Aug. 30, 1932. W. S. PATTERSON ET AL 1,875,128

AIR HEATER

Filed Sept. 2, 1931 2 Sheets-Sheet 1

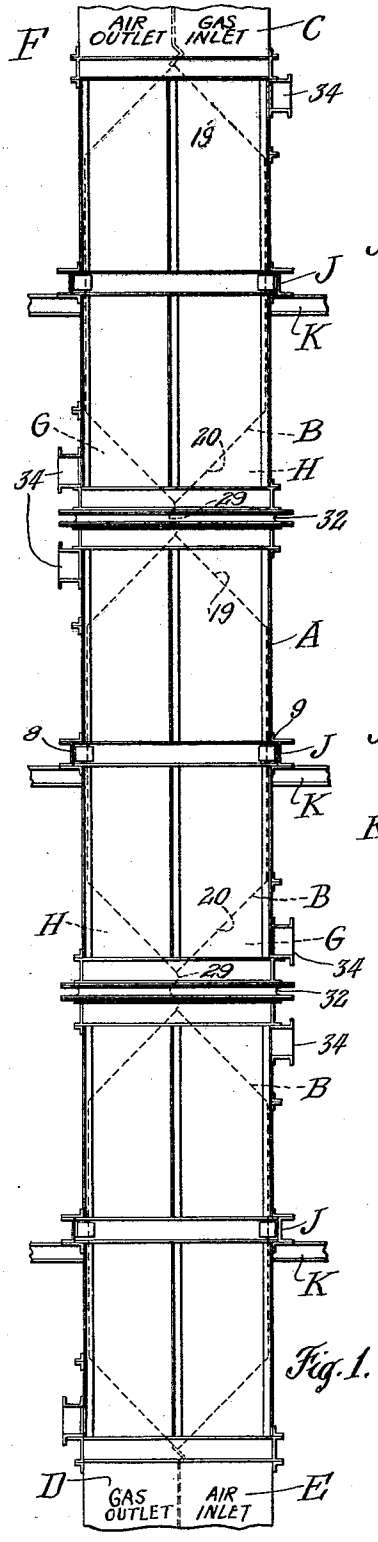


Fig. 1.

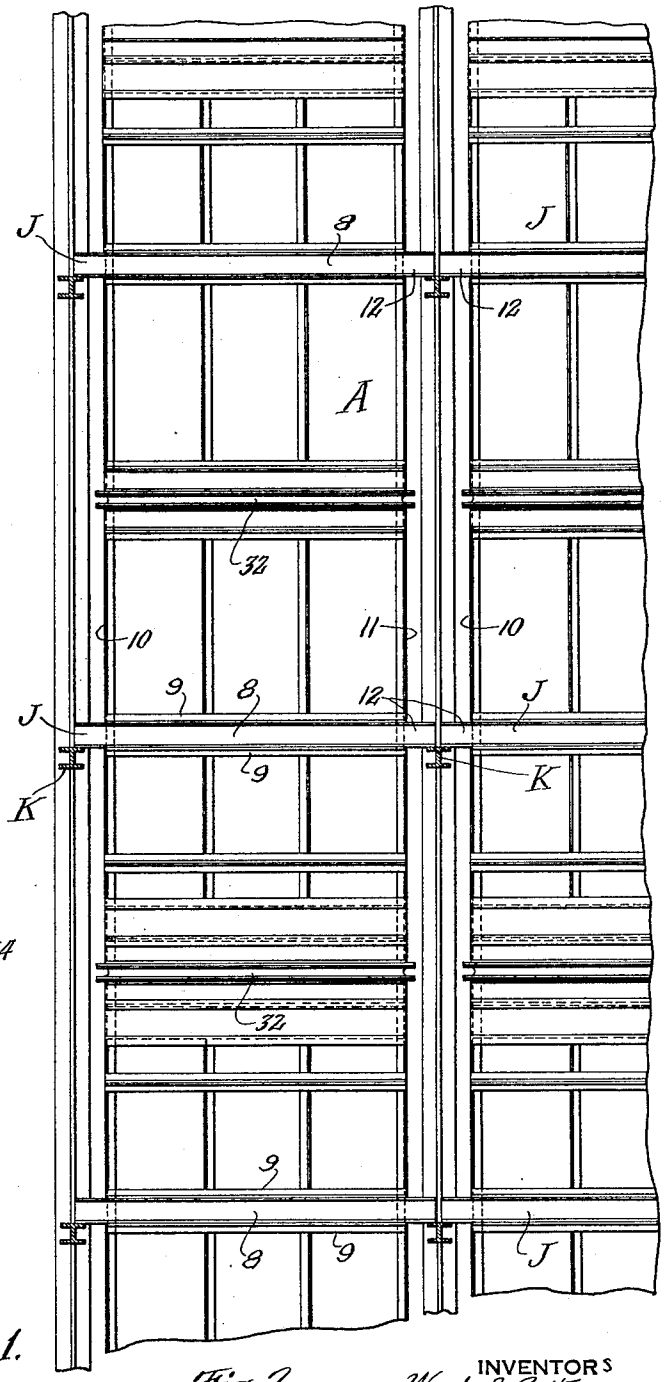


Fig. 2.

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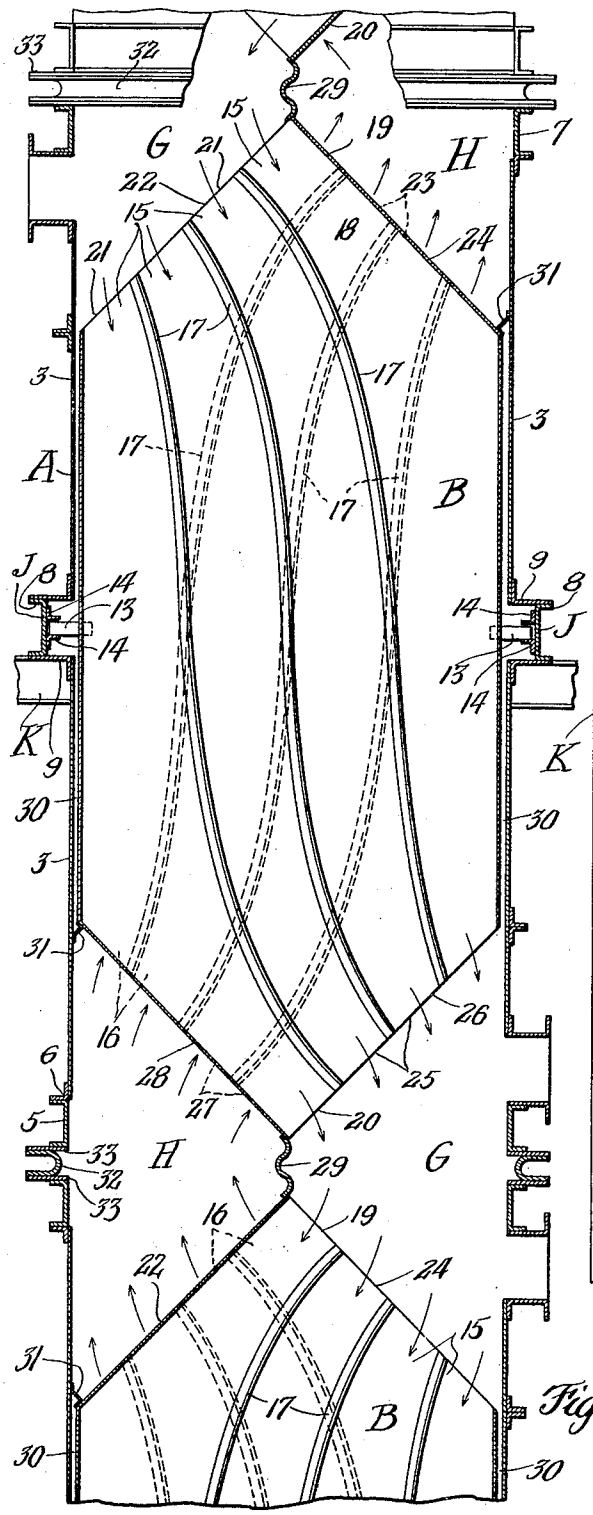


Fig. 4.

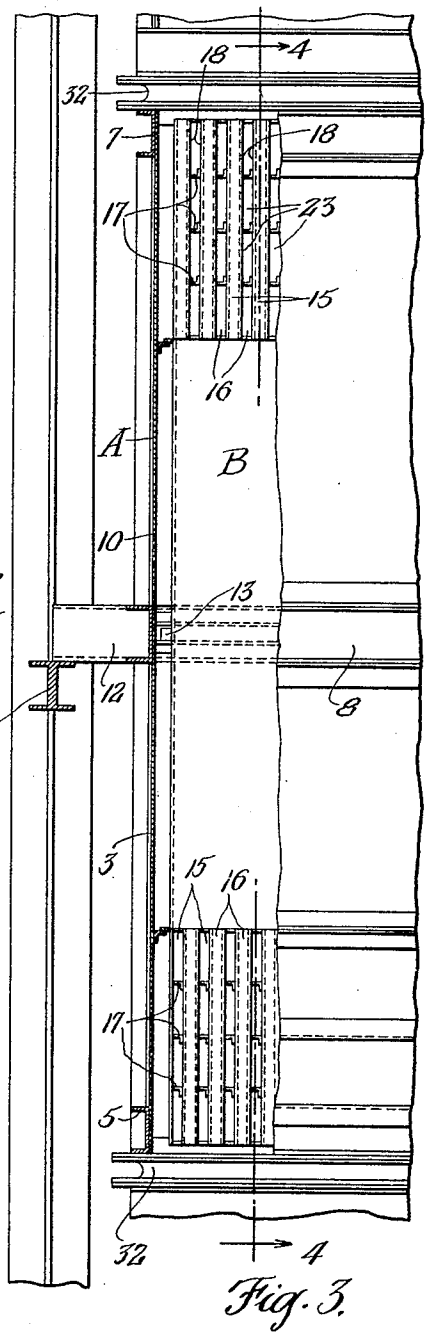


Fig. 3.

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1,875,128

UNITED STATES PATENT OFFICE

WARD S. PATTERSON, OF CRANFORD, NEW JERSEY, AND CONWAY PIERCE, OF ALAMORGORDO, NEW MEXICO, ASSIGNORS TO INTERNATIONAL COMBUSTION ENGINEERING CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

AIR HEATER

Application filed September 2, 1931. Serial No. 560,720.

This invention relates to air heaters of the sectional type.

One of the primary objects of our invention is the provision of a sectional heater simple in form, rugged in construction, economical of space, and effective in operation.

Another object resides in the provision of a multi-section air heater built up of a plurality of like sections which are readily removable and reversible.

A further object of our invention is the provision of a multi-section air heater in which the ducts or chambers for connecting the various sections are entirely within the heater casing.

Still another object resides in the provision of a multi-section air heater in which each section is independently supported.

A further object resides in the provision of heater elements of novel shape.

How the foregoing, together with such other objects and advantages as may hereinafter appear, or are incident to our invention, are realized, is illustrated in preferred form in the accompanying drawings wherein—

Figure 1 is an end elevational view of a heater constructed in accordance with our invention.

Figure 2 is a side elevational view of the heater shown in Figure 1.

Figure 3 is an enlarged fragmentary side elevational view of a portion of the heater with the casing shown partly in section; and

Figure 4 is a vertical cross sectional view taken on the line 4—4 of Figure 3.

Our improved air heater comprises in general, casing structure indicated as a whole by the reference character A; heater elements B located within the casing structure; gas inlet and outlet ducts C and D; air inlet and outlet ducts E and F; chambers G and H between superjacent heater elements B—B, the chambers G in this instance being gas chambers, and the chambers H being air chambers; and support members J associated with the heater and adapted to rest on structural work K.

The heater is what may be termed a multi-section heater and is composed of a plurality of like sections of such construction that they are readily removable, interchangeable, and reversible. The sections are each supported independently, and the supporting members are arranged midway of the tops and bottoms of the sections, and the casing and heater elements are symmetrical so that the sections are not only interchangeable but also reversible. The sections may be completely assembled at the shop and shipped as a unit, the size limit being determined by handling and shipping facilities.

Referring, now, particularly to Figures 3 and 4, it will be seen that the casing structure of each section is composed of a sheet metal portion 3 and that the bottom edge thereof is stiffened by channel members 5 secured to the metal casing by means of angle irons 6, and that the upper end thereof is similarly constructed as indicated at 7. Channel irons 8 are attached to the sheet metal casing parts by means of angle irons 9, it being noted that the channel members 8 are located midway of the height of the section.

By referring to Figures 2 and 3, it will be seen that the side channel members 8 extend beyond the faces 10 and 11 of the section as indicated at 12, and that these extending portions rest on the structural work K associated with the air heater so that the channel members act as the support means J for the sections. The heater elements B are attached to the members 8 through the medium of any suitable attaching means such as lugs 13 and angle clips 14, it being noted that the lugs 13 are located at the middle point of the elements vertically considered.

Through this construction the heater elements are supported independently of the sheet metal casing. It is also to be noted that by extending the support members beyond the ends of the sections, they may be handled in erection and supported by means of the extensions.

The heater elements are provided with a plurality of gas passages 15 and a plurality of air passages 16, which passages may be formed by means of angle shaped dividing members 17 extending between side sheets 18.

The gas passages are preferably alternately arranged with respect to the air passages, as clearly shown in Figure 3. The heater elements have upper and lower V-shaped ends, as indicated at 19 and 20.

Referring to the upper V-shaped end 19 of the heater element B, shown in Figure 4, it will be seen that gas inlet openings 21 to the gas passages 15 are provided in the leg 22, and air outlet openings 23 for the air passages 16 are provided in the other leg 24. At the lower V-shaped end 20, gas outlet openings 25 are provided in the leg 26, and air inlet openings 27 are provided in the leg 28. In the lower heater element B, the gas inlet openings are provided in the leg 24 of the upper V-shaped end, and the air outlet openings are provided in the leg 22.

The superjacent heater elements B are spaced somewhat apart and a flexible member 29 is attached to the adjacent ends of the elements at the apices thereof. This member is secured in place in the field as by means of welding, and it acts as a sealing member adapted to divide the space between the adjacent elements into two chambers G and H above referred to, and prevents leakage from one chamber to the other. By employing heater elements having V-shaped ends, we have provided a novel arrangement whereby the gas and air chambers connecting the gas and air passages of superjacent elements are entirely within the casing structure of the heater, thereby eliminating the use of outside ducts for connecting the passages. The arrangement is advantageous from the point of both cost and space occupied as compared with heaters having outside connecting ducts. A further advantage resides in the fact that straighter flow of the gas and air is provided.

By making the V-shaped ends of the heater elements of the proper angle, it will be seen that the exit and entrance areas from the passages at the legs of the V may be made the same as they would be if the bottom of the elements were made straight. To accomplish this, the angle of the V would be made such that the lengths of the legs would be equal to the distance between the upper edges of the V.

In order to prevent air from leaking from the air chambers to the gas chambers through the clearances 30 between the heater elements and the casing structure, suitable sealing means, such as strips 31, are provided, as clearly indicated in Figure 4 of the drawings. These strips may be of flexible metal and may be welded or otherwise secured to the heater elements. The casings of the superjacent sections may be connected together by means of expansion joints 32 secured to the flanges 33 of the casings, this construction being desirable because of the sections being supported independently of one another, as has been pointed out above.

In the particular arrangement disclosed in the drawings, we have shown our heater as composed of three sections B in height, although it is to be understood that any number of sections may be employed. Also, any number of upright units, each composed of a plurality of sections B in height, may be employed in constructing a large capacity heater. In the form illustrated, the gases are led to and away from the heater by means of the gas inlet and outlet ducts C and D which may be common to all of the upright units.

It will be seen from the foregoing that we have provided a very simple and effective multi-section air heater in which the sections, by virtue of their being removable and reversible, can be re-arranged or replaced to take care of corrosion at the cold end, or oxidation at the hot end. In some instances it may be desirable to employ shorter sections at various points in the installation so that after a certain period of operation the shorter sections could be re-arranged; i. e., a section at the hot end where oxidation tends to occur, may be replaced by another section that has been doing duty in a cooler part of the heater. Also, by employing such shorter sections, it would be justifiable in some instances, owing to the small cost thereof, to allow them to remain in place until burned through or corroded, before replacing them. Furthermore, due to the small size thereof, these sections may be made of special metals for the cold end or for the hot end of the heater, without entailing heavy expense.

Among the advantages of our invention is the possibility of shop assembly, which enables us to employ shop labor which is less expensive than field labor, and of shop testing, since the sections may be assembled and tested for leakage before being shipped.

It is also pointed out that by supporting each section independently we are enabled to make the sections of much lighter construction than would be the case if one section depended on the other for support. The independent support also enables any section to be readily removed or replaced no matter wether it is at the bottom of the heater, at an intermediate point, or at the top, since the lower sections do not bear the weight of the upper sections.

It is to be noted that the casing is so designed as to make the gas passages between elements readily accessible for cleaning between sections of the heaters. Cleanout openings 34 are provided for this purpose.

What we claim is:—

1. A multi-section air heater comprising a casing, a plurality of superjacent heater elements in said casing having V-shaped ends and means providing a gas and an air cham-

ber in said casing between superjacent heater elements.

2. A multi-section air heater comprising a casing, a plurality of superjacent heater elements in said casing having V-shaped ends, and means associated with the adjacent V-shaped ends of said heater elements to provide a gas and an air chamber between the elements and within the confines of the casing walls.

3. A multi-section air heater comprising a casing, a plurality of heater elements therein, one above the other, said elements having V-shaped ends and a plurality of gas and air passages, means at the apices of the V-shaped ends dividing the space between adjacent heater elements into two V-shaped chambers one of which affords communication between the gas passages of adjacent sections and the other of which affords communication between the air passages of adjacent sections.

4. A multi-section air heater comprising in combination, a plurality of like heater sections each including a casing and a heater element therein providing a plurality of gas and air passages, said elements having V-shaped ends; means connecting the adjacent ends of the casings of adjacent sections together; and means at the apices of adjacent ends of the heater elements of adjacent sections for providing two separated chambers between adjacent sections, one being an air chamber and the other a gas chamber, said plurality of gas passages having communication with the gas chambers, and said plurality of air passages having communication with the air chambers.

5. A multi-section air heater comprising a casing, a plurality of heater elements within said casing arranged in spaced superjacent relations, said elements having V-shaped ends, means providing a plurality of air and gas passages in said heater elements, and means at the apices of the heater elements dividing the spaces therebetween into two chambers, one of the chambers of each space being adapted to communicably connect the gas passages of the heater elements, and the remaining chambers being adapted to communicably connect the air passages of the heater elements.

6. In a multi-section air heater, the combination of a plurality of interchangeable heater sections each comprising a casing, support means located centrally of the top and bottom of the casing, said casing having an open top and bottom, a heater element within said casing having a plurality of gas and air passages; and means for securing said heater element to said support, said heater element having V-shaped ends; means for securing said sections together in superjacent relation; and means at the apices of the heater elements providing two chambers in the casing between superjacent elements, one of said chambers affording communication between the gas passages of the sections and the other of said chambers affording communication between the air passages of the sections.

7. An air heater comprising a casing, and heater elements in said casing having V-shaped ends and a plurality of gas and air passages, one leg of each end having air openings establishing communication to and from the air passages, and the other leg of each end having gas openings establishing communication to and from the gas passage.

8. An air heater section for multi-section air heaters, comprising a casing and heater elements having a V-shaped top and bottom and gas and air passages extending from top to bottom, said gas passages having inlet for gases at one leg of one of the V's and outlet for gases at one leg of the other V, and said air passages having inlet for air at the remaining leg of one of the V's and outlet for air at the remaining leg of the other V.

9. An air heater section for multi-section air heaters comprising a casing, and heater elements having V-shaped ends and a plurality of gas and air passages, said gas passages having inlets thereto in one leg of one of the V-shaped ends and outlets therefrom in one leg of the other V-shaped end, and said air passages having inlets thereto in the other leg of one of the V-shaped ends and outlets therefrom in the other leg of the other V-shaped end.

10. An air heater section for multi-section air heaters comprising a casing, heater elements, supporting members, means for securing the casing to the supporting members, and means for securing the heater elements to the supporting members.

11. A heater section for multi-section air heaters comprising a casing, support means located centrally of the casing, means for supporting said casing from said support means, a heater element having a plurality of gas and air passages, and means for supporting said elements from said support means and independently of the casing.

12. A multi-section air heater comprising, in combination, a plurality of like heater sections each including a casing, heater elements therein providing a plurality of gas and air passages, said elements having V-shaped ends; expansion joints connecting the adjacent ends of the casings of adjacent sections together; and flexible means at the apices of adjacent ends of the heater elements of adjacent sections, for providing two separated chambers between adjacent sections, one being an air chamber and the other a gas chamber, said plurality of gas passages having communication with the gas chambers, and said plurality of air passages having communication with the air chambers.

13. A multi-section air heater comprising,

in combination, a plurality of like heater sections each including a casing, heater elements therein providing a plurality of gas and air passages; an expansion joint for connecting the adjacent ends of the casings of adjacent sections together; means for supporting each section independently; and gas and air chambers between the sections for establishing communication between the air and gas passages of the sections.

14. A multi-section air heater comprising in combination, a plurality of like heater sections, each having supporting members located midway between the tops and bottoms of the sections, said members extending beyond the walls of the sections.

15. In combination, a multi-section air heater each section of which is provided with supporting members, and structural work associated with said heater adapted to support the sections of the heater independently of one another through the medium of said supporting members.

16. In combination, multi-section air heater each section of which is provided with supporting members, and structural work associated with said heater adapted to support the sections of the heater independently of one another through the medium of said supporting members, together with expansion joints for communicably connecting the sections together.

In testimony whereof we have hereunto signed our names.

WARD S. PATTERSON.
CONWAY PIERCE.