

Dec. 12, 1933.

A. S. VILLASUSO

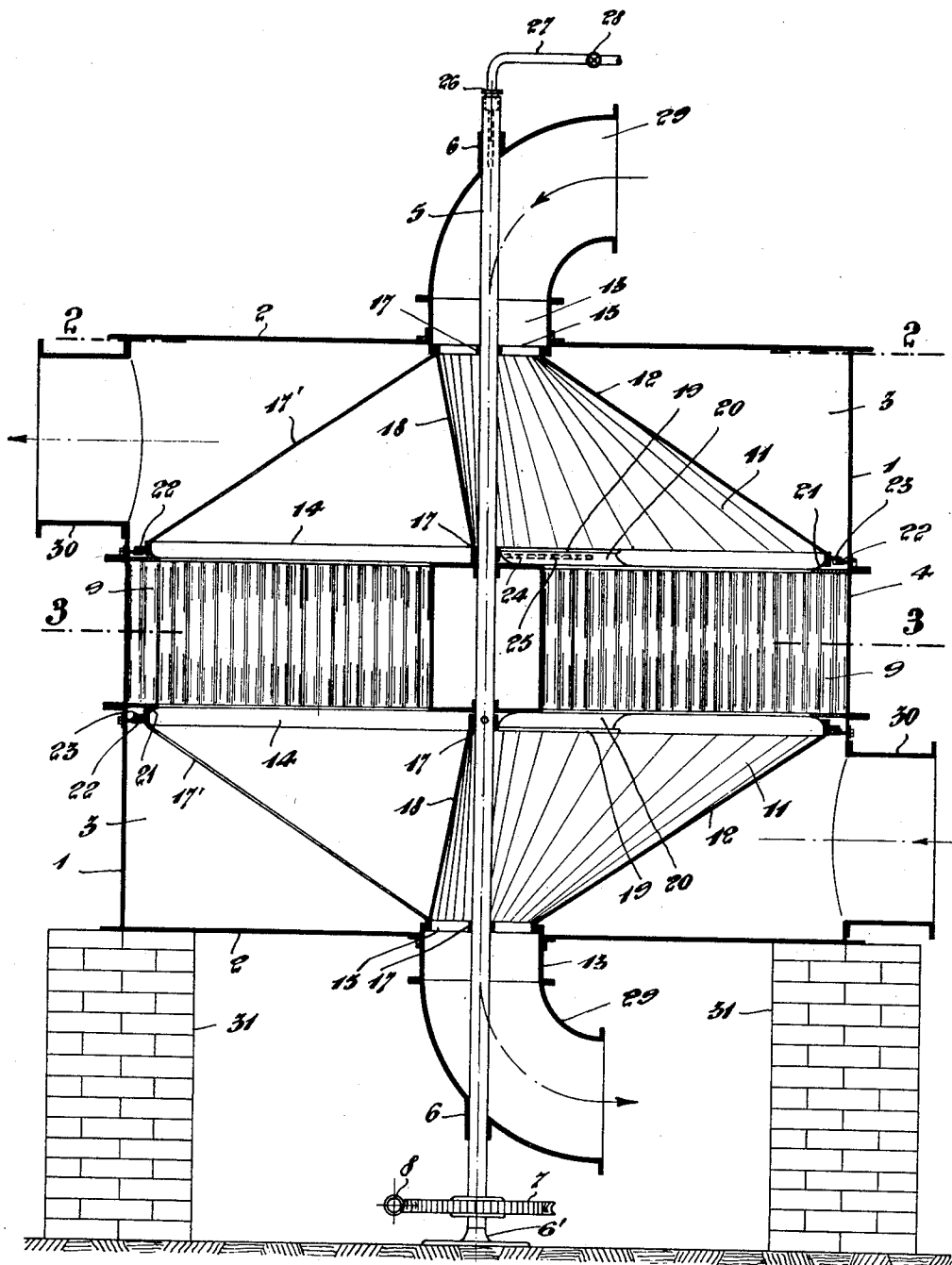
1,939,153

REGENERATIVE HEATER

Filed Feb. 23, 1932

2 Sheets-Sheet 1

Fig. 1



A. S. Villasuso
INVENTOR

B₆: Marks Clerk
Atty's.

Dec. 12, 1933.

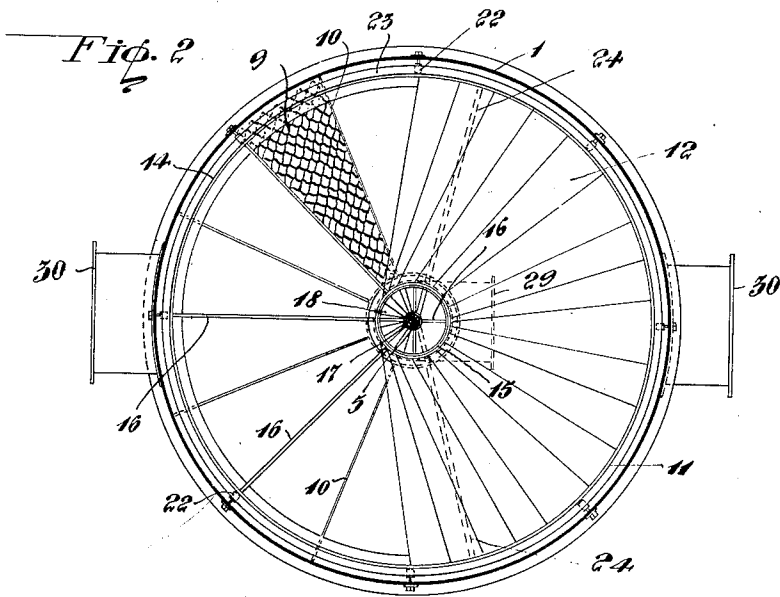
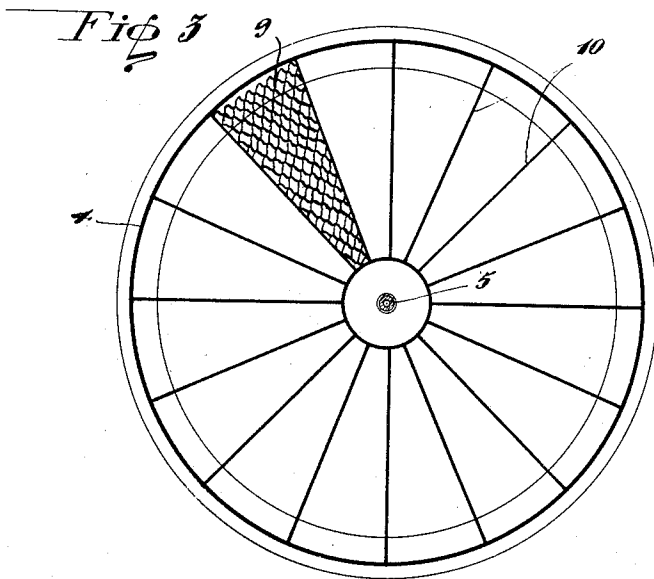
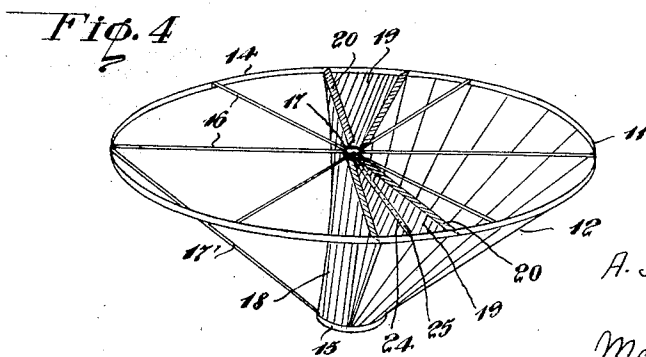
A. S. VILLASUSO

1,939,153

REGENERATIVE HEATER

Filed Feb. 23, 1932

2 Sheets-Sheet 2



A. S. Villasuso
INVENTOR
By: Markes & Clerk
ATTYS.

UNITED STATES PATENT OFFICE

1,939,153

REGENERATIVE HEATER

Armando S. Villasuso, Tucuman, Argentina

Application February 23, 1932. Serial No. 594,699

1 Claim. (Cl. 257—6)

This invention relates to an improved air pre-heating device for boilers and the like, heated by means of the combustion gases and has for its primary object to provide an apparatus of the kind set forth which will be reliable in operation, of rather small dimensions, low cost and considerable efficiency.

It is a well known fact that the efficiency of boiler furnaces and the like is greatly enhanced by feeding it the same with hot air and several apparatus have been devised for heating the air for combustion by means of the hot gases generated by the burning process. Said known apparatus, however, whether of the recuperating or of the transmitting or radiating type, offer certain objectional features, such as their large dimensions, high cost, etc.

The apparatus which forms the object of this invention, essentially comprises a heat storing device or accumulator, formed by a fixed body filled with materials of great thermic capacity and surface area, which form passages or ducts within which the gases and the air are alternately caused to circulate. A mechanical distributing means is provided for directing, at the desired moment, the gases to one part of the accumulator and the air to the other part thereof. After the gases have heated the part through which they pass, the distributing means will then feed the air thereto, and so on in succession. From the foregoing it will be seen that the air is not heated by radiation or transmission of heat through walls or partitions, but by absorbing heat from the heat storing elements, previously heated by the gases.

Other advantages and particular features of the invention will be set forth in the course of the following specification.

In order that the invention may be readily understood and carried into practice, the same has been shown, by way of example, in the accompanying illustrative drawings, wherein:—

Figure 1 shows a vertical section of the apparatus.

Figure 2 is a horizontal section of the same, on the line 2—2 of Figure 1.

Figure 3 illustrates a horizontal section on the line 3—3 of Figure 1.

Figure 4 shows a perspective of the distributing device.

In all the said views, the same numbers of reference have been used to indicate like or corresponding parts.

The apparatus forming the object of this invention, comprises, in the embodiment shown, a ver-

tical cylindrical body part or drum 1, constructed of sheet metal and having its ends closed by the top and bottom walls 2. The body 1 consists of three parts, viz: the two symmetrical compartments 3 situated at either end, and the storing compartment or accumulator 4, placed between the former. Axially extending through the conjoint is a metallic axle 5, which rotates in bearings 6, mounted at the elbows of the air ducts and at a lower pivot 6'. To one of the ends of said axle is secured a worm wheel 7, driven by the worm 8.

The accumulator 4 which is stationary as the remainder of the drum 1, consists of corrugated metallic sheets 9 which totally fill the sectors formed by the radial sheets 10. The channels or ducts formed between the corrugations of the sheets extend in a longitudinal direction and open at both sides of the accumulator. By this arrangement, no obstruction interferes with the passage of the gases through the drum, while a large surface for contact is provided for the same. As there is no connection between one sector and the other, the gases flowing through the same, will be obliged to issue by the opposite end of the same sector or compartment. It will be evident that the metallic sheets 9 which form the surface elements for absorbing the heat from the combustion gases and delivering the same to the air which is being fed to the furnace, might also be given several other shapes.

In front of each end of the accumulator rotates a distributing means 11, mounted on the axle 5 and which serves to lead the combustion gases to one part of the accumulator and the air to the opposite part of the same. Said distributing means which are symmetrical in construction, comprise each a conical surface formed by a metallic sheet 12, corresponding to one half of a truncated cone, the larger base of which corresponds with that of the accumulator, while its smaller base corresponds with that of the air duct 13, hereinafter to be described. The edge or rim of the larger base is riveted to a rim 14, while the edge of the smaller base is riveted to a rim 15. The radial arms or spokes 16 connect the rims to collars 17, mounted on the axle 5 and which serve to secure the distributing devices on said axle. Other arms or stays 17' are provided for connecting the rim 14 to the rim 15 at the opposite part of the sheet 12, in order to secure a perfectly rigid construction. A longitudinal partition, formed by a sheet 18, extends from a diameter of the larger base corresponding to the ends of the metallic sheet 12, to the rim of the smaller base 15, so as to surround the part of said rim not surrounded

by the sheet 12. Between the sheets 12 and 18 is thus formed a channel which on one side covers the whole of the smaller base of the distributor, while covering on the other side one half of its large base. This latter part of the larger base is restricted by two closure members in the form of sector shaped sheets 19, of similar dimensions as those of a sector of the accumulator, being arranged adjacent to the diameter formed by the partition sheet 18. On both sides of each of said closure members or sectors is arranged a strip 20 of thin steel, of arched section, so that its free edge will be in frictional contact with the front side of the accumulator. These two steel strips have for object to prevent any connection between the two parts of the distributor by the small separation formed between this latter and the accumulator. Further, in order to prevent any leakage by the periphery, a strip or ribbon 21 of this steel, of arched section, is placed inside of the rim 14, so that the free edge of said steel strip will be in frictional contact with the front side of the accumulator.

In order to enhance the stability of the distributing device, the same is also supported by its rim 14 on rollers 22, mounted to rotate freely on pins secured to the drum 1; the engagement between the rim and the rollers taking place by means of horizontal flanges 23 extending from each rim and resting on rollers 22.

On one of the blind sectors 19 of each distributor and diametrically opposite one to another, is arranged a radial tube 24, joined to the axle 5, having its free end closed and being provided with a row of small openings 25, directed towards the front of the accumulator. The axle 5 is hollow from its upper end to the tube 24 of the lower distributor, being connected through a packing gland 26 with a steam feed pipe 27, provided with a stop cock 28. This arrangement allows of passing a steam jet into the channels or ducts of the accumulator, in order to remove the soot therefrom.

Through the centre of each bottom or top wall 2 of the drum 1 extends a cylindrical air hose 13 within which loosely fits the rim 15 of the distributor, said air hose being extended outside by an elbow 29; to the upper elbow is connected an inlet duct for fresh air, driven in by means of a fan (not shown), while to the lower hose a suitable duct (not shown) is connected for leading the heated air to the fire box. In the outer wall of each elbow is formed the bearing 6 for the axle 5, as already stated.

Each compartment 3 formed at the ends of the drum 1, within which rotate the conical distributors, is provided with a lateral tube 30, of which the lower one serves as an inlet for the combustion gases coming from the fire box, while the upper tube is connected to the chimney (not shown).

The conjoint of the stationary part of the apparatus is mounted, in the embodiment shown, on pillars of brickwork, indicated at 31.

The operation of the apparatus is as follows:

The axle 8, driven in any suitable or desired manner, causes the axle 5 to rotate at a speed of one revolution, or thereabout, for every two minutes, so that the combustion gases and the air will alternately pass, within about a minute, through each element or part of the accumulator. To that end, the distributor has for purpose to direct the gases to one of the halves of the accumulator, and the air to the other half, so that while one part of the accumulator is being heated

by said gases, the other will deliver the heat thus received to the air. By referring to the drawings it will be seen that the gases which enter into the lower compartment 3, to the right, surrounding the part of the lower distributor formed by the sheets 12 and 18, will pass through the free part of the same, flow through the left half of the accumulator, issue from this latter and pass through the free half of the upper distributor, flow to the upper compartment or chamber 3 and thence to the chimney. The air, in turn, enters through the upper hose or conduit 13, passes by the upper distributing duct formed by the sheets 12 and 18, flows through the right half of the accumulator, issues from this latter, passes by the conduit formed by the lower distributor, enters into the lower hose or conduit 13 and flows thence to the fire box. The air, therefore, flows in a direction contrary to that of the gases, according to the general practice.

The division of the accumulator may be performed by equal parts between the air and the gases, that is to say, a similar number of sectors will be provided for the passage of the air and the gases, though it is preferable that preponderance should be allowed for the gases. For instance, in the embodiment shown, where the accumulator comprises sixteen sectors, eight of the same are subjected to the action of the hot gases and six to the air, two sectors remaining without connection, owing to the blind or obturated sectors 19. Thus, every sector or compartment of the accumulator is heated by the flue gases during one half of a revolution of the distributor, then it remains during a short time disconnected on account of the obturating sector 19 and after the passage of this latter, fresh air will start circulating through the sector during a period of time somewhat less than one half of a turn of the distributor, these operations being continuously repeated in the same succession. From the foregoing description it will have been understood that the heat is not transmitted or radiated through walls or partitions, but is accumulated during a certain lapse of time by metallic sheets and delivered thereby a short time afterwards.

The distributing devices being the only moving parts of the apparatus and their motion being besides very slow, only a small amount of power will be required for driving the same and a fraction of one horse power will be sufficient even in case the device should be of considerable dimensions.

The cleaning device will be used periodically for removing the soot which may have settled in the accumulator; for this purpose, jets of steam are injected by the orifices of the pipes 24, after opening the cock 28.

It will be evident that several modifications of construction and detail may be introduced without departing from the spirit and scope of this invention, which will be clearly described in the claim annexed to this specification.

Having now particularly described the nature of my said invention and the manner in which the same is to be performed, I declare that what I claim and desire to secure by Letters Patent, is:—

A preheater for air of the type described comprising a cylindrical accumulator divided into sectors filled with regenerative material through which gases and air may pass, a chamber at each end of the accumulator and in communication therewith at its adjacent face and provided in its walls with inlet and outlet apertures for burnt

gases and air, one of which inlet and outlet apertures is in the form of a central orifice, a distributor at each end of the accumulator, located in the corresponding chamber and in the form of a funnel consisting of half a truncated cone whose major base is a sector adjacent the face of the accumulator and whose minor base is a complete circle coaxial with said major base and connected to the corresponding central orifice in the wall of the chamber, said funnel being of the same height as said chamber, a shaft passing through the center of the apparatus and having one end projecting thereabove and carrying the two distributors, means for supporting and imparting rotary motion to said shaft, two closure members each consisting of a sector shaped metal plate fixedly secured to the radial wall of said funnel adjacent the face of the accumulator, in such manner that each of said shutters keeps at least one sector of said accumulator closed, said shaft having a hollow part extending from its projecting end to a point adjacent the accumulator, radial cleaning tubes connected to said shaft at said point, and a packing gland mounted on said projecting end of said shaft at the connection with the source of cleaning fluid and in a position lying wholly outside of the apparatus.

ARMANDO S. VILLASUSO.