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METHOD OF HEATING GASEOUS FLUIDS

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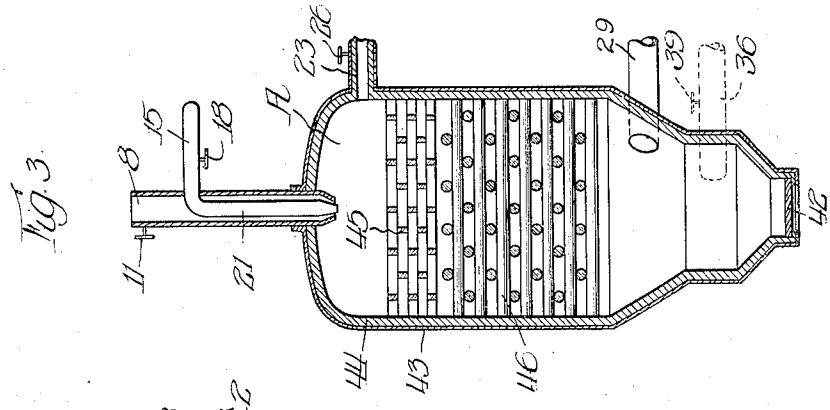


Fig. 3

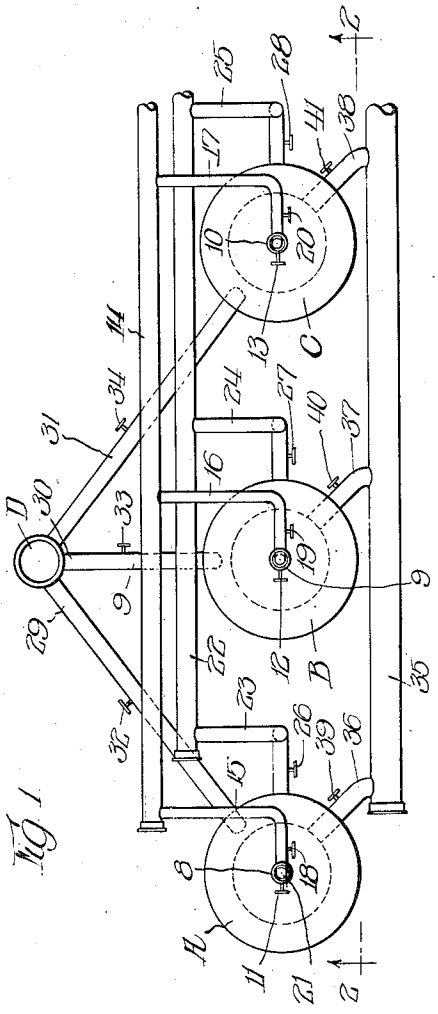


Fig. 1

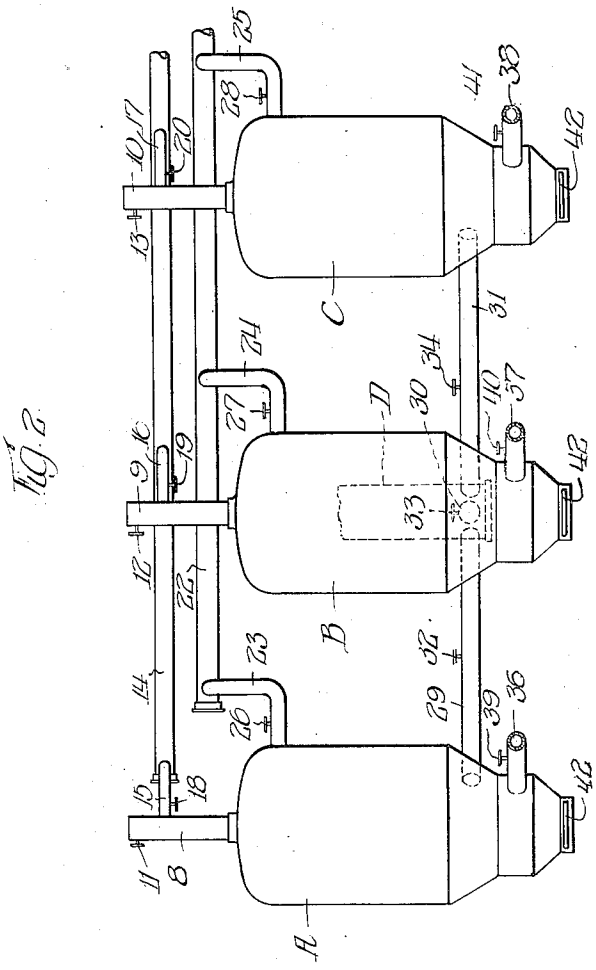


Fig. 2

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UNITED STATES PATENT OFFICE.

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METHOD OF HEATING GASEOUS FLUIDS.

Application filed January 4, 1923. Serial No. 610,720.

To all whom it may concern:

Be it known that we, HERMAN A. BRASSERT and CHARLES W. ANDREWS, citizens of the United States, residing respectively, at Chicago, in the county of Cook and State of Illinois, and at Duluth, in the county of St. Louis and State of Minnesota, have jointly invented certain new and useful Improvements in Methods of Heating Gaseous Fluids, of which the following is a specification.

This invention relates to a new and improved method of heating gases and more particularly to a method adapted for use in heating blast air, gases or steam in connection with gas producers, water-gas machines, blast furnaces, or the like.

Heretofore, gases have been commonly heated for these purposes either by continuous recuperation or by regeneration through periodical reversals, the period being relatively long, generally one hour in duration. Regeneration with cycles of such length involves heat storage apparatus of sufficient capacity to store all the heat which is to be given up by the regenerator and absorbed by the gases during the one hour period of heat delivery.

This method has numerous disadvantages in that it involves a large installation of high initial cost, as well as high repair and maintenance charges in connection with the regenerator brickwork. A further disadvantage consists in the great radiation losses through the extensive surfaces of the large heat storage apparatus. Such a method also involves undesirable characteristics in that there is a gradual but substantial drop in the temperature of the gases heated by the apparatus during the one hour heat delivery period and this drop requires heat regulating means such, for example, as apparatus for intermixing varying proportions of cold air.

The method of our present invention overcomes these various disadvantages by utilizing much smaller heat absorbing masses than those commonly used, the smaller masses also being preferably of a higher conductivity, this combination permitting regeneration in short cycles so that there may be no substantial drop in the temperature of the gases heated by the regenerators. The method thus requires no regulation to afford a uniform temperature curve.

Our invention is best carried out by the use of a plurality of stoves filled with heat absorbing material, such as fire brick or metal, or a combination of both. The stoves alternately are heated by the combustion of gases and give off the accumulated heat to the gaseous medium to be heated. The reversal takes place at relatively short periods preferably from five to ten minutes, and may be automatically controlled by mechanical or electrical means.

It is an object of the present invention to provide a new and improved method for the heating of gases which method comprises regeneration by means of short heat absorbing and heat discharging periods for each generation unit whereby a relatively even temperature of the heated gases may be maintained throughout the heat discharging period without additional regulation.

It is a further object to provide a method of this character which is adapted to be carried out by installations of comparatively small size and low installation and up-keep cost.

Other and further objects will appear as the description proceeds.

We have illustrated a preferred embodiment of our invention in the accompanying drawings, in which—

Figure 1 is a somewhat diagrammatic plan view showing a three-unit installation;

Figure 2 is an elevation of the installation of Figure 1 taken on line 2—2; and

Figure 3 is a vertical section of one of the regenerator units.

The installation shown in Figures 1 and 2 comprises the three regenerator units A, B and C, and the stack D. These three units are provided with air inlet passages 8, 9 and 10, respectively, these passages being controlled by valves 11, 12 and 13. The units are also connected at their upper ends with the gas heater 14 by means of passages 15, 16 and 17, controlled by valves 18, 19 and 20, respectively. The interrelation of the air and gas passages at their point of entrance into the unit is best shown in Figure 3. As shown in this figure, the air passage 8 encircles the downwardly directed portion 21 of the gas passage 15, and the two

passages terminate within the upper portion of the unit A forming a burner.

The upper portions of the units A, B and C are connected to the hot gas header 22 by passages 23, 24 and 25, controlled by valves 26, 27 and 28, respectively. The lower portions of the regenerator units are connected to stack D by passages 29, 30 and 31, controlled by valves 32, 33 and 34, respectively. The lower portions of the units are also connected to the cold gas header 35 by passages 36, 37 and 38, controlled by valves 39, 40 and 41, respectively. The lower ends of the unit are provided with clean-out doors 42, as shown in Figure 3, for the removal of waste material accumulating in the units.

The units in the form shown in Figure 3 comprise an outer metal shell 43 and inner refractory lining 44, the heat absorbing brick checkerwork 45, and the heat absorbing metal rods 46.

In the operation of the installation according to our method, gas is introduced into the tops of the units from header 14 through the passages 15, 16 and 17, and air is simultaneously introduced through passages 8, 9 and 10. The gas is introduced under pressure and induces the flow of air through the surrounding passage. The gas is burned in the upper portion of the regenerator units. The flame impinges upon the brick checkerwork 45 and the heated products of combustion pass down through metal rods 46 which are laid upon each other in reversed directions and in staggered relation so as to provide passage for the gas. The products of combustion pass out through passages 29, 30 and 31 to the stack D. It will be understood, of course, that the heat remaining in the gases may be utilized in waste heat boilers or in any other apparatus.

The gas utilized in heating the regenerators may be any type of combustible gas such as producer gas, water gas or natural gas, or may be blast-furnace or other similar gases. The gas may already have a high temperature when introduced into the regenerators and the sensible heat of the gas may play a material part in heating the regenerators.

When a regenerator is sufficiently heated, its supply of air and gas is cut off by closing the necessary valves such as valves 11 and 18 in connection with unit A. Its communication with the stack is shut off by closing valve 32. The air, gas or steam to be heated is now introduced from header 35 through passage 36, valve 39 being open. The fluid to be heated is thus introduced at the lower or cooler portion of the regenerator and passes up through the metal rods and thence through the heated checkerwork, absorbing heat as it rises. The valve 26 is opened and the fluid passes through passage 23 to the hot header 22 which carries it to the apparatus in which it is intended to be used.

The metal rods are particularly efficient in quickly absorbing heat and in quickly giving it off. It is, therefore, possible to pass the gases through the regenerator with considerable velocity and yet to acquire the desired raise in temperature. This portion of the cycle continues for a short period, preferably about five or ten minutes, and in this short period the temperature of the regenerator has not been so lowered as to cause a material change in the temperature of the heated gas passing from the regenerator. At the end of this period, unit A is put on blast, unit B is cut off from blast, and the fluid to be heated is introduced into unit B where it is heated as just described in connection with unit A.

By the use of three units, as shown, each unit may be held twice as long upon the heat-absorbing portion of the cycle as upon the heat discharging portion, and adequate temperatures may thus be maintained. It will be understood, of course, that it is possible to carry out our method by using merely two units, one being upon blast while the other is delivering heat. With either two or more units, a continuous flow of substantially uniformly heated gas is assured by our method without the necessity for regulation by means of intermixing cold air or other means of maintaining a uniform temperature curve.

It will be understood that our method can be carried out by other forms of apparatus than that specifically illustrated and it is our intention to cover such modifications as come within the scope of the appended claims.

We claim:

1. The method of heating gases adapted for heating blast air or steam, which method comprises regeneration by means of short heat absorbing and heat discharging periods for each regeneration unit, the periods being of such duration that a relatively even temperature of the heated gases may be maintained throughout the heat discharging period without regulation or mixing of gases.

2. The method of heating gases adapted for heating blast air or steam, which method comprises regeneration by means of short cycles of regeneration using small units adapted to rapidly absorb and give off heat whereby a relatively even temperature of the heated gases may be maintained throughout the heat discharging period without regulation or mixing of gases.

3. The method of heating gases adapted for heating blast air or steam, which method comprises regeneration by means of short cycles of regeneration using small units adapted to rapidly absorb and give off heat, a plurality of units being used whereby each

unit may undergo the heat absorbing portion of the cycle for a longer period than it is used to give off heat, and whereby a relatively even temperature of the heated gases may be maintained throughout the heat discharging period without regulation or mixing of gases.

4. The method of heating gases adapted for heating blast air, or steam, which method comprises regeneration by heating masses of metal, and thereafter passing the gases to be heated into contact with said metal for a short period, the periods being of such duration that the temperature of the heated gases is not materially less at the end of the period than at the beginning.

5. The method of heating gases adapted for heating blast air, or steam, which method comprises regeneration by heating masses of metal, and thereafter passing the gases to be heated into contact with said metal for a short period, the periods being of such duration that the temperature of the heated gases is not materially less at the end of the period than at the beginning, the operation being carried out by means of a plurality of units whereby the masses of metal may be heated for periods longer than their heat delivery periods and whereby a continuous flow of uniformly heated gas may be delivered.

6. The method of heating gases adapted for heating blast air or steam which method comprises regeneration by heating masses of fire brick and metal and thereafter passing the gases to be heated into contact with said fire brick and metal for a short period, the period being such that the temperature of the heated gases is not materially less at the end of the period than at the beginning.

7. The method of heating gases adapted for heating blast air or steam which method comprises regeneration by heating masses of fire brick and thereafter passing the gases to be heated into contact with said fire brick for a short period, the period being such that the temperature of the heated gases is not materially less at the end of the period than at the beginning.

Signed at Chicago, Illinois, this 23rd day of December, 1922.

HERMAN A. BRASSERT.

Signed at Duluth, Minnesota, this 18th day of December, 1922.

CHARLES W. ANDREWS.