E. B. FREEMAN.

AIR HEATER.

APPLICATION FILED FEB. 2, 1909.

1,083,395.

Patented Jan. 6, 1914.

2 SHEETS—SHEET 1.

Fig. 1.

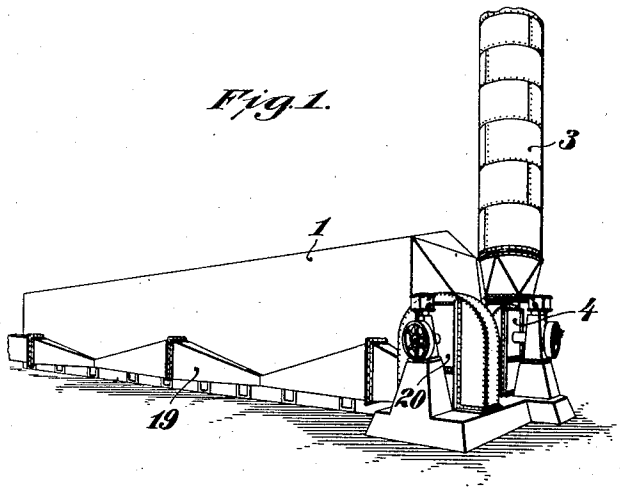
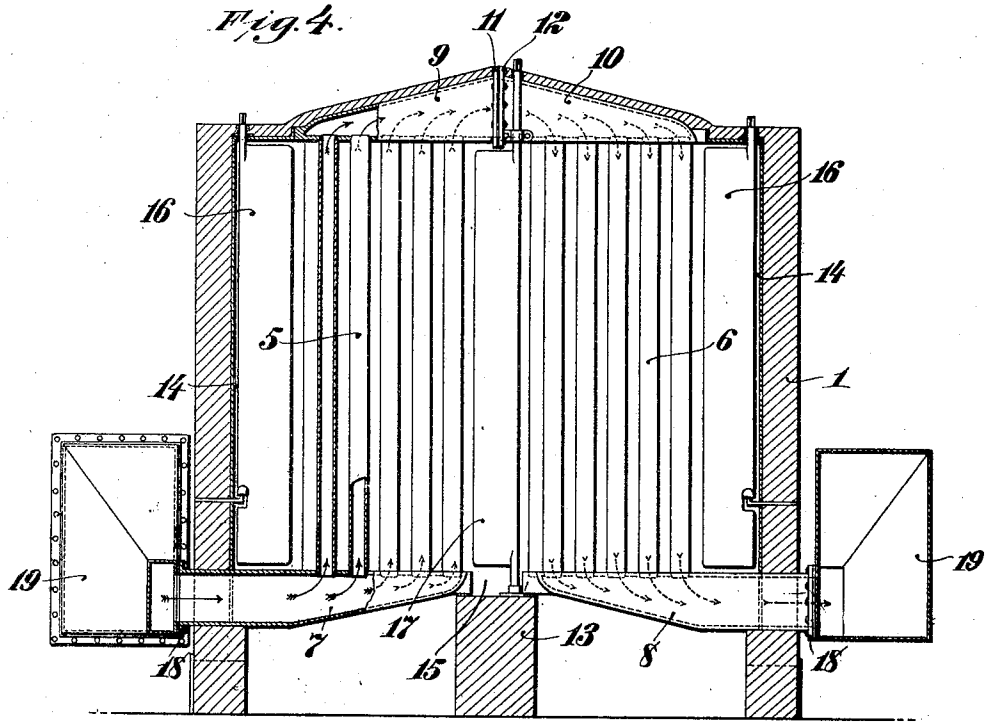


Fig. 4.



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2 SHEETS—SHEET 2.

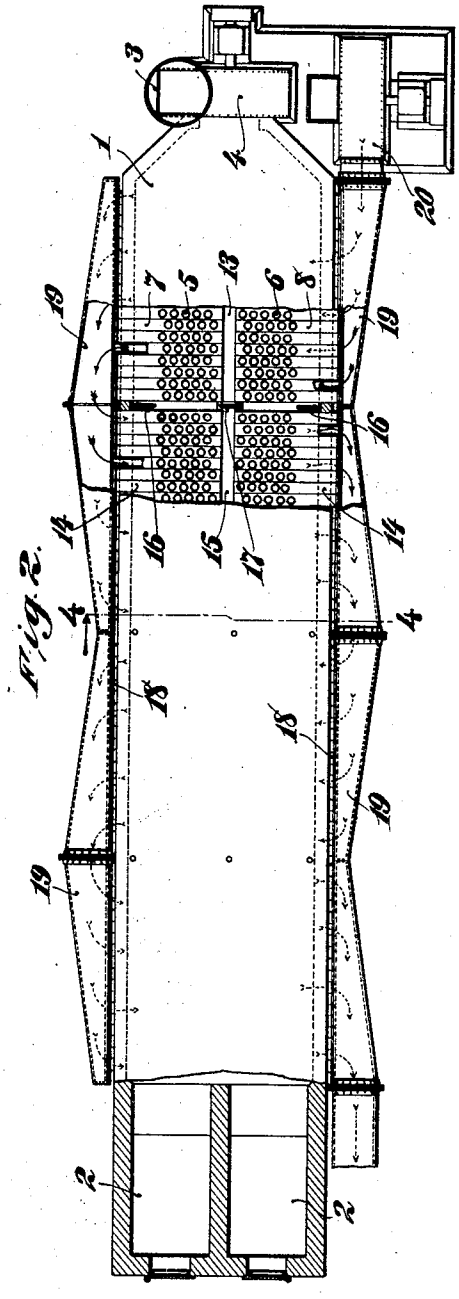


Fig. 2.

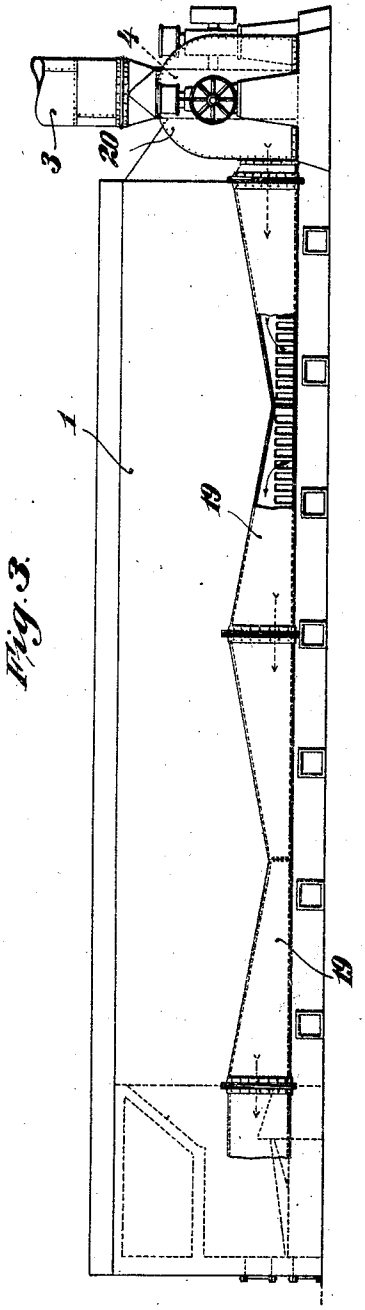


Fig. 3.

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UNITED STATES PATENT OFFICE.

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AIR-HEATER.

1,083,395. Specification of Letters Patent. Patented Jan. 6, 1914.

Application filed February 2, 1909. Serial No. 475,547.

To all whom it may concern:

Be it known that I, ERNEST B. FREEMAN, citizen of the United States, residing at Dedham, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Air-Heaters; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to air heaters adapted to utilize waste heat in raising the temperature of air to be used for ventilating, heating, drying, or for any of the purposes for which hot air is used in the arts.

The object of the invention is to provide an air heater of this character having an improved and novel construction and arrangement of pipes and connections through which the air to be heated is circulated, whereby a large volume of air may be passed through the apparatus and efficiently heated, whereby the parts may be conveniently assembled and installed, and whereby the apparatus may be conveniently kept in repair and good working order.

To these ends the invention comprises the features of construction and arrangement and the combinations of parts hereinafter described and set forth in the claims.

The various features of the invention will be readily understood from an inspection of the accompanying drawings, in which—

Figure 1 is a perspective view illustrating the general construction of an air heater embodying the invention; Fig. 2 is a plan view partly in section; Fig. 3 is a side elevation, parts of the wall boxes being broken away; and Fig. 4 is a vertical transverse section on line 4—4, Fig. 2.

In the construction illustrated in the drawings, the pipes of the air heater through which the air to be heated is passed are arranged vertically within a flue chamber 1, through which the hot gases pass from the fire boxes indicated at 2 to the stack indicated at 3. A fan 4 may be provided for inducting a draft through the flue chamber if found desirable.

As shown, the heater comprises a plurality of sections, each section consisting of two series of pipes 5 and 6 connected with headers at their upper and lower ends. The lower headers 7 and 8 for the two series of pipes connect with the pipes of each series at their lower ends, but do not afford communication between the two series of pipes at this end of the section. The upper ends of the two series of pipes are connected by two upper header sections 9 and 10 which form in effect a single sectional header connecting the two series of pipes, so that air passes through the header from one series of pipes into the other. The two header sections 9 and 10 may be integrally connected to form a double header, but are preferably formed in two separate sections provided with abutting joint seats 11 and 12, through which the sections are united. The joint seats are preferably in the form of flanges surrounding the open ends of the header sections, and a suitable gasket packing is interposed between the flanges to secure a tight joint, the flanges being bolted together as is usual with this form of joint.

While it is not essential to the broader features of the invention that the header for connecting the ends of the two series of pipes so that air is directed from one series of pipes into the other be arranged at the upper end of the section, this arrangement is preferable and forms a feature of the invention by which certain advantages are secured. By this arrangement a strong and substantial support is provided at the top of the heater for firmly supporting the mechanism necessarily used for scraping the circulating pipes. In case the header is formed in sections provided with joint seats, this arrangement results in the location of the joint between the header sections at the top of the heater where it is conveniently accessible and where it is substantially out of the path of the hot gases passing through the flue chamber, and is not, therefore, subject to deterioration and injury by the action of the hot gases.

The headers for connecting the lower ends of the pipes in each series are preferably of tapered construction; that is to say, are so constructed that the cross sectional area of the passage for the air decreases from the open toward the closed end of the header so that a uniform distribution of the air to the tubes of the series connected to the header, and a substantially uniform velocity in the air passing through the header and tubes, is secured. For the same reasons, the header sections connecting the two series of pipes at

their upper ends form a double header preferably of a double-tapered construction; that is to say, is so constructed that the cross sectional area of the passage for the air decreases from the adjoining ends of the header sections to their outer ends.

In order that the air may be repeatedly subjected to the heating action of the hot gases passing through the flue chamber, the heater may be provided with a plurality of sections connected in series so that the air will pass through one section into a succeeding section, the number of sections connected in series so that the air passes through one section after another, being varied in accordance with the size of the heater and the length of time it is desired that the air shall continue to be subjected to the heating action of the hot gases. In order that a large volume of air be handled, it is also desirable that the heater sections be arranged in groups, and that the air, after being passed through one group of sections, be delivered into a succeeding group of sections connected in series with the first group, the number of groups connected in series depending upon the results which it is desired to secure and the conditions under which the apparatus is used. It is also preferred to arrange the sections transversely of the path of travel of the hot gases through the flue chamber and to provide wall boxes for connecting the sections in series, since with this construction and arrangement the joints in the devices for connecting the sections in series may be located outside of the walls of the flue chamber where they are convenient of access and where the packing in the joints is not subjected to the action of the hot gases.

In the construction shown, the lower headers 7 and 8 of the heater sections extend through the side walls of the flue chamber 1 and are firmly supported at their inner ends upon the wall 13. In order to enable a person to gain access to the pipes and devices within the interior of the flue chamber, the sections are preferably so arranged with relation to the inner walls of the flue chamber that passage ways 14 are provided between the walls and the circulating pipes, and the two series of pipes in each section are so arranged that a passage 15 is provided through the center of the sections. Deflecting plates 16 and 17 may be pivotally mounted within these passage ways to deflect the hot gases from the passage ways against the circulating pipes of the heater sections and may be adjusted by turning them on their pivots or hinges. The ends of the lower headers 7 and 8 which project outside of the walls of the flue chamber are provided with flanges 18 by which the headers are connected to the wall box sections 19. The wall box sections are so arranged and connected that the heater sections are connected in groups, and the successive groups of sections are connected in series with each other, the air passing from one wall box section into the lower headers at one side of a group of sections and passing from the lower box section which communicates with a wall box section connected to deliver the air to the lower headers of the next succeeding group of sections. The wall boxes for delivering the air to the lower headers of the first group of sections is preferably of tapered construction, so that a uniform distribution of air to the sections and a uniform velocity in the air passing through the wall box is secured. For the same reason, the wall boxes for connecting two succeeding groups of sections are preferably of double-tapered construction, as indicated in the drawings.

A fan 20 is provided for forcing air through the wall boxes and heater sections, the air preferably entering the sections at the end of the flue chamber from which the hot gases escape, and being delivered from the sections at the end of the flue chamber where the gases are the hottest.

While it is preferred to employ the specific construction and arrangement of the parts shown and described, it will be understood that this specific construction and arrangement is not essential to the broader features of the invention and may be varied and modified without departing therefrom.

Having set forth the nature and object of the invention, and specifically described one form of apparatus in which it may be embodied, what I claim is:—

1. An air heater, having, in combination, a flue chamber, a series of sections arranged transversely of the flue chamber and each consisting of two series of circulating pipes, lower headers connecting the pipes in each series and extending through the walls of the flue chamber, upper headers connecting the pipes in each series and having abutting joint seats, joint seats on the ends of the lower headers outside the flue chamber, and wall boxes outside the flue chamber provided with joint seats connecting the lower headers, substantially as described.

2. An air heater, having, in combination, a flue chamber, a series of sections arranged transversely of the flue chamber and each consisting of two series of circulating pipes, a header at one end of the section for each series of pipes and a header at the other end of the section connecting the two series to direct the air from one series into the other, a wall box outside the flue chamber connected by joint seats outside the flue chamber with a plurality of sections to direct air into a group of sections, and a second wall box outside the flue chamber connected by joint seats outside the flue chamber with a group

of sections and a plurality of succeeding sections to direct the air from one group of sections into a succeeding group of sections, substantially as described.

3. An air heater, having, in combination, a flue chamber, a plurality of sections arranged transversely of the chamber, each section consisting of two series of vertical circulating pipes, two uncommunicating lower headers extending through the walls of the flue chamber, and communicating upper headers connecting the two series of pipes, a wall box connected by joint seats outside the flue chamber with the lower headers of a plurality of sections at one side of the flue chamber, and a wall box connected by joint seats outside the flue chamber with the lower headers of a plurality of sections at the other side of the flue chamber and with the lower headers of a plurality of succeeding sections, substantially as described.

4. An air heater, having, in combination, a flue chamber 1, a plurality of series of pipes 5 and 6 arranged transversely of the flue chamber, lower headers 7 and 8 connected with the series of pipes 5 and 6 respectively and extending through the opposite walls of the flue chamber, upper oppositely tapered communicating headers 9 and 10 connected with the series of pipes 5 and 6 respectively, and wall boxes connected with the ends of the lower headers outside the flue chamber, substantially as described.

5. An air heater, having, in combination a flue chamber, a series of heater sections arranged transversely of the flue chamber and each consisting of two series of circulating pipes, lower headers connecting the pipes in each series, upper headers connecting the pipes in each series, the heater sections being spaced from the walls of the flue chamber and the two series of circulating pipes of each section spaced from each other whereby a passage way is formed between each wall of the flue chamber and the heater sections and also between the pairs of series of circulating pipes, and adjustable deflecting plates mounted in the passage ways, substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

ERNEST B. FREEMAN.

Witnesses:

IRA L. FISH,

N. D. MCPHAIL.