No. 659,065. Patented Oct. 2, 1900.

J. B. HOUSTON.

HEAT ECONOMIZER.

(Application filed July 11, 1900.)

(No Model.) 2 Sheets—Sheet 1.

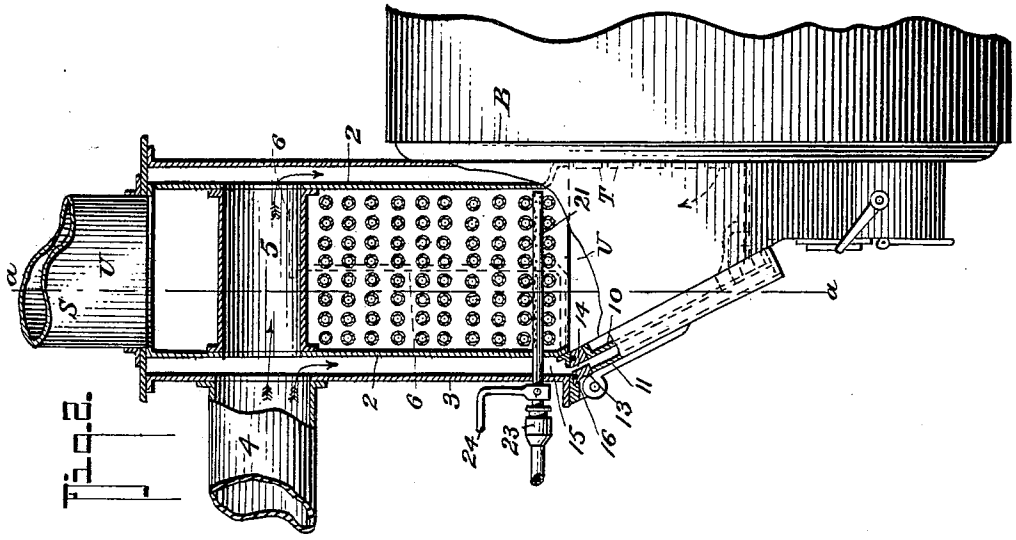


Fig. 2.

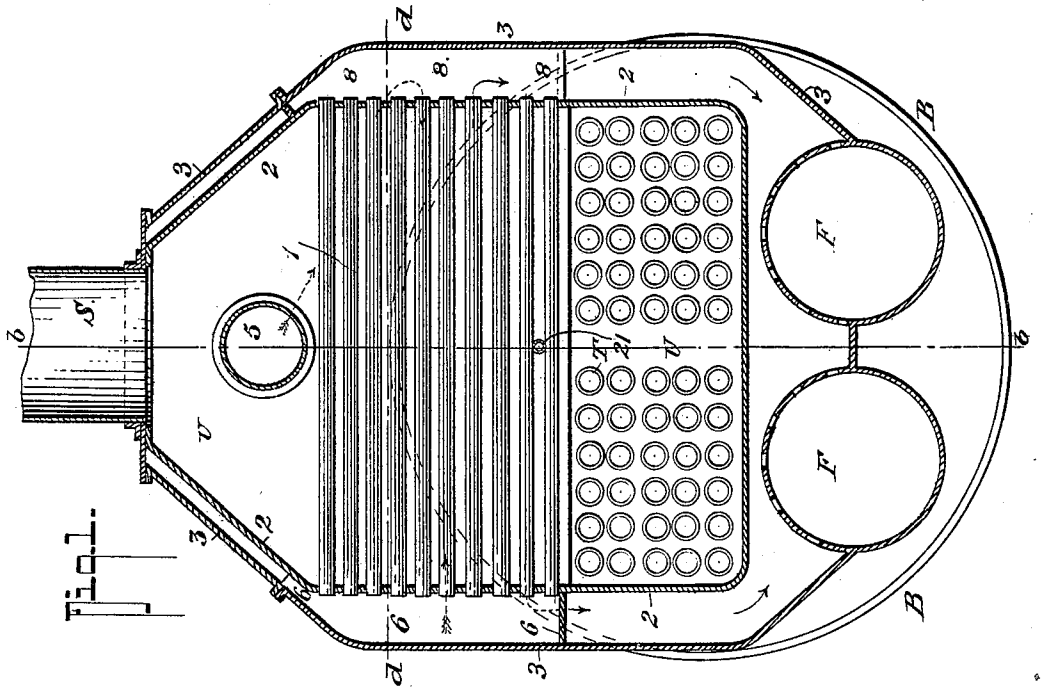


Fig. 1.

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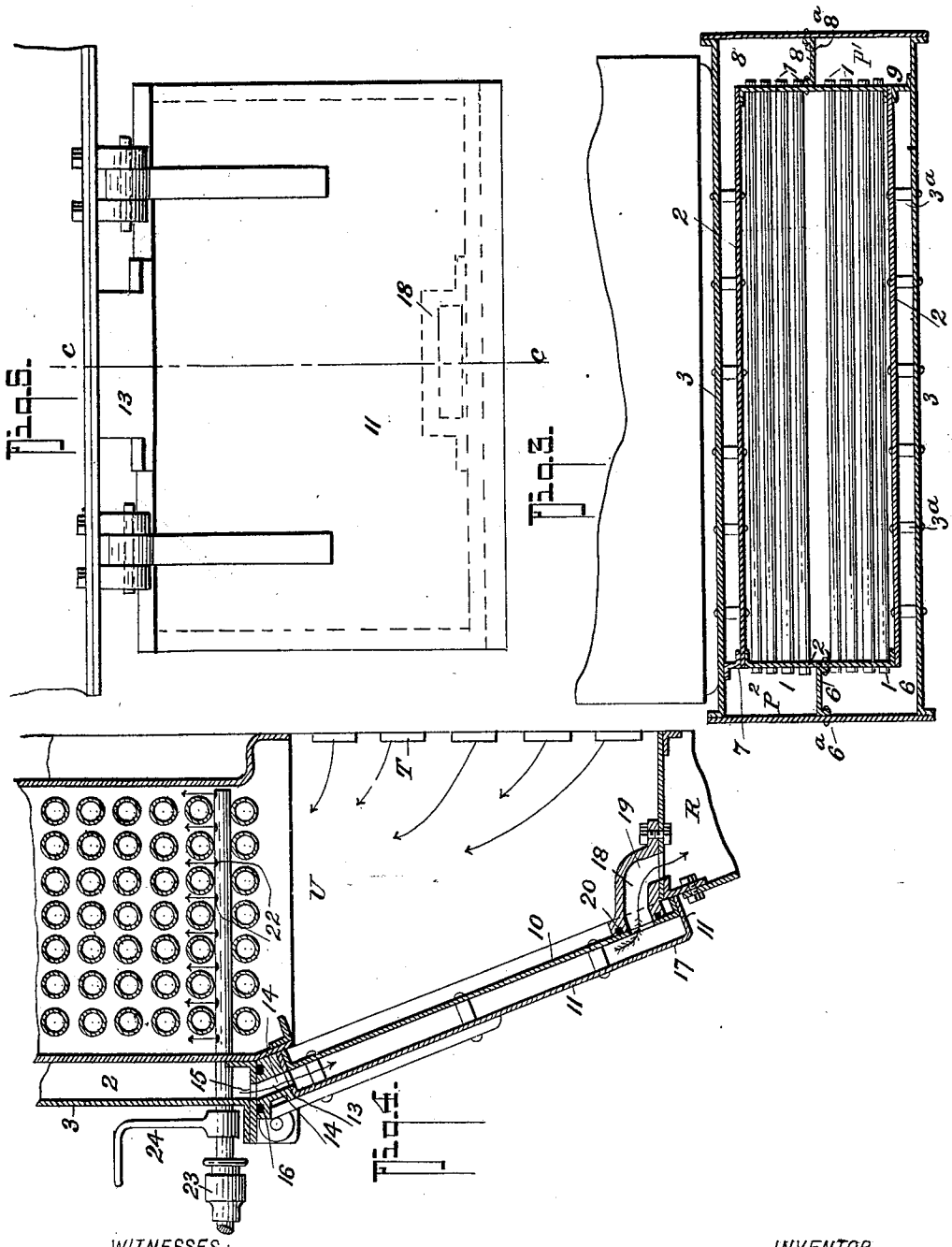
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JOHN BROADFOOT HOUSTON, OF VANCOUVER, CANADA.

HEAT-ECONOMIZER.

SPECIFICATION forming part of Letters Patent No. 659,065, dated October 2, 1900.

Application filed July 11, 1900. Serial No. 23,259. (No model.)

To all whom it may concern:

Be it known that I, JOHN BROADFOOT HOUSTON, a citizen of the Dominion of Canada, residing at Vancouver, in the Province of British Columbia, Canada, have invented a new and useful Heat-Economizer, of which the following is a specification.

My invention particularly relates to that form of economizer wherein the air for combustion, whether in forced or induced draft, is heated during its passage to the furnace by being brought in conductive proximity to the heated gases from the same, which having parted with their efficient heat to the boiler are passing through the uptake to the smoke-stack.

My aim has been to design an apparatus which shall be thoroughly efficient in deriving all available heat from the waste gases from the furnace; wherever possible to jacket the uptake-flues with the incoming air, so as to expose a cool surface to the boiler-room; to so construct it that the uptake-passages can be readily cleaned by the means provided from any accumulation of soot or furnace-dust, and to make it extremely simple and practical in construction. I attain these objects by the means illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view of the economizer as applied to a boiler of the ordinary marine type, taken on a line *a a* in Fig. 2. Fig. 2 is a vertical cross-section of the same on the line *b b* in Fig. 1. Fig. 3 is a horizontal cross-section on the line *d d* in Fig. 1. Fig. 4 is an enlarged detail, being a section through the uptake-door on the line *c c* in Fig. 5, which shows my means of jacketing the same and also the means by which I free the interior surfaces of the uptake from soot, &c. Fig. 5 is a front elevation of the door.

In the drawings, B represents the front or furnace end of a boiler of the ordinary marine type, of which F are the furnaces and T the return-tubes, from which the products of combustion pass into the uptake U, as indicated by the arrows. In the uptake U and just above the level of the boiler-tubes T, I place the tubes 1 of my economizer, passing horizontally across the width from side to side of the uptake. Surrounding the front, back, and sides of the uptake-casing 2 and forming a jacketed wall for the same up as far as the base of the smoke-stack S is an outer casing or jacket 3. This jacket-casing 3 is carried down below the bottom of the uptake-flue and connects to a furnace-front of suitable design to insure regulated admission of the heated air to the furnaces. Near the upper part of this jacket is a passage 4, by which the air-supply to the furnace flows, and directly in line with this is a passage 5, connecting the front and back jackets through the uptake. (See Figs. 1 and 2.) This conveys a portion of the air-supply entering by the inlet 4 to the back jacket by the short direct pipe 5, exposed to the heat in the uptake, which pipe incidentally braces the front and back walls of the uptake. The side jackets are so constructed that the parts opposite the economizer-tube plates are removable, giving access to the tubes.

In the left-hand side jacket a division-plate 6 starts from the outer casing 3 of the front jacket below the bottom row of economizer-tubes, runs horizontally to the center of the tube-plate, and then vertically upward to above the top row of tubes. Thence it is carried to the outer casing of the back jacket. A division 7, (see Fig. 3,) forming a prolongation of the economizer-tube plate backward, cuts this side jacket off from the back jacket. Similarly in the right-hand side jacket a division-plate 8 runs from the outer casing of the back jacket to the center of the tube-plate vertically up to above the top row of tubes and thence to the outer casing of the front jacket. A division 9 (see Fig. 3) cuts the right-side jacket off from the front one. These divisions are riveted in where convenient, as in 7 and 9; but in 6 and 8 the casings 2 and 3 are drawn up together against the edges of the division-plate by the screw-bolts at intervals, as at 6^a and 8^a. The outer and inner casings of the jacket are tied together at intervals by bolts 3^a to prevent bulging or buckling of the flat surfaces. The effect of these partitions is to divide the incoming air for combustion entering by the passage 4, so that part flows across the front jacket to the left side through the front half of the horizontal tubes and thence down the front half P′ of the right-side jacket to the reservoir or chamber R, from which the fur-

naces derive their supply. The remaining portion of the incoming air passes through the pipe 5 to the back jacket, across it to the right side, and, passing through the back half of the horizontal tubes, goes down the back half P^2 of the left-side jacket to the furnaces. By this arrangement where two or more furnaces are used I am enabled to get an equal distribution of the air to the furnaces, and I also insure that each stream is of the same temperature. The arrangement is also one which enables a simple and eminently practical construction to be adopted.

In boilers having any system of forced combustion the uptake gases are so hot that where they impinge on such a surface as an uptake-door, which gives access to the boiler-tubes and therefore receives the direct impact of the gases as they come through the tubes T, any ordinary method of protecting the same by means of baffle-plates or non-conductive linings are totally inefficient, and under such conditions the life of the door is not only extremely short, but the door is cumbersome and heavy and with the best of such protection transmits a very considerable heat to the boiler-room. I obviate these objections by constructing my uptake-door with an ample air-space between two walls and providing for the circulation of air therein. The door is composed of two plates, an inner 10 and outer 11, flanged around their edges, as shown, and riveted through these flanged edges one within the other, so as to leave an ample intervening space. Such construction offers an easy method of riveting, while the flanges impart rigidity to the door and offer a convenient means of making a tight seat-joint on the front face of the uptake-flue. Distance-pieces are riveted between the plates to stay the flat surfaces against buckling. The doors are hung on hinges and fastened shut in the usual manner with such doors.

I secure circulation of air through the doors in the following manner: In the base of the front uptake-jacket, just above each door, an aperture 15, of suitable size, is cut and another to correspond in the top of the outer flange of each door. A light casting 13, having an aperture 14 cored therein to correspond with those of the door and jacket-base, is bolted on the top flange of the door, so that the openings correspond, and the top face of this casting terminates in a plane proximate to the lower surface of the angle-iron which forms the jacket-base. A groove runs around the opening in this face of the casting, in which packing 16 is placed, so that when the door is closed and fastened such packing will form an air-tight closure around the opening. A similar opening 17 is cut in the inner casing of each door in proximity to the lower flanged edge, and in the bottom plate of the uptake-flue an opening is cut to correspond therewith. A casting 18 is attached to the latter, having a port or passsage 19 cast therein to correspond with the openings in the flue bottom and door. The passage in this casting is carried around to the plane of the inner plate of the door when closed, and around the opening is a groove wherein packing 20 is placed, so that when the door is shut and fastened an air-tight closure is made around the passage. Thus a communication is made by which the incoming air can flow from the jacket through the door and into the hot-air chamber adjacent to the furnaces. The heat is carried away from where it is useless and injurious and conveyed to where it is beneficial in aiding complete combustion of the fuel.

When furnace gases and smoke come in contact with the cooling-surfaces of the uptake jackets and tubes, they will readily condense and adhere to them as soot, and it is imperative that these surfaces be kept free from such deposits or the possible economies of such a system as this are lost, for such deposits not only impede the draft by restricting the passages, but as non-conductors prevent the conveyance of heat through the tubes and plates to be taken up by the air for combustion. To obviate this objection, I have introduced a system of cleaning the otherwise inaccessible parts which is simple in construction, can be readily used without opening the uptake-doors or stopping the stoking or use of the furnace, and is thoroughly effective. I introduce at the center of the bottom of the group of economizer-tubes, just above the bottom row, a steam-pipe 21. This pipe is plugged at the inner end and is provided with a series of perforations 22, corresponding with the surfaces of the uptake and the spaces between the tubes. The pipe passes through the plates of the jacket and uptake, a drilled fit, and, being provided with a packed gland 23 outside the casing, can be readily rotated by means of the lever 24. Steam being turned into the pipe 21, it is rotated through a sufficient arc by means of a handle 24, and the issuing steam from the perforations 22 sweeps all deposits adjacent to the planes of its rotating jets, and the soot is carried up the stack by the draft.

Having now described my invention, what I claim as new, and desire to be protected in by Letters Patent, is—

1. In an economizer of the class described; in combination with an uptake-flue connecting the boiler-tubes with the smoke-stack; a number of tubes passing horizontally across such uptake; an air-tight jacket or casing surrounding the front, back and sides of the uptake and extending from the base of the smoke-stack down to the furnace-front; means for conveying the air for combustion to within such jacket; an air-passage connecting the front and back jacket through the uptake; division-plates or partitions in the air-tight jacket dividing the groups of tubes vertically into two sections, and so ar-

ranged that the entering air shall flow in two streams in opposite directions through the back and front sections of the vertically-divided group of tubes and thereafter pass to the furnaces, substantially as and for the purposes set forth.

2. In an economizer as described; in combination with an uptake-flue; a jacket surrounding the front, back and sides of the same; an uptake door or doors composed of an inner and outer casing, which being flanged around their edges and riveted together one within the other, around such flanged edges forming the joint of the opening the door is designed to close; an air-space retained between the inner and outer casing of the door and means whereby air may be circulated within such door air-space, when the door is shut and fastened, as and for the purposes described.

3. In an economizer as described, in combination with an uptake; a jacket surrounding the same; an aperture in the base of such jacket just over such uptake-door; an uptake-door having an inner and outer casing and an air-space therebetween; an aperture in the upper flange of the outer casing to correspond with one in the base of the jacket; a casting surrounding such opening fastened to the door and carried up close to the aperture in the jacket-base; a groove surrounding the opening in the casting and packing therein that joints around the aperture in the base of the jacket when the door is closed and fastened, and forms an air-tight closure surrounding the passage; an opening in the inner casing of said door in proximity to the lower flanged edge; a corresponding opening in the bottom plate of the uptake-flue; a casting attached to the bottom plate of the uptake-flue having a port or passage in it to correspond with the aperture, such passage and casting to be carried up and around until its face is adjacent to and in a proximate plane with that of the inner casing of the door; a groove surrounding such opening and a packing in the groove to form an air-tight joint around the opening in the door-casing when the door is shut and fastened, all substantially as and for the purposes set forth.

4. In an economizer having air-tubes passing across an uptake-flue and a jacket surrounding the same, in combination; a steam-pipe closed at its inner end and passing through the jacket into the uptake in a line at right angles to the direction of the air-tubes and in a parallel horizontal plane, said pipe to be capable of rotation in the jacket-casings; perforations in such steam-pipe between each vertical row of tubes and adjacent to the front and back plates of the uptake; a gland-packed attachment to the steam-service exterior to the economizer; and a handle for rotating the same, substantially as and for the purposes described.

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