

(No Model.)

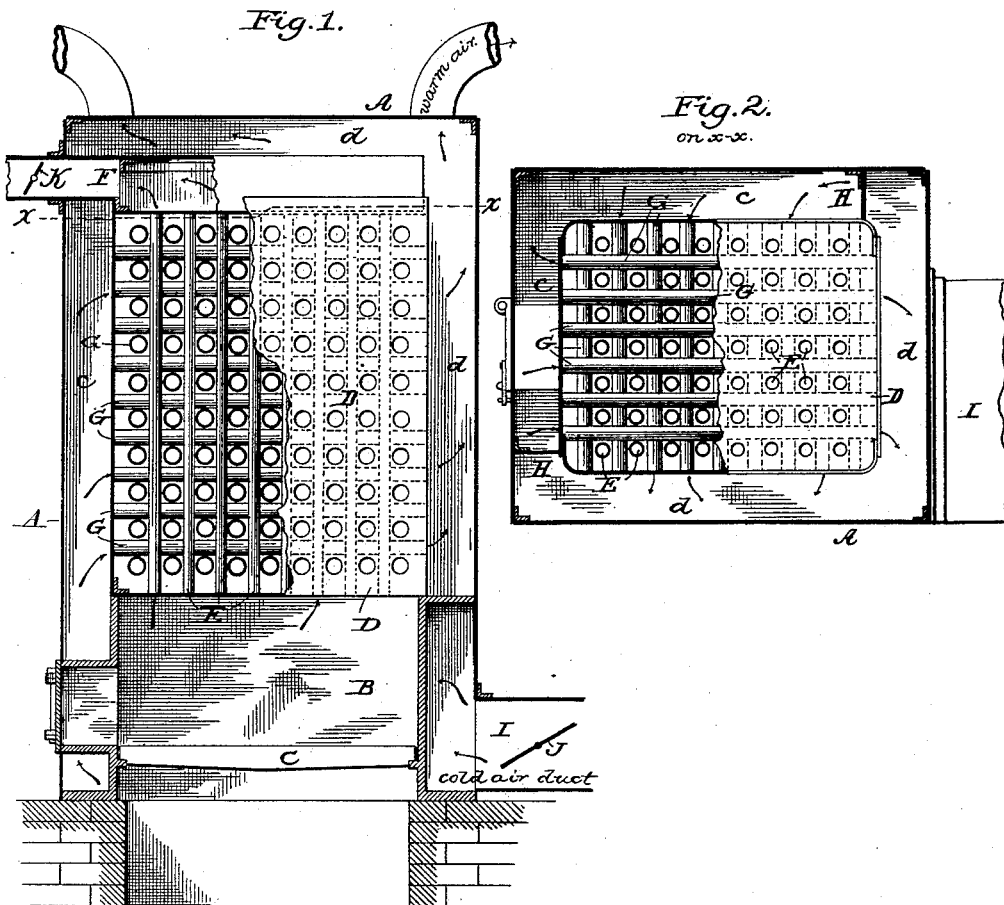
3 Sheets—Sheet 1.

E. REYNOLDS.

COMBINED STEAM GENERATOR AND RADIATOR.

No. 345,991.

Patented July 20, 1886.



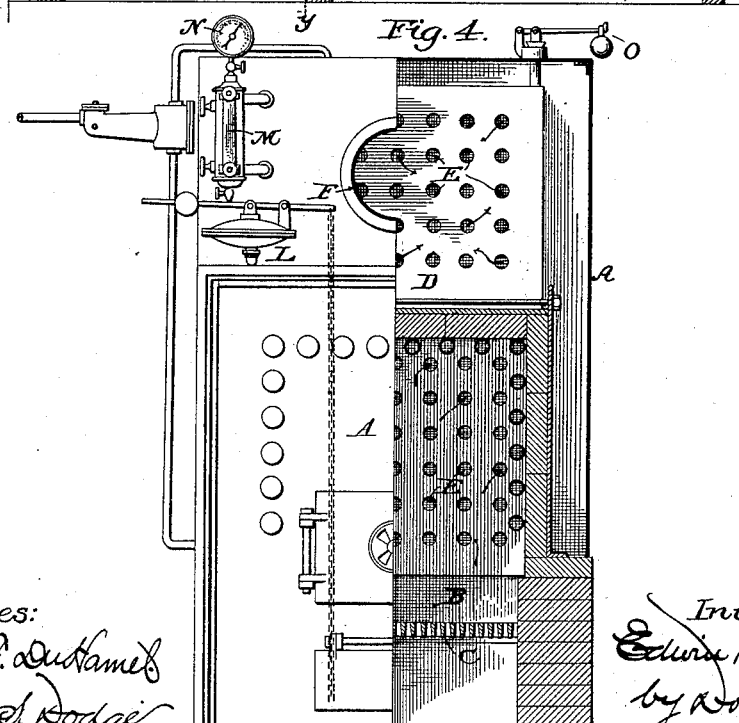
Witnesses:  
James F. Outland  
Walter S. Dodge.

Inventor:  
Edwin Reynolds  
by Rodger Son,  
his Atty.

3 Sheets—Sheet 2.

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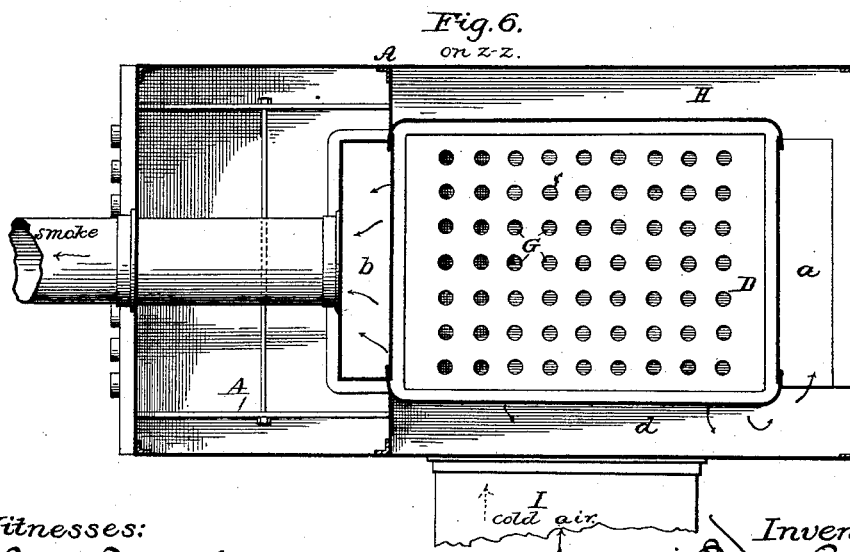
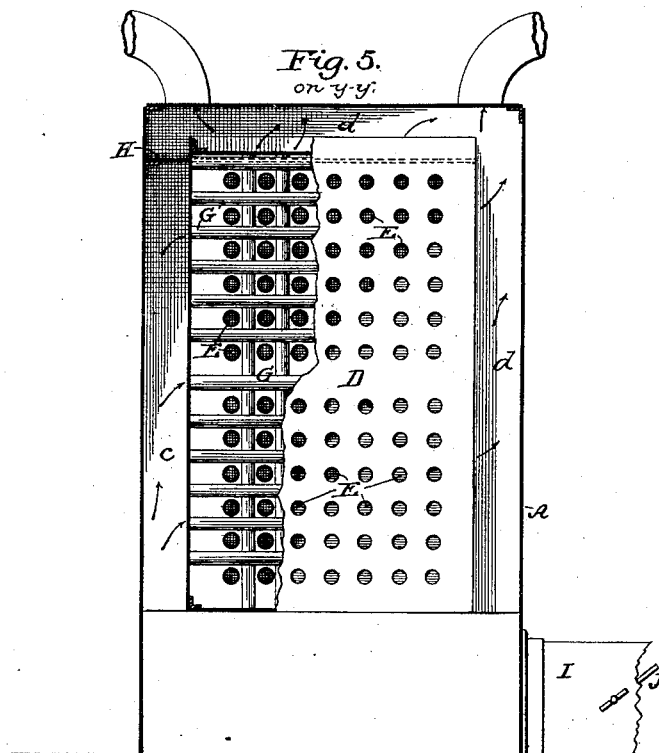
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# UNITED STATES PATENT OFFICE.

EDWIN REYNOLDS, OF MILWAUKEE, WISCONSIN.

## COMBINED STEAM GENERATOR AND RADIATOR.

SPECIFICATION forming part of Letters Patent No. 345,991, dated July 20, 1886.

Application filed November 4, 1885. Serial No. 181,843. (No model.)

*To all whom it may concern:*

Be it known that I, EDWIN REYNOLDS, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Combined Steam-Generator and Radiator, of which the following is a specification.

My invention has reference to the heating of buildings; and it consists in a combined steam-generator and radiator hereinafter more fully described, in which the heat of the fire is first imparted to the water in the generator, and by the water to air passing through tubes or flues traversing the generator. By this plan the apparatus is caused to give heat to the rooms from the moment the temperature of the water rises above that of the incoming air, instead of requiring a temperature of 212° and upward before the heating begins, and the benefits of the fuel are more completely utilized than heretofore.

The manner of carrying out my invention may be varied greatly as to details, the only essential requisites being that the products of combustion be made to heat the water of the generator and that the water be in turn caused to heat a body of air passing through said generator.

The setting of the furnace, the particular arrangement of fire and air flues, and other like matters may and will be varied to suit the particular location, arrangement, and size of the building or apartments to be heated, the character of the fuel to be used and other influencing considerations.

In the drawings I have illustrated two slightly differing plans embodying my invention.

Figure 1 is a vertical sectional view of my generator and radiator showing the fire-pot directly beneath the generator, the fire or smoke flues passing vertically through said generator, and two sets of air-flues traversing the same horizontally at right angles to each other. Fig. 2 is a horizontal section on the line *xx* of Fig. 1; Fig. 3, a longitudinal vertical section of the combined generator and radiator, showing the fire or smoke tubes or flues arranged horizontally in two series, and the air-flues traversing the generator both horizontally and vertically at right angles to the fire tubes or flues. Fig. 4 is a half-sectional

front elevation of the apparatus shown in Fig. 3. Fig. 5 is a vertical sectional view of the same on the line of Fig. 3, looking toward the rear, the flue-plate partially broken away; Fig. 6, a horizontal section on the line *zz* of Fig. 3.

The manner of utilizing or applying the heat produced by my improved apparatus may be varied to suit special cases or requirements. Thus I propose in some cases to employ no outside radiators, but to rely solely upon the heating of the requisite volume of air to proper temperature within the apparatus itself, the heat of the water being so far reduced or kept down by the cooling effect of the air passing through the flues that no steam shall be formed, and warm air alone being produced and carried to the rooms. In other cases, and especially where by reason of insufficient draft of the flues or great exposure of the apartment to be heated there may be difficulty in delivering a due amount of warm air thereto, I contemplate employing radiators in such apartments and carrying steam thereto from the generator.

In order that the apparatus may be susceptible of use in either way at will, and without change in construction, I provide the same with air-inlets of ample capacity to furnish the full amount of air likely to be required under any circumstances, and I furnish such inlets with valves or gates by which their capacity may be reduced, and the temperature of the water consequently allowed to be raised sufficiently to produce steam. To further provide for the reduction of steam when required, the furnace is supplied with drafts and regulators.

Referring now to the drawings, A indicates the external casing or body of the apparatus; B, a fire box or chamber provided with a suitable grate, C; and D, the generator, a steam-tight body, advisably of wrought iron, put together in the usual manner of constructing steam-generators.

E E indicate smoke or fire tubes opening from the fire-box B, and traversing the generator D, either vertically, as in Fig. 1, or horizontally, as in Fig. 3, in which latter case the tubes E are shown as consisting of two sets, the first extending from the fire-box to a

smoke-chamber, *a*, at the rear of the generator, and the second set returning from said smoke-chamber *a* to a similar chamber, *b*, at the front, from which the smoke and products of combustion pass off through a pipe, *F*, to a chimney or directly to the atmosphere. The flames and products of combustion thus passing through the flues or tubes *E* heat the water which surrounds them in the generator *D*, with the exception of the upper tier, ordinarily.

Passing through the body of the generator *D*, from side to side and from front to rear when the vertical fire or smoke tubes are employed, as in Fig. 1, or passing through said body from side to side and from top to bottom when the smoke or fire tubes are arranged horizontally, as in Fig. 3, are air tubes or flues *G*.

Diaphragms *H*, arranged within the outer casing, *A*, and generator-body *D*, serve to separate the cold-air space *c* from the warm-air space *d*, and air is admitted to the space *c* through suitable inlets, *I*, as indicated in the several figures. The smoke-spaces *a* and *b* are also inclosed and separated from the air-spaces, as illustrated in the drawings. Air entering the inlets *I*, and prevented by the diaphragms *H* from entering directly into the warm-air space *d*, is carried to the cold-air ends of the air-flues *G*, which it traverses, and through which it passes to the warm-air space *d*, from which it is conveyed by pipes to the required points, as in any ordinary warm-air heating system.

In passing through the tubes or flues *G* the air takes up a large percentage of the heat of the water, and of course by just so many degrees reduces or keeps down the temperature of the water. In other words, the apparatus acts upon the principle of a condenser, and so long as the volume of the air and its temperature are sufficient to take up all heat of the water from 212° upward no steam will be formed; but whenever the cold air fails to thus take up all heat from 212° upward steam will be formed at a rate varying with the temperature of the water.

The air-inlet *I* is furnished with a valve, *J*, by which the volume of cold air entering the radiator may be varied and controlled, and of course as the volume is lessened the amount of heat taken up in passing through the flues *G* will be correspondingly lessened and the temperature of the water increased. So, too, the furnace is provided with a draft-regulator, *K*, or the draft and the combustion may be controlled by opening or closing the fuel and ash-pit doors, and in this way the temperature of water may be varied, so that by properly

regulating the fire and the air-supply, each in relation to the other, the action of the apparatus can be accurately controlled, and steam may be formed or not, and a large or a small volume of air may be heated to a moderate or a higher temperature, as circumstances require.

The furnace will be provided advisably with a steam-draft regulator, *L*, and will of course have water and steam gages *M* and *N* and safety-valve *O*.

An automatic valve may be provided, if desired, to supply water to and maintain it at proper level in the generator.

It is obvious that one or more large fire and air flues may be substituted for the numerous small ones, but not with as good results.

I am aware that it is not new to provide a generator with air-flues, and that it is also old to construct a heating-drum with air-flues at right angles to one another, and to these features, *per se*, I lay no claim. I am not aware, however, that anyone has heretofore provided a generator with two sets of flues or passages for the travel of the fresh air through the water-receptacle, the flues of one set being arranged at right angles, or substantially so, to those of the other set. Under this arrangement I am enabled to utilize to the greatest possible extent the heat of the water, insuring an economical use of fuel and an exceedingly compact construction and arrangement.

Having thus described my invention, what I claim is—

1. In combination with a casing, *A*, a fire-box, *B*, generator *D*, provided with smoke-flues *E* and with two sets of air-flues, *G*, those of one set crossing those of the other, and diaphragms separating the smoke and airspaces.

2. The combination of casing *A*, fire-box *B*, grate *C*, water-vessel *D*, fire-flues *E*, a smoke-chamber at the end of said flues, smoke-pipe *F*, air-flues *G*, diaphragm *H*, and air-inlet *I*.

3. In a heating apparatus, a steam-generator provided with smoke-flues and with two sets of flues or passages for the travel of fresh air through the water-receptacle, the air-flues of one set being arranged at right angles, or substantially so, to those of the other set.

4. A vessel for heating purposes provided with suitable air and fire tubes and with six rectangular sides, all of said sides being supported by and connected to the air and fire tubes to withstand internal pressure, as shown and described.

EDWIN REYNOLDS.

Witnesses:

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