2 Sheets--Sheet 1.

B. HOLLY.

Steam Heating Radiator.

No. 232,821. **Patented Oct. 5, 1880.**

Fig 1.

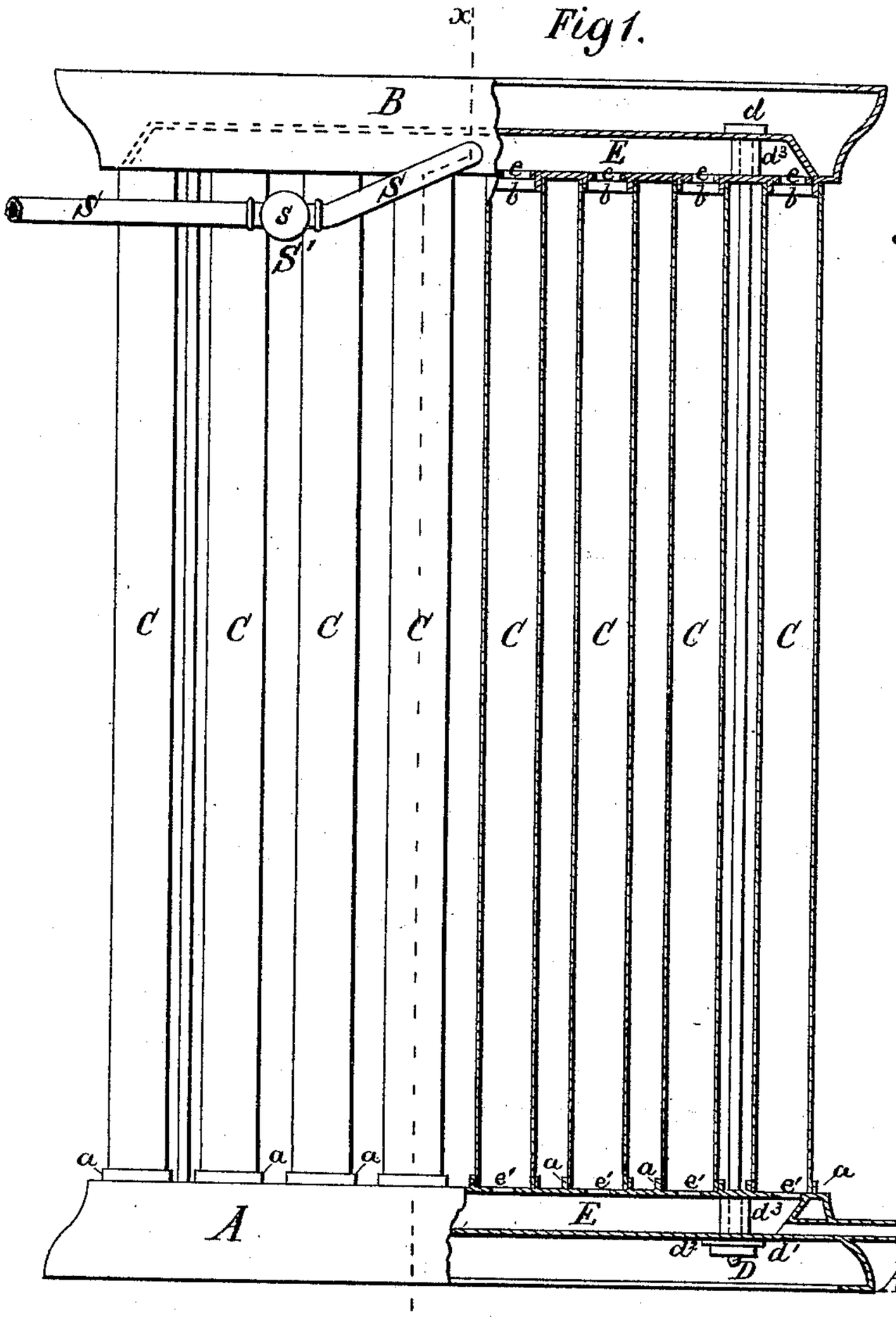


Fig 2.

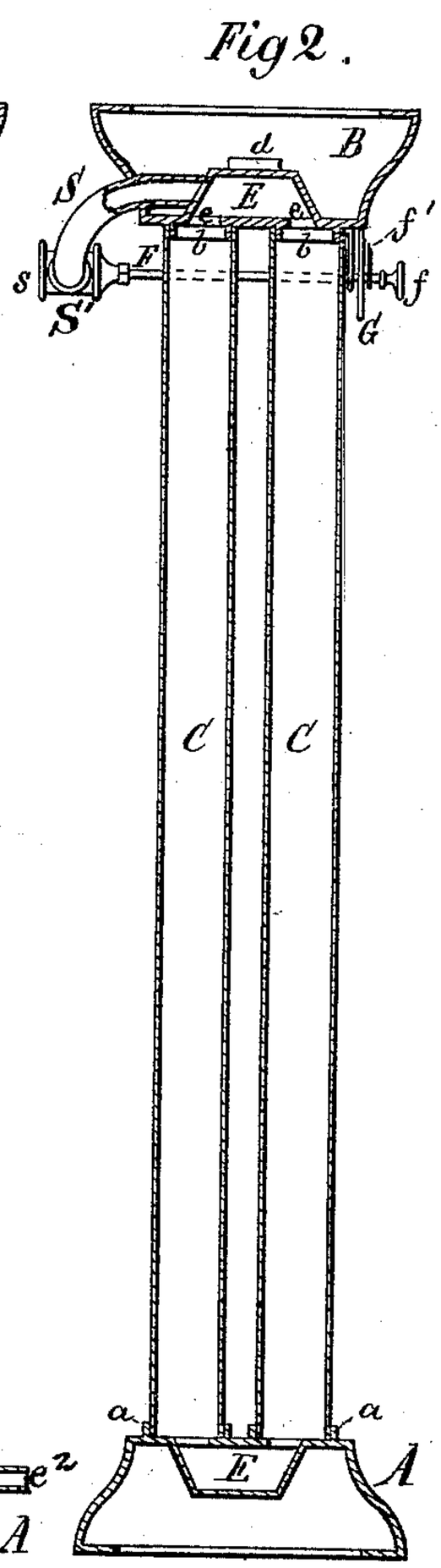


Fig 3.

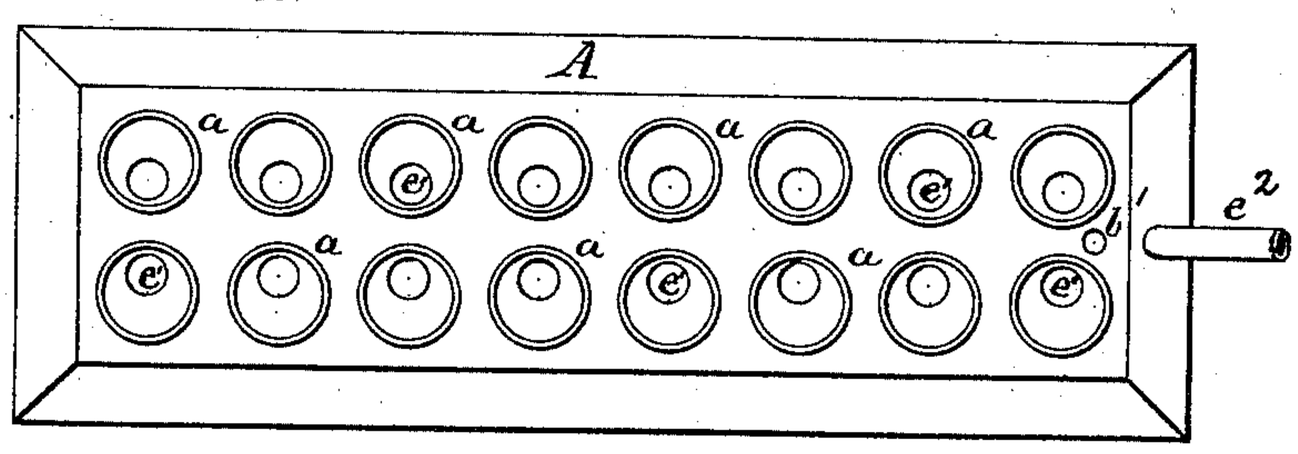


Fig 4.

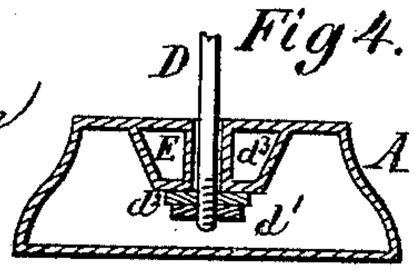
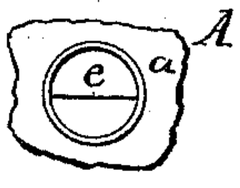


Fig 5.



Witnesses:
G. H. Thes. Lang
J. P. Th. Lang

Inventor:
Birdsill Holly
by Fenwick Lawrence
Mason
Attorneys

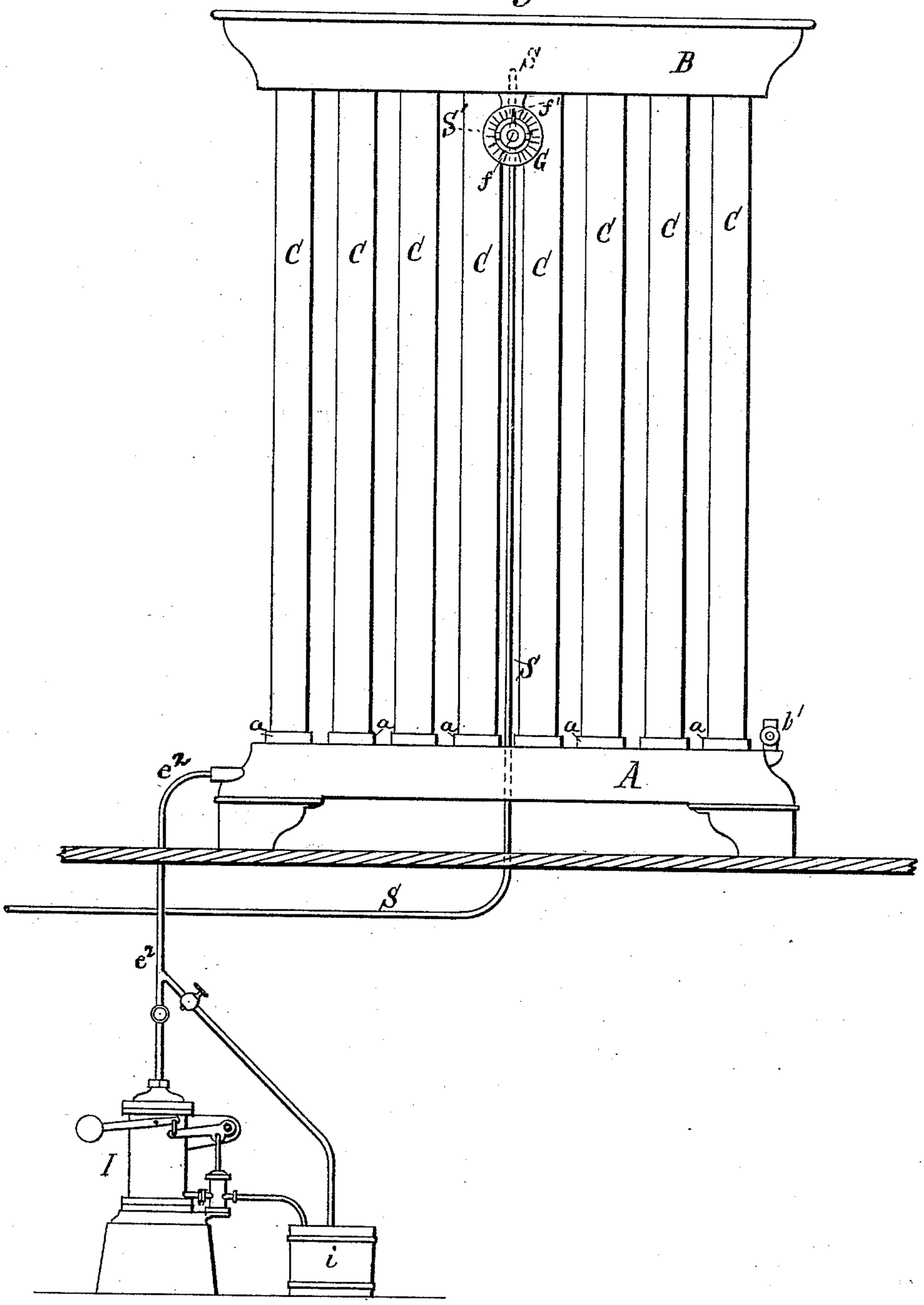
2 Sheets--Sheet 2.

B. HOLLY.

Steam Heating Radiator.

No. 232,821. **Patented Oct. 5, 1880.**

Fig 6.



Witnesses:
G. H. Theo Lang
J. P. H. Lang.

Inventor:
Birdsill Holly
by
Marsh Fenwick & Laurence
Attorneys.

UNITED STATES PATENT OFFICE.

BIRDSILL HOLLY, OF LOCKPORT, NEW YORK.

STEAM HEATING-RADIATOR.

SPECIFICATION forming part of Letters Patent No. 232,821, dated October 5, 1880.

Application filed April 2, 1879.

To all whom it may concern:

Be it known that I, BIRDSILL HOLLY, of Lockport, in the county of Niagara and State of New York, have invented a new and useful Improvement in Radiators, which improvement is fully described in the following specification and accompanying drawings, in which—

Figure 1 is a back view of my improved radiator, partly in elevation and partly in section. Fig. 2 is a vertical transverse section in the line *x x* of Fig. 1. Fig. 3 is a top view of the lower reservoir or chamber as it appears when the heating-pipes are removed. Fig. 4 is a vertical sectional detail of a portion of the lower chamber, showing the construction of the uniting-bolts and their bearings or abutments. Fig. 5 is a detail view of a modified construction of one of the ports of the chamber opening into the heating-pipes. Fig. 6 is a front view of the radiator connected with a street-main steam-supplying apparatus and with a condensed-water-collecting apparatus.

This invention relates to steam heating-radiators, and is particularly adapted for use in connection with my system of steam-heating, patented July 17, 1877, in which system the steam is delivered to the consumer through underground street-mains, the same as water and gas are delivered at the present time.

The nature of my invention consists—

First, in a radiator comprising in its construction a steam-gaging contrivance which controls the amount of steam-pressure and determines the amount of radiating-surface to be brought into use and the height of the column of atmospheric air to be maintained in the tubes of the radiator, an upper reservoir, a lower reservoir, and intermediate thin metal vertical radiating-surfaces, said radiator having a steam-induction pipe at its top, a condensed-water-discharge passage, ports leading downward into the radiating-pipes, ports leading to the discharge-pipe for condensed water, and one or more constantly open or valveless ports for the unrestricted flow of atmospheric air through them accordingly as the amount of pressure in the pipes of the heating-surface is increased or decreased. By this part of my invention the atmospheric air is allowed to fill the lower reservoir and lower portions of the vertical radiating-tubes, and the steam is admitted under perfect control into the upper reservoir and upper portions of the said tubes, and is supported by said air while its heat is being absorbed and rapidly radiated by the thin metal tubes, the amount of surface exposed to the heat of the steam being in accordance with the pressure of the steam and the rapidity with which the heat thereof is absorbed and radiated by the thin metal tubes, and the height of the column of air in the tubes being greater or less as the pressure of the steam is increased or decreased. The surface acted upon by the steam and by the condensed hot water on its passage to the discharge-pipe, being very thin, causes the air of the room to be quickly and effectively heated, and the amount of heating-surface brought into use can be varied according to the pressure of the steam upon the atmosphere in the pipes, and thus a radiator which has sufficient heating capacity or surface for the coldest winter weather can have the amount of its radiating-surface which is exposed to the direct action of the steam-heat so reduced at will as to adapt it for mild or spring weather.

Second, in an index-scale and induction-valve combined with the within-described radiator, whereby the amount of radiating-surface brought into action by exposure to steam-heat may be regulated in accordance with the requirements of the temperature of the outer atmosphere or weather.

Third, in the peculiar means, hereinafter described, whereby the parts of the radiator are united and rendered safe against injury from expansion by heat.

Fourth, in the peculiar means, hereinafter described, whereby the vertical tubes are secured in their places and prevented from leaking.

In the annexed drawings, A represents the base, B the head, and C C the vertical tubes, of a radiator, secured together by vertical bolts D. S is a supply-steam pipe provided with a steam-gaging contrivance, as at S′, and connected to head B. *b′* represents one or more ports for the free flow of atmospheric air into and out of the tubes C C.

The base A and head B are provided with distributing-reservoirs E and ports *e*, the latter of which establish communications be-

tween the reservoirs E and the tubes C C. Around the ports e', and on the upper surface of the lower reservoir, collars or socket-rims *a* are provided, and similar collars or socket-rims *b* are provided on the lower surface of the upper reservoir.

Into the socket-rims *a* the lower ends of the tubes C are fitted, and the upper socket-rims, *b*, receive the upper ends of said tubes. By this construction any water which may collect from condensed steam in the upper reservoir is caused to escape from this reservoir by way of the ports *e* and pass along the inner surface of the tubes into the lower reservoir without leaking through the joints.

A pipe, e^2, conducts the water from the lower reservoir and out of the heated room to a suitable receiver, as illustrated in Fig. 6.

The pipe S is provided with a suitable valve at *s*, operated by a stem, F, which extends from the valve to the front of the radiator, where it is provided with a knob, *f*, and index-finger f'. The front portion of the stem F passes through the center of an index-plate, G, suitably fastened to the head B, which in practice will be provided with a circular scale having numbers representing the graduations of a thermometer.

A number of bolts, D, pass vertically through the base A and head B, and by means of heads *d* at one of their ends and nuts d' and elastic washers d^2 unite the parts A, B, and C of the radiator in such manner that the elastic washers will compensate for the expansion and contraction of the radiator under changes from heat and cold.

The bolts D are isolated from the steam in the reservoir by means of hollow stays d^3.

The supply-steam pipe S may be a service-pipe from one of the steam-supplying street-mains, and the waste water from the lower reservoir may be conducted by the pipe e^2 into a hot-water-distributing receiver, I, or into a vat, *i*, as seen in Fig. 6, and thus serve for use in kitchens and other places.

The radiator as described is not intended to be subjected to steam-pressure great enough to force the steam into the room. Consequently it can be made of very light material, as sheet-iron or tin for the tubes and thin cast-iron for the base and head, and being made of such materials its heating capabilities will be greatly enhanced, and a rapid escape of heated air, both by radiation through the metal and by circulation through the port b', takes place.

To heat a room or rooms with this radiator the operator turns the knob *f* until the pointer or finger f' stands opposite a number on the index-plate G which corresponds with the desired degree of pressure in the radiator. By this operation the supply-valve is opened, and a continuous current of steam is admitted to the upper reservoir of the radiator under a relatively high pressure.

The steam, on entering the upper reservoir, immediately expands until its pressure is reduced in the tubes C to the proper degree—say a little above fifteen pounds to the square inch—which occurs by the time it has descended the desired distance in the tubes against the atmosphere therein, and at the same time its heat is imparted to the metal of the radiator and to the air therein. The air being heavier than steam, and the steam by radiation of its heat becoming reduced in pressure supports the same at a greater or less elevation in the tubes, the point of elevation being in accordance with the volume or pressure of supply-steam. During this operation the steam becomes condensed, and the water of condensation is collected in the lower reservoir and drawn off through the pipe e^2.

The heated air in the reservoir gives off part of its heat to the radiator, and finally circulates through the port b' into the room, and at the same time a constant supply of cold air is admitted through said port into the lower part of the radiator.

It will be seen that the main heating portion of the radiator is that which is exposed directly to the steam, and that as is the height of steam in the tubes C, supported by the atmospheric air therein, so will be the amount of heat radiated by the radiator into the room, while at the same time the heated air in the lower portion of the reservoir circulates into the room in a moist state, and the water of condensation in the radiator aids in heating the lower portion of the tubes.

It will be understood that the admission of fresh steam into the radiator is at all times so controlled that the atmospheric air is not wholly expelled from the radiator, and thus an overflow of steam into the room through the port b' is prevented, no matter how high may be the pressure of the steam in the street-supply main.

I am aware that steam-radiators made of both cast and wrought metal, and also of thick and thin sheet metal, are not new; also, that it is old to admit steam at the top and permit it to escape from the base of a radiator; also, that it is common to provide radiators with air-vents which are closed either by hand or automatically after the air is fully expelled by the steam from the radiator. I therefore do not claim any of these old contrivances as my invention; but

What I claim is—

1. The radiator comprising in its construction a steam-gaging contrivance, S′, such as described, an upper reservoir provided with a steam-supply pipe, S, and ports *e*, a lower reservoir having ports e', thin metal radiating vertical surfaces C, one or more constantly-open or valveless ports, b', for the continuous passage of atmospheric air through them, and a port, e^2, for the escape of water of condensation, substantially as and for the purpose described.

2. The combination of the upper reservoir, E and the supply-pipe S, having a valve-stem,

F, pointer or finger f', and index-plate G, substantially as set forth.

3. The combination of the base A, head B, tubes C, bolts D, and hollow stays d^3 of the base and head, elastic washers d^2, and nuts d', substantially as set forth.

4. In the described radiator, the combination of the base A, having outer socket-rims, *a*, the tubes C, and the head B, having inner socket-rims, *b*, substantially as and for the purpose set forth.

BIRDSILL HOLLY.

Witnesses:
LEONARD EVERETT,
B. D. HALL.