The hollow top has a greater quantity of water than the hollow base, and as the lower ends of the hollow base are extended below the bottom that side of the radiator is trapped and circulation will not pass that way. Consequently the water in the hollow top, which is not heated to as high a temperature as that which ascends through the perforations in the upper part of the lower water-chamber, will pass downward into the hollow base and force the hot water up through said perforations, thereby having a continuous circulation through the tubes. There may be any number of these inlet and outlet perforations *h* and *i* for each of the water-tubes F. They will be clearly seen by referring not only to the sectional view of Fig. 1, but to the plan view in Fig. 3. Thus it will be seen that the water may have a free circulation between the top water-chamber B and the basal water-chamber C through the various water-tubes F, which tubes F have an annular form in consequence of the existence at the center of each of them of a hot-air tube G. These hot-air tubes G are properly screwed into or otherwise attached to the bottom wall of the top water-chamber B, and they also pass through the basal water-chamber C, being properly screwed into or otherwise attached to both the upper and the lower sides of said chamber C, and they open into the hollow base A, so that the hot air arising from the burners *e e* may enter the open lower end of the air-tubes G and ascending through the same act upon the water which surrounds each one of these tubes for the purpose of heating it and promoting its circulation through the various tubes and chambers. It will be seen, therefore, that each of the hot-air tubes G is surrounded by a body of water which is heated by the presence of the hot-air tube.

The upper ends of the tubes F and G may in certain radiators be made to stop at the bottom plate of the top water-chamber B, into which they are screwed or to which they are attached. Under certain circumstances, however, these tubes may be extended through said bottom plate of the top water-chamber B and upwardly to a point near the top plate of chamber B. In Fig. 1 I have shown all the tubes so extended, with the exception of those at each end of the radiator. With such an arrangement the circulation of the water is promoted and the hot water is carried directly to the top of the radiator. Of course in this case, as well as in the case where the pipes or tubes end at the bottom of the chamber B, it will be understood that the upper ends of the air-tubes are closed by the bottom plate of chamber B.

The air-tubes G communicate at points near their upper ends with the atmosphere surrounding the tubes F, through the short transverse pipes or tubes *g g*, which pass from the tubes G through the tubes F and open into the apartment or room in the spaces *f*. These short branch tubes or pipes *g* are preferably inclined, although it is not necessary to have them so. There may be any number of them. The hot air ascending through the various air-tubes G passes out into the room through the aforesaid lateral openings *g g*.

In the modifications shown in Fig. 4 the upper ends of the tubes are not closed by the bottom wall of the chamber B, but they extend through said bottom wall without interruption to the free passage of a current of air through them, and they enter the top plate of the chamber B and open at that point into the atmosphere of the room, thereby discharging their hot-air contents into the room at the top of the radiator. In this case the lateral branch openings *g g* may be and usually are dispensed with as being unnecessary.

The upper plate or wall of the basal water-chamber C is reinforced at L at the points where the tubes F are screwed thereinto, the reinforcement being for the purpose of making the turn-joint of the outer tube perfectly tight, and also the wall of the same chamber is reinforced at the point L', where the inner or air tubes G are screwed thereinto, the same being for the purpose of making the turn-joint of these pipes perfectly tight. It will also be observed that the bottom of the water-chamber B is reinforced at *l* and *l'* for the purpose of making the joints of the inner and outer pipes at those points perfectly tight. The reinforcement at the points where the inner or air tubes are screwed into the bottom wall of the chamber B is what may be termed a "blind" one, it being arranged, as already stated, so that the air cannot pass upward into the hollow top plate B, but must pass out into the room through the openings *g g*.

The top water-chamber B is provided with

a plug M, as shown in Fig. 1, and the lower or basal water-chamber C is provided with a plug *m*. These plugs are for the purpose of enabling a connection to be made with the radiator of a hot-water pipe extending from the radiator to a hot-water boiler located in the basement or any other part of the building, which pipe can be controlled in the usual way by valves, so that the radiator may be used from a hot-water-circulating boiler whenever it is desired so to use it. When it is operated in this way, the expansion-tank J, which is located upon the top of the water-chamber B, will be removed, and the openings by means of which it is connected with the chamber B will of course be plugged up. When it is required to use the radiator in connection with gas, the valves may be closed from the hot-water boiler and the gas turned on, and hence it will be clearly perceived that my improved radiator may be employed either directly with a gas heating appliance or it may be used with a boiler located in the basement or some other suitable locality.

On top of the water-chamber B is a thermometer I (see Fig. 1) for the purpose of indicating the temperature of the water in the radiator.

J designates an expansion-tank situated on top of the water-chamber B, having a glass index *j*, said tank being for the purpose of indicating the water-line and the expansion-line and allowing the circulation of the water and also the expansion of the same when the same is heated. Through the glass *j* the observer may see the water-line in the radiator.

Referring to Fig. 3, it will be seen that I employ connecting bars or strips N, situated between the inner tubes G and the outer tubes F, for the purpose of longitudinally connecting these tubes and keeping them properly relationed and positioned with respect to each other.

Assuming now that the gas-supply pipe E is connected with the gas-main and is controlled by a gas-regulating valve E′ on the outside of the radiator, the first step to take in the use of the radiator will be to remove the filling-plug in the expansion-tank J and fill the said tank and the radiator with water until the whole is full up to the water-line in the expansion-tank, as marked in Fig. 1. The plug will then be replaced in the expansion-tank, or, if desired, a smaller vent-cock may be used in lieu of the plug. The gas will next be turned on and the burners lighted through the openings A^2 in the plate or plates A′, the light being applied with a match or pilot-light. The resulting flame will at once spread over the bottom of the basal water-chamber C, and immediately the temperature of the water within said chamber and within the radiator will begin to increase. A sufficient amount of air will be allowed to pass through the dampers in the plates A′ to create a proper combustion within the hollow base A. The heated air will at once ascend through the several air-tubes G, striking at the upper ends of said tubes against the bottom of the chamber and escaping into the room through the various openings *g*. The water as the temperature thereof changes will ascend through the water-tubes F, and more particularly through those tubes F which are lengthened at their upper ends to extend to a point close to the upper plate of chamber B, and thereby the water will be carried up to the top of said chamber.

It having already been noted that the ends of the basal water-chamber C are widened at C′ C′, it will be evident that at said ends of the radiator traps are provided, and a circulation of the water will not take place at those points, and hence the water in the upper chamber B, which is not heated to as high a temperature as that which ascends through the pipes extending to the top of the chamber B, will pass downwardly into the basal chamber C and force the hot water up through the openings *i i*, thereby insuring a continuous circulation of the water through the several tubes. It will thus be seen that by my improved arrangement of inner and outer tubes, the inner tubes functioning as air-tubes and the outer tubes functioning as water-tubes, said tubes being connected to water-chambers at top and bottom in the manner I have already specified at length, I am enabled to effectuate many useful results by insuring a perfect circulation of the water, a perfect heating of the water, and complete radiation of the heat generated within the radiator, and a consequent thorough heating of the atmospheric air within the room wherein the radiator is located.

Numerous changes in the exact construction and arrangement of the several parts of my improved radiator may be made without departing from the essentials of my invention, and I therefore reserve the liberty of so varying, rearranging, readapting, and modifying the various elements, both as to relation, construction, and function, as to insure the best results in actual practice, although without departing from the broad lines of the invention as herein laid down in the specification and claims.

Although I have herein described the water and air tubes as being screwed into the upper and lower water-chambers, yet I do not wish to be restricted to such a connection, because it is evident that the pipes may be cast with the tanks or arranged in any other way that is thought best.

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

1. In a radiator, the combination of the lower water-chamber having depressions in its bottom, the upper water-chamber, and water-tubes providing communication between the two chambers, the tubes in which the liquid rises extending into the upper chamber and those in which the liquid descends

extending into the depressions of the lower water-chamber.

2. In a radiator, the combination of the lower water-chamber having depressions in its bottom, the upper water-chamber, water-tubes providing communication between the two chambers, the tubes in which the liquid rises extending into the upper chamber and those in which the liquid descends extending into the depressions of the lower water-chamber, and air-tubes leading from the base to the bottom of the upper water-chamber, the said air-tubes being inclosed within and concentrically formed with said water-tubes.

3. In a radiator, the combination with the upper chamber having a perforated bottom, of a lower chamber having a perforated top, enlarged chambers C′ C′ formed in the lower chamber, water-tubes extending into said chambers C′ C′, water-tubes connecting the upper and lower chambers, air-tubes within the water-tubes, connections between the various water-compartments, and lateral passages leading from the air-tubes through the water-tubes.

4. In a radiator, the combination with the lower tank, of a dip at the ends thereof, water-tubes extending into said dip, heating means below the lower tank, the upper tank, water-tubes extending from and communicating with the upper part of the lower chamber, and extending to within and near the top of the upper chamber for the purpose of controlling the circulation.

5. In a radiator, the combination with the upper tank having a perforated bottom, of the lower tank having a perforated top and enlarged chambers or ends C′ C′, water-tubes extending from and communicating with the upper part of the lower chamber, and extending to within and near the top of the upper chamber, those tubes which enter the chambers C′ C′ being extended downward to a point near the bottom of said chambers, for the purpose of controlling the circulation.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS HENNESSY.

Witnesses:
HERBERT W. COOMBS,
JOHN G. PARK.