To all whom it may concern:

Be it known that I, DAVID CARLISLE HUMPHREYS, of Lexington, Virginia, have invented a new and useful Improvement in a Combination Hot-Air and Hot-Water Heater for House-Warming, Constituting a Complete System or Apparatus, of which the following is a specification.

My invention relates to heaters for house-warming where both air and water are used to convey the heat from the furnace or heater to the rooms to be warmed; and the objects of my improvement are, first, to provide a completely-water-jacketed fire-pot, to prolong the life of the fire-pot, to prevent its becoming red hot and "burning" the air, and to prevent its cracking and letting gas escape into the house; second, by introducing a vessel, which I call a "heat-economizer," between the furnace and the chimney to cause a portion of the heat of the smoke and combustion-gases which is now wasted to pass into water, which water when heated is used in house-warming; third, to provide a damper-regulator which will close the dampers to the furnace when the water reaches any desired temperature above or below the ordinary boiling-point, thus preventing the water from boiling or the house from becoming too warm. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 shows in section the essential parts—the fire-pot, the economizer, and the damper-regulator. Fig. 2 shows a top view or plan of the economizer with the top cover removed. Fig. 3 shows a top view or plan of the fire-pot.

Similar letters refer to similar parts throughout the several views.

The fire-pot is made with holes near the bottom for the return-water to enter and other holes near the top for the water to go out and then go through a pipe or pipes to a vessel, (marked A in the drawings.) In the drawings the three pipes from the top of the fire-pot enter a casting which is directly over the fire, and from this casting a single large pipe goes to the vessel A. I make the fire-pot in three sections, each section having an entering and an exit pipe. The vessel (marked A) forms a part of the damper-regulator, to be described later in this specification.

The heat-economizer (shown in Figs. 1 and 2) is a cylindrical vessel made very much like an ordinary upright boiler. It is placed between the furnace and the chimney. The smoke from the furnace enters the top of this vessel. In this vessel a damper (marked d in the drawings) is located, as shown, and can be turned horizontally, as indicated by the dotted line, in which case the smoke and combustion-gases go directly into the chimney and the economizer is not in use. It will be turned in this position in starting the fire, and as soon as the chimney has gotten thoroughly hot the damper is turned vertically, as shown by the full line, and when in this position the smoke and combustion-gases go down through the flues on the left and ascend through those on the right, then go out through a pipe into the chimney. The small flues through which the smoke passes are surrounded by water, which enters the economizer near the bottom of the flue-space and goes out near the top of said furnace, as shown in the drawings. Thence it goes to a vessel, (marked A), or one of the outflow-pipes may go directly to radiators for warming the house.

The said vessel which I call an "economizer," is covered by a top which may be easily removed for the purpose of cleaning the flues. In the bottom chamber of the economizer is a door (marked b) for removing soot.

The economizer is shown in a vertical position, but it may be placed in a horizontal position. The draft-door d may be operated by hand by turning the wheel h, and in starting the fire it will be so regulated, the damper being then in the horizontal position shown by the dotted line. After the chimney-flue has become hot the damper d may be operated by hand by turning the wheel n, and in starting the fire it will be so regulated, the damper being then in the horizontal position shown by the dotted line. After the chimney-flue has become hot and the draft consequently strong the damper will be turned in the vertical position, thus throwing the economizer into action. Then, if desired, the chain attached to the damper-regulator (shown in the drawings) may be partly bent around the wheel n and attached to it by a hook. When so attached, the damper-regulator will automatically open the damper d, thus throwing the economizer out of action whenever the water gets hotter than is desired.

The damper-regulator is shown in section...
in Fig. 1, which also shows the method of attaching the chains for regulating the draft-doors and dampers. It consists of a vessel (marked A) filled with the hottest outflowing water from the heater. This vessel is cast and made in two sections—an upper and a lower—bolted together, as shown. The lower part has holes for the entering and outgoing hot water. The upper section has in it a thermometer t and an air cock k, and in the top of it is a hole, through which a pipe passes packed water-tight. Inside of said vessel A is another vessel, (marked B,) consisting of a spherical shell or ball made of thin metal. Soldered to the top of this vessel is a short tube passing out at A through water-tight packing and covered by a cap, in which is an air-cock l, and through said cap passes a pipe of small bore m, extending down into B and connecting said vessel B with a third vessel (marked C) having an elastic diaphragm across its center. The vessel B, the lower portion of C, and the connecting-pipe m are completely filled with water before the diaphragm and the upper portion of C are put on. The air-cock l serves to let the air out of the upper portion of B while the water enters through m. The construction of the vessel C is similar in most respects to the ordinary damper-regulator, from which it differs in two important respects—first, it has underneath the elastic diaphragm a nearly-flat circular plate, (marked f,) as well as the ordinary flat circular plate above it, (marked e;) second, the lever-arm (marked g) extends both ways from the fulcrum.

The lower plate f is bolted to the upper plate e at the center, and to the upper plate e is attached a post, which passes through a hole in the cover of C, loosely fitting, so as to allow air to pass in and out of the top part of C. This post is fastened by a pin to the lever-arm g near the fulcrum. A movable weight w rests on the lever-arm g and may be placed on either side of the fulcrum. The top part of C is bolted to the lower part in the usual way.

Operation of the damper-regulator.—The elastic diaphragm is at all times pushed upward by the tension of the vapor of water in the vessel B, the amount of that tension depending on the temperature of the water in B, which is the same as the temperature of the water in A. When the diaphragm rises, vapor forms in B, occupying the upper portion and pushing water through the pipe m into the lower half of C. The elastic diaphragm is also at all times pushed downward by the pressure of the atmosphere, which is practically constant. If the weight be on the left of the fulcrum, as is shown in the drawings, the action of the weight will assist the vapor-pressure in raising the diaphragm and help that vapor-pressure to overcome the pressure of the atmosphere. If the weight be near the fulcrum, the assistance given by the weight will be but slight and the diaphragm will not rise until the temperature of the water is nearly 212° Fahrenheit. The farther the weight is placed from the fulcrum the greater is the assistance given to the vapor-pressure and the lower the temperature at which the diaphragm will rise, causing the drafts to be shut off from the fire.

If the expansion-tank be elevated above the highest radiator, or if the water be somewhat cooled before it reaches the highest radiator, as it should be by doing some heating in its upward passage, the water in the furnace may be heated considerably above 212° Fahrenheit. In extremely-cold weather it will be desirable to get the water as hot as possible. In order to shut off the drafts when the temperature is above 212° Fahrenheit, the weight is placed on the right of the fulcrum, in which position, as in the ordinary damper-regulator, the action of the weight is to assist the atmosphere to hold the diaphragm down against the vapor-pressure, which would now ordinarily be called "steam-pressure," which is pushing it up. As before, the temperatures at which the dampers will be operated can be regulated by placing the weight in different positions on the lever-arm g.

As no vapor or steam ever goes into C and only a small amount of water, the water in C will remain comparatively cool. The position of C in the drawings is shown directly above B and A; but it may be placed at any convenient place for operating the ducts and the connecting-pipe m be made long.

The vessel B, the lower part of the vessel C, and the connecting-pipe may be filled with any other volatile fluid than water, such as alcohol. I am aware that prior to my invention combination hot-air and hot-water heaters existed with arrangements at the fire-pot for heating water, and I make no broad claim to any hot-air furnace; but I do claim as my invention, and desire to secure by Letters Patent, is—

In combination with a water-jacketed fire-pot with smoke and air flues above same, a water-containing receptacle communicating with said water-jacket, a damper-regulating lever, and men's and means carried by said receptacle for actuating said lever, a water-heating compartment with smoke-flues passing through same into smoke-chambers at the ends thereof, a damper located in the upper of said smoke-chambers, and connections between the damper and said lever, as set forth.

In testimony whereof I have signed my name to this specification in the presence of the two subscribing witnesses.

DAVID CARLISLE HUMPHREYS.

Witnesses:

W. S. HOPKINS,
FRANK MOORE.