Oct. 23, 1928. 1,688,700

H. F. GAUSS

REGENERATIVE AIR HEATER

Filed Jan. 14, 1926

Fig. 1.

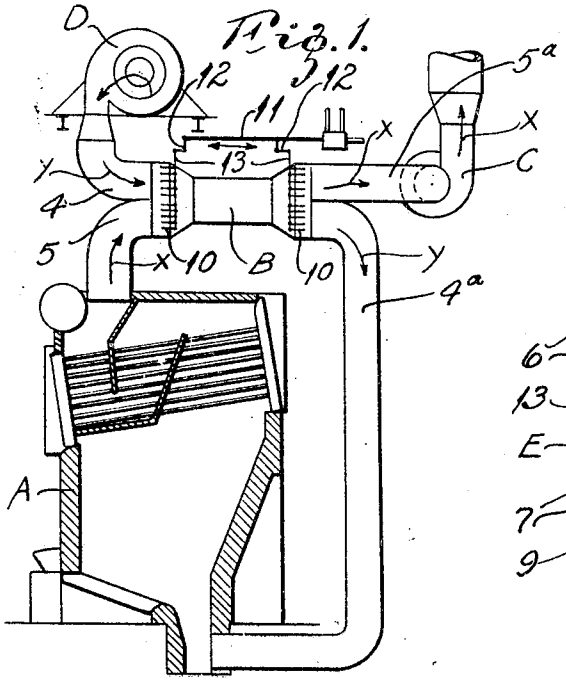


Fig. 2.

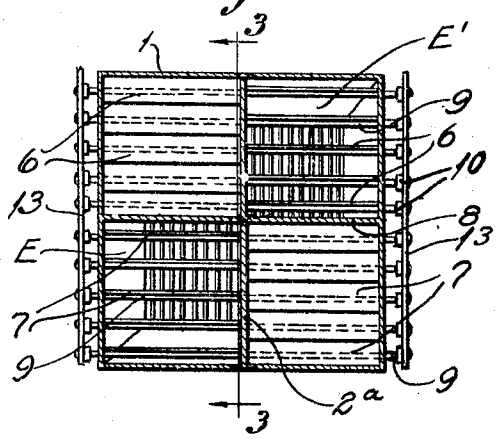


Fig. 3.

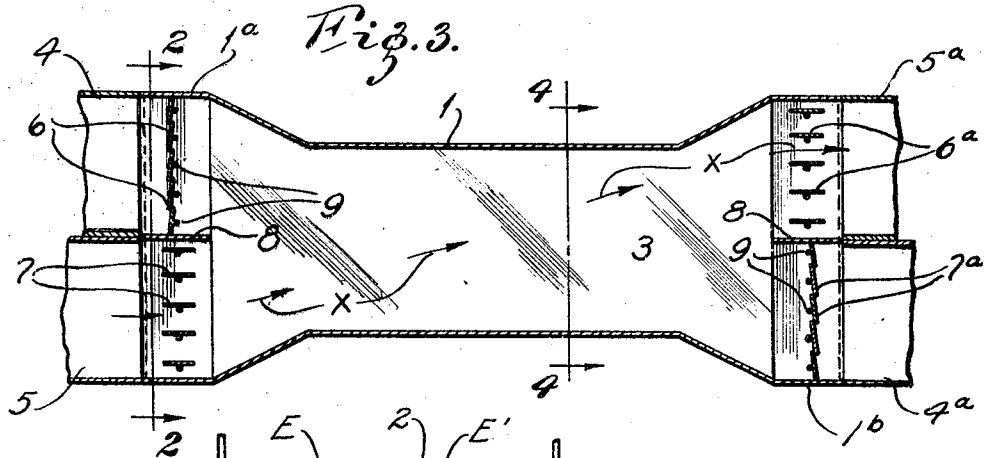
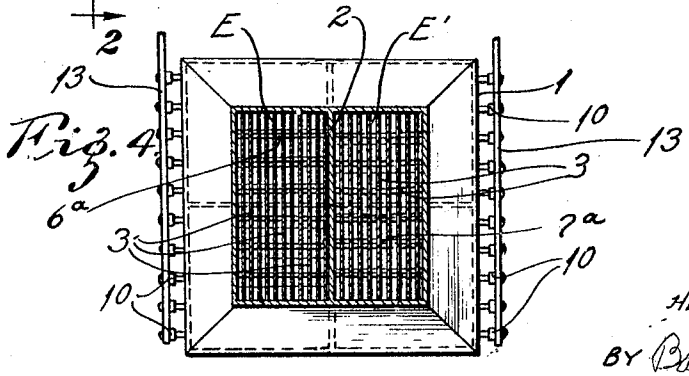


Fig. 4.



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UNITED STATES PATENT OFFICE.

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REGENERATIVE AIR HEATER.

Application filed January 14, 1926. Serial No. 81,336.

This invention relates to devices of the kind that are used for abstracting heat from one gaseous medium and transmitting said heat to a different gaseous medium of a lower temperature, and particularly to air heaters of the regenerative type, such as are used with boilers and other heating apparatus for heating air that is supplied to the furnace of the apparatus to support combustion.

The object of my invention is to provide a regenerative air heater that is highly efficient and inexpensive to construct.

Figure 1 of the drawings is a side elevational view of an air heater constructed in accordance with my invention, combined with a water tube boiler.

Figure 2 is a vertical transverse sectional view of said heater, taken on the line 2—2 of Figure 3.

Figure 3 is a vertical longitudinal sectional view of said heater, taken on the line 3—3 of Figure 2; and

Figure 4 is a transverse sectional view, taken on the line 4—4 of Figure 3.

Referring to the drawings which illustrate the preferred form of my invention, A designates a water tube boiler or other heating apparatus, B designates a regenerative air heater arranged in the path of travel of the gases or products of combustion which escape from said boiler, C designates a fan or other suitable suction device for causing the gases to circulate through the heater B, as indicated by the arrows x in Figure 1, and D designates a fan or other suitable device for causing air to circulate through said heater, as indicated by the arrows y in Figure 1 and then pass to the furnace of the boiler A to support combustion.

The heater B is preferably composed of a sheet metal casing 1 whose interior is divided into two flues or passageways E and E′ by a partition 2, herein illustrated as being disposed vertically. Each of said flues or passageways contains a means that is capable of absorbing heat from the gases which circulate through the heater, and thereafter transmitting said heat to the air which circulates through the heater, said heat absorbing means preferably consisting of metal plates 3 arranged parallel in the flues E and E′ in spaced relation, as shown in Figure 4. The casing 1 of the heater is provided at one end with an inlet portion 1^a constructed preferably in the form of a rectangular-shaped frame, and said casing is provided at its opposite end with a discharge portion 1^b which is also preferably constructed in the form of a rectangular-shaped frame. The conduit 4 through which air is supplied to the heater extends transversely across the entire width of the inlet portion 1^a of the casing in alignment with the upper half of said inlet portion, and the conduit 5 through which gases are supplied to the heater also extends transversely across the entire width of the inlet portion 1^a of the casing, but in alignment with the lower half of said inlet portion. The conduit 4^a through which the heated air is conducted from the heater to the furnace of the boiler A extends transversely across the entire width of the discharge portion 1^b of the casing of the heater in alignment with the lower half of said discharge portion and the conduit 5^a that leads from the heater to the device C which draws the gases through the heater extends transversely across the entire width of the discharge portion 1^b of the casing in alignment with the upper half of said discharge portion.

At the inlet end of the heater each of the flues E and E′ is provided with two sets of inlet valves or dampers 6 and 7 arranged one above the other, as shown in Figure 2, and at the discharge end of the heater each of said flues or passageways E and E′ is provided with two sets of discharge valves or dampers 6^a and 7^a arranged one above the other. The valves or dampers just referred to preferably consist of hinged or oscillating shutters arranged horizontally in the inlet portion 1^a and in the discharge portion 1^b of the casing of the heater, and said inlet portion and discharge portion are each provided with a vertical partition 2^a arranged in alignment with the center partition 2 in the casing A, and a horizontally-disposed partition 8 that divides its upper half from its lower half. Thus, as shown in Figure 2, the inlet end 1^a of the casing of the heater is divided into four separate and distinct portions, each of which is provided with a group of inlet valves, and the discharge portion 1^b of the casing is also divided into four separate and distinct portions, each of which is equipped with a group of discharge valves.

The inlet valves 6 and 7 and the discharge valves 6^a and 7^a of the heater may be of any suitable type, but I prefer to construct each of said valves from a flat strip of metal that

is connected to a horizontally-disposed shaft 9 which is arranged transversely of the opening in which the valve is positioned, the shafts 9 of said valves being so disposed that the group of valves which constitute one closure are arranged in overlapping relation when they are in their closed position, as shown in Figure 3. Each of the valve shafts 9 is provided at its outer end with an angularly-disposed arm 10 which is joined to an operating mechanism that is used to reverse the valves or change the position of the valves. Thus, as shown diagrammatically in Figure 1, the operating mechanism may consist of a longitudinally-shiftable operating bar 11 that is joined by bell crank levers 12 to links 13 which are attached to the arms 10 on the valve shafts 9. The valve arms 10 are so disposed that the top group of inlet valves 6 of the passageway E and the bottom group of discharge valves 7^a of said passageway are closed when the bottom group of inlet valves 7 and the top group of discharge valves 6^a of the passageway E′ are closed. At this time the bottom group of inlet valves 7 and the top group of discharge valves 6^a of the passageway E are open and the top group of inlet valves 6 and the bottom group of discharge valves 7^a of the passageway E′ are also open. Consequently, hot gases from the boiler will circulate longitudinally through the passageway E, as indicated by the arrows in Figure 3, and air will circulate longitudinally through the passageway E′, thereby causing the heat absorbing means in the passageway E to be heated to a high temperature by the gases flowing through said passageway and causing the air flowing through the passageway E′ to be heated to a high degree by the heat absorbing means in said passageway E′. At intervals the operating bar 11 is shifted longitudinally so as to reverse the position of the valves and cause gases to flow through the passageway E′, and air to flow through the passageway E, the air abstracting heat from the heat absorbing means in the passageway E, and the heat absorbing means in the passageway E′ being raised to a high temperature by the gases traveling through said passageway. I prefer to combine the inlet conduits and the discharge conduits for the gases and the air with the heater in such a way that the gases and the air circulate through the heater in substantially diagonal paths, so as to insure the gases and air circulating over substantially the entire area of the heat absorbing plates in the passageways E and E′, this being accomplished by arranging the air supply conduit 4 in alignment with the upper half of the inlet end of the casing of the heater, arranging the air discharge conduit 4^a in alignment with the lower half of the discharge end of the casing and arranging the gas supply conduit 5 and the gas discharge conduit 5^a in alignment with the lower half and the upper half of the inlet and discharge ends respectively of the casing of the heater.

An air heater of the construction above described is inexpensive to build, as it is constructed principally from sheet metal elements, it is compact and it is exceptionally efficient, as each of the passageways E and E′ is provided with a heat absorbing means having a relatively great surface area.

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

1. A device for transmitting heat from one gaseous medium to another gaseous medium, comprising a pair of passageways provided with a heat absorbing means, inlet ducts for supplying different gaseous mediums arranged at one end of said passageways, discharge ducts at the opposite end of said passageways, top and bottom groups of inlet valves arranged at the inlet end of each of said passageways for establishing and cutting off communication between said passageways and said inlet ducts, top and bottom groups of discharge valves arranged at the discharge end of each of said passageways for establishing and cutting off communication between said passageways and said discharge ducts, said valves being so disposed that the top group of inlet valves and the bottom group of discharge valves of one passageway are open when the other inlet and discharge valves of said passageway are closed and the bottom group of inlet valves and the top group of discharge valves of the other passageway are open when the remaining valves of said other passageway are closed, and means for reversing the position of said valves.

2. An air heater, comprising a casing divided into two passageways, a heat absorbing means in each of said passageways, an inlet at one end of said casing divided into four portions, an inlet duct that communicates with two of said portions, a separate inlet duct that communicates with the other two portions, a discharge at the opposite end of said casing divided into four portions, a discharge duct communicating with two of said discharge portions, a separate discharge duct communicating with the two remaining discharge portions, and closures for the four portions of the inlet and for the four portions of the discharge arranged so that two of the inlet closures and two of the discharge closures are normally open, and the remaining inlet and discharge closures are normally closed.

3. An air heater comprising a casing provided with a longitudinally-disposed partition that divides the interior of said casing into two passageways, metal plates arranged in said passageways in spaced relation so as to serve as heat absorbing elements, an intake at

one end of said casing divided into four portions, an inlet duct that co-operates with two of said portions, a separate inlet duct that co-operates with the other two inlet portions, a discharge at the opposite end of said casing divided into four portions, a discharge duct that co-operates with two of said discharge portions, a separate discharge duct that co-operates with the two remaining discharge portions, a group of inlet valves arranged in each portion of said inlet, and a group of discharge valves arranged in each portion of said discharge, said valves being so disposed that one half of the inlet end of each passageway and one half of the discharge end of each passageway is normally open and the remaining half of the inlet and discharge ends of said passageways are normally closed, and a means for reversing said valves.

4. An air heater, comprising a casing divided into two passageways, heat absorbing elements in said passageways, rectangular-shaped inlet and discharge portions at the opposite ends of said casing, two inlet ducts that co-operate with said inlet for supplying different gaseous mediums to one end of said passageways, two discharge ducts that co-operate with the opposite end of said passageways, four groups of valves in each of said inlet and discharge portions, each of which groups comprises a plurality of oscillating valves arranged in overlapping relation when they are closed, and an operating mechanism for said valves combined with same in such a manner that the inlet valves at the top side of one passageway and the discharge valves at the bottom side of said passageway, the inlet valves at the bottom side of the other passageway and the discharge valves at the top side of said other passageway are closed when the remaining valves of said respective passageways are open.

5. An air heater, comprising a sheet metal casing provided with a longitudinally-disposed partition that divides the interior of same into two passageways, parallel metal plates arranged in said passageways inspaced relation so as to constitute heat absorbing elements, rectangular-shaped frames at the opposite ends of said casing that constitute inlet and discharge portions for the casing, each of said frames having a vertical and a horizontal partition that divides the interior of same into four parts, two inlet ducts that co-operate with one of said frames, two outlet ducts that co-operate with the other frame, and hinged valves combined with said frames to serve as closures for the four parts of each of said frames, said valves being so arranged that one half of the valves of each frame are normally closed and the remaining valves are normally open.

HENRY F. GAUSS.