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G. H. ISLEY

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REVERSING AND CONTROLLING APPARATUS FOR HEATING FURNACES

Filed April 28, 1926

3 Sheets-Sheet 1

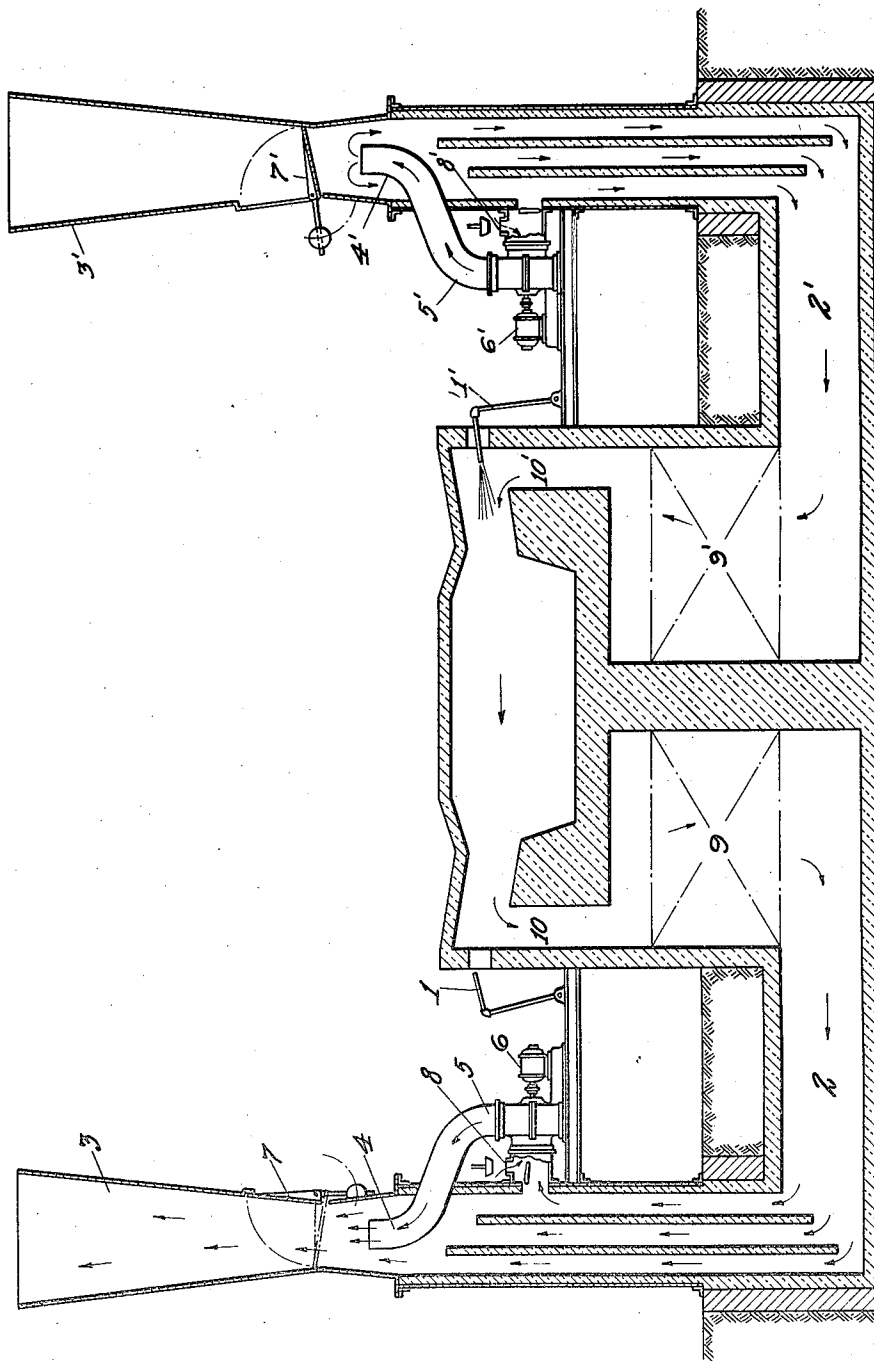


Fig. 1.

Inventor:
George H. Isley
By attorney
Wm. F. Pennington

July 23, 1929.

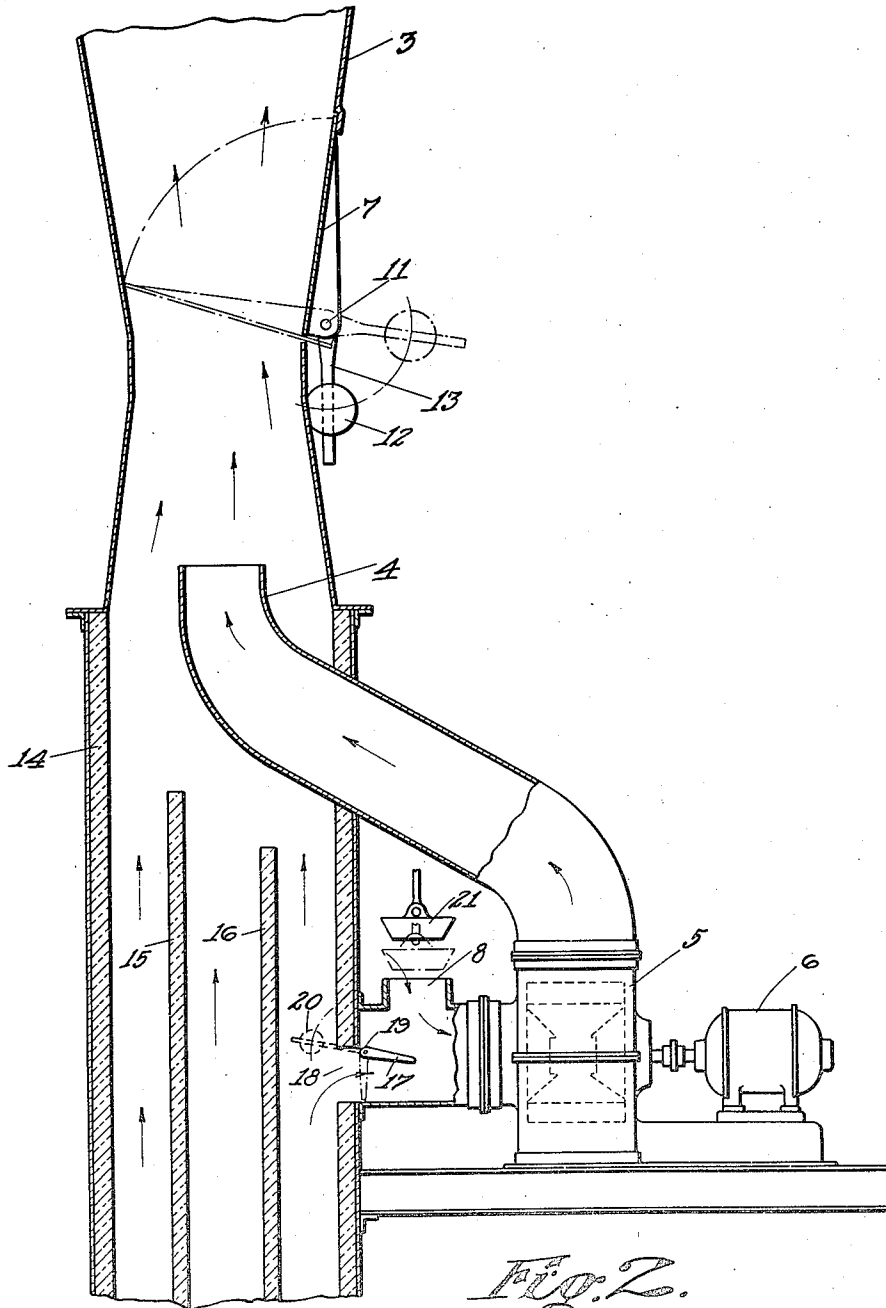
G. H. ISLEY

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3 Sheets-Sheet 2



Inventor
George H. Isley
By Attorney
Messrs. H. Kennedy & Co.

July 23, 1929.

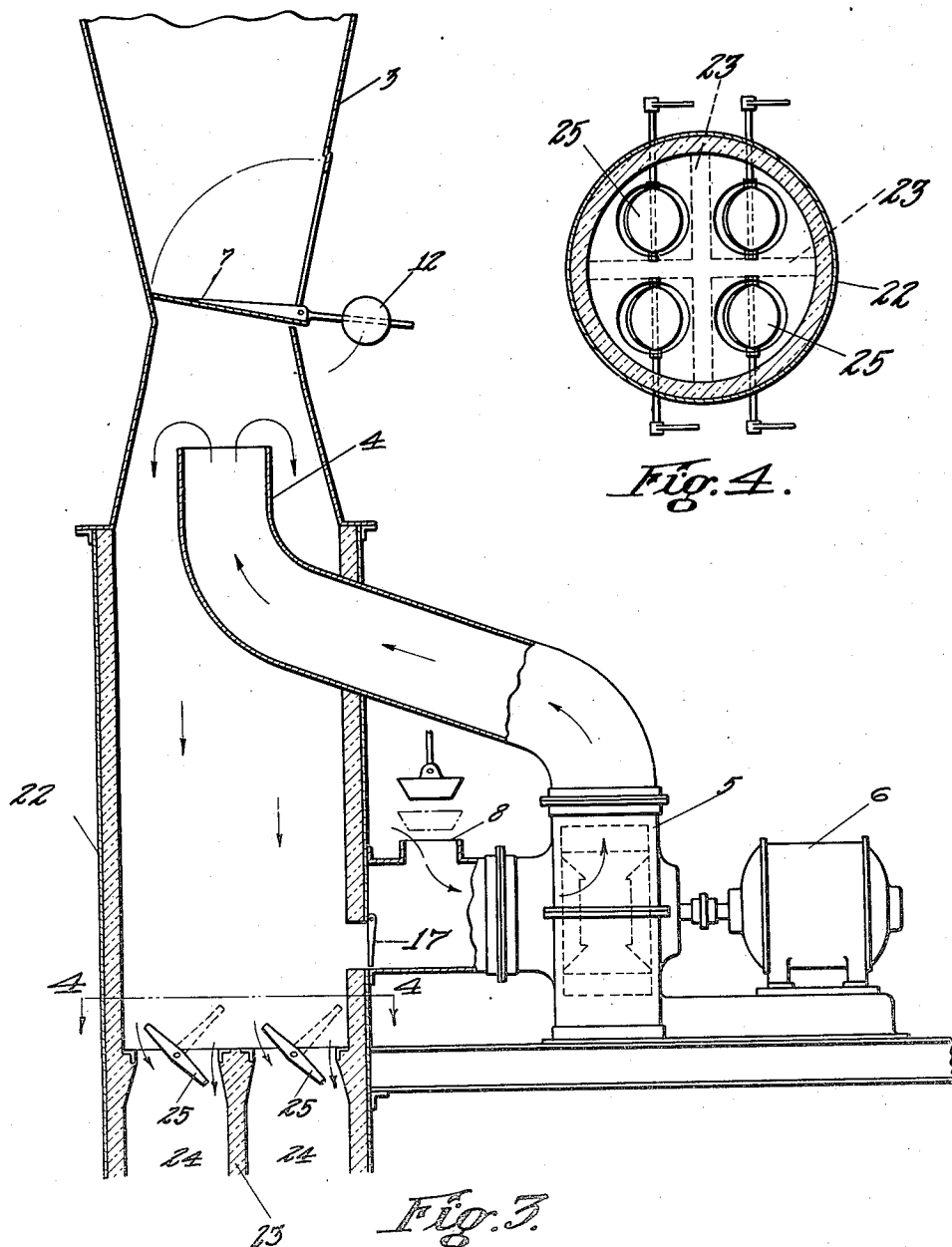
G. H. ISLEY

1,721,735

REVERSING AND CONTROLLING APPARATUS FOR HEATING FURNACES

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INVENTOR:
George H. Isley
By attorney
Geo. F. Kennedy & Co.

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UNITED STATES PATENT OFFICE.

GEORGE H. ISLEY, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO MORGAN CONSTRUCTION COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

REVERSING AND CONTROLLING APPARATUS FOR HEATING FURNACES.

Application filed April 28, 1926. Serial No. 105,204.

The present invention relates to improvements in the apparatus which is used with the regenerative type of furnace for reversing and controlling the course of the gaseous flow through such a furnace. The invention utilizes, in part, the principles of operation which characterize the apparatus shown and described in my United States Letters Patent No. 1,464,002, dated August 7, 1923, and No. 1,591,090, dated July 6, 1926, and it is fully described hereinafter with reference to the accompanying drawings, wherein—

Fig. 1 is a sectional view showing the invention as applied to a conventional type of regenerative furnace.

Fig. 2 is an enlarged sectional view illustrating a detail of construction.

Fig. 3 is a similar view illustrating the adaptation of the invention to a plurality of heating furnaces or soaking pits.

Fig. 4 is a section on the line 4—4 of Fig. 3.

Like reference characters refer to like parts in the different figures.

The invention is applicable, in general, to any type of regenerative furnace, irrespective of the fuel used therein. The furnace shown in Fig. 1, for example, is adapted for the use of oil, coke oven gas, tar, powdered coal, and the like, as fuel, involving the employment of suitable burners 1, 1', at each end of the furnace. Under these conditions, the invention is applicable to the regenerative heating of the air used to support combustion of the fuel, said air being admitted to the furnace by way of alternately used regenerator passages 2 and 2'. The air regenerator passages 2 and 2' are connected, respectively, to upwardly opening ducts 3 and 3', each preferably in the form, substantially, of a Venturi tube, and each equipped at or near its throat portion with a nozzle 4 or 4', respectively. Said nozzles are supplied with air by blowing units 5 and 5', respectively, the latter being driven by any suitable means, such as motors 6 and 6', respectively.

Gravity closing hinged valves or dampers 7 and 7' are located above the nozzles 4 and 4', respectively, and are arranged to operate within ducts 3 and 3'. In connection with the passage of the gases through the furnace from right to left as shown in Fig.

1, the left hand burner 1 is inoperative and the right hand burner 1' furnishes the fuel to the furnace. The air for supporting combustion is drawn from the atmosphere into the blower 5' through opening 8' and is discharged through nozzle 4' at relatively low pressure. Said discharge pressure, in this instance, is not sufficient to raise damper 7', and therefore the air is deflected by damper 7', which results in the flow of fresh air downward, through the lower part of duct 3', regenerator passage 2' and thence upwardly through regenerator 9' and furnace port 10'. Here the air mixes with fuel from burner 1', and the resulting combustible mixture is directed to the furnace. It is obvious that by controlling the amount of fuel passing through burner 1', and the amount of air discharged from blower 5' (by adjustment of its speed) the proper combustion may be maintained in the furnace.

The products of combustion leave the furnace by way of port 10 and pass through regenerator 9, regenerator passage 2, and enter the bottom of duct 3, where they are drawn upwardly and discharged from the top of duct 3 by the entraining action of the air discharged from nozzle 4,—the pressure, in this instance, being sufficient to hold open the swinging damper 7.

The reversal of the furnace is effected by simply causing the fuel to flow through burner 1 in place of burner 1' and by reducing the pressure at nozzle 4, whereby damper 7 will automatically close and deflect the flow from nozzle 4 towards the furnace. By increasing the pressure of fluid discharged from nozzle 4', the damper 7' will automatically open and stay open as long as the increased pressure is maintained. The cycle of reversal is now complete and the high pressure air discharged from nozzle 4' will induce the products of combustion to pass from the furnace through port 10', regenerator 9', regenerator passage 2' and upwardly, discharging from the top of duct 3'.

It is obvious that by suitably varying the high pressure air discharged from nozzle 4 or 4', as the case may be, on the outgoing side, a suitable draft may be maintained, and by suitably varying the low pressure air discharged from nozzle 4 or 4', as the case may be, on the ingoing side, the proper

amount of ingoing air will be supplied to the furnace, and that the furnace may be properly controlled at all times regardless of atmospheric conditions.

5 Fig. 2 shows an enlarged section of the essential apparatus involved in this invention. The damper 7 (or 7') when in the open position becomes part of the wall of duct 3 (or 3'). The hinge rod 11, counterweight 12, and lever 13 are preferably on the outside of the duct in order that the flow within the tube will not be obstructed, and furthermore, the counterweight 12 may be adjusted on the lever 13 so that a predetermined pressure within the duct will cause the damper to operate. The dampers 7 and 7', when in closed position, are preferably sloping, for the purpose of shedding rain water and preventing such moisture finding its way into the furnace. The lower part of each duct 3 (or 3') is lined with a refractory material 14, and provided with additional regenerator walls 15 and 16 for the purpose of absorbing the maximum heat from the products of combustion before the latter pass the nozzles 4 or 4'.

When the blowing unit 5 (or 5') is operating in an outgoing direction, a conservation of power will be effected by permitting a portion of the products of combustion to enter the blower inlet. This is accomplished by providing a damper 17 to control an opening 18 leading to said inlet from the associated regenerator. The damper 17 is provided with a hinge rod and a counterweight 20. The counterweight 20 is adjusted so that when the blower 5 (or 5') is discharging at high pressure for outgoing operation, the suction created by the blower will hold the damper 17 open, and permit a portion of the products of combustion to pass directly from duct 3 to the blower. When the pressure delivered by blower 5 (or 5') is reduced, for ingoing operation, the suction will not be great enough to hold the damper 17 open and it will automatically close by gravity.

The volume of fresh air entering the inlets 8 and 8' of the blowers is controlled in any suitable way, as by an adjustable mushroom valve 21.

Referring now to Figs. 3 and 4, the invention is illustrated in connection with and applied to a conduit or passage 22 which is adapted to serve, alternately, as the ingoing and outgoing side of a plurality of regenerative furnaces or soaking pits. To this end, said conduit 22, below the nozzle 4, is divided by partitions 23, 23 into a plurality of independent passages 24, 24,—it being understood, of course, that duplicate apparatus is provided in connection with the furnaces or soaking pits at their opposite ends. Each passage 24 communicates with one of these furnaces or soaking pits by way of a suit-

able regenerator passage, not shown, and each is preferably equipped with a valve or damper 25, enabling the operator to put out of action any one or more of the furnaces or soaking pits, while leaving the remainder to be served, as regards reversal and control by the two blowing devices, whose construction and operation is the same as above described in connection with Figs. 1 and 2.

Modifications in the construction and arrangement of the parts may be made without departing from my invention.

I claim:

1. A regenerative furnace, having a regenerator passage leading from each end thereof, a blowing device associated with each of said passages, and a damper in each of said passages, adapted to be opened and held open by the pressure produced by its respective blowing device.

2. In a regenerative furnace, a regenerator passage leading from each end thereof, a blowing device associated with each of said passages, and means for conveying to each blowing device, when employed for the outflow of gases from said furnace, a portion of the products of combustion, as a medium for the entrainment of the remaining products.

3. In a regenerative furnace, a regenerator passage leading from each end thereof, a blowing device associated with each of said passages, and means for conveying to each blowing device, when employed for the outflow of gases from said furnace, a portion of the products of combustion, as a medium for the entrainment of the remaining products, and an automatic damper for controlling the passage of said combustion products to the inlet of each blowing device.

4. In a regenerative furnace, a regenerator passage leading from each end thereof, a blowing device associated with each of said passages, and means for conveying to each blowing device, when employed for the outflow of gases from said furnace, a portion of the products of combustion, as a medium for the entrainment of the remaining products, and an automatic damper for controlling the passage of said combustion products to the inlet of each blowing device, said damper adapted to close by gravity when said blowing device is employed to effect inflow of air to said furnace.

5. A regenerative furnace, having a regenerator passage leading from each end thereof, means for supplying a blast of air to the outlet of each passage, and means in each passage outlet, responsive to the pressure of the air supply therein, for effecting selectively the inflow of said air to the furnace, or its entrainment of waste gases for discharge from the furnace.

6. A regenerative furnace, having a regenerator passage leading from one end

thereof, said passage serving alternately, as the furnace is reversed, for the discharge of combustion products from, and for the inflow of air to, the furnace, means for supplying a blast of air to the outlet of said passage, and a gravity closing damper in said passage outlet, said damper being opened and held open by the pressure of said air supply, when the passage is serving for the discharge of combustion products from the furnace.

7. A regenerative furnace, having a regenerator passage leading from one end thereof, said passage serving alternately, as the

furnace is reversed, for the discharge of combustion products from, and for the inflow of air to, the furnace, means for supplying a blast of air to the outlet of said passage, and a gravity closing damper in said passage outlet, said damper being opened and held open by the pressure of said air supply when the passage serves for the discharge of combustion products from the furnace, and said damper closing by gravity when said passage serves for the inflow of air to the furnace.

Dated this twenty-third day of April, 1926.

GEORGE H. ISLEY.