Sept. 30, 1930. W. H. OWEN 1,777,148

AIR HEATER

Filed March 30, 1927

Fig. 1.

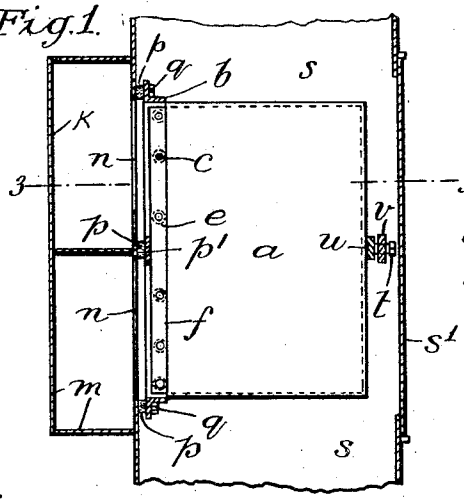
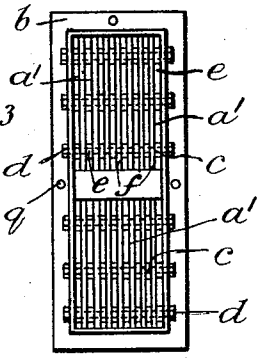


Fig. 2.



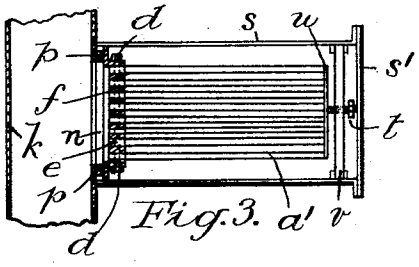


Fig. 3.

Fig. 7.

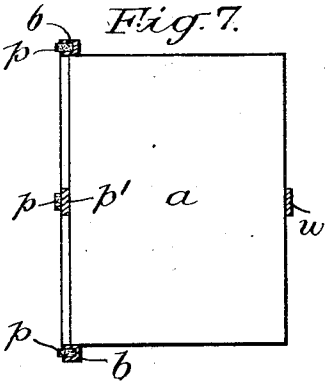
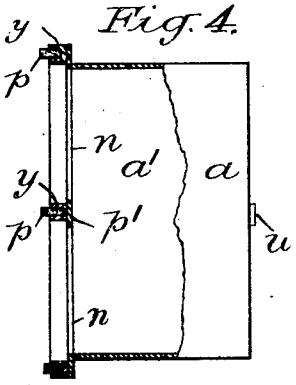


Fig. 4.



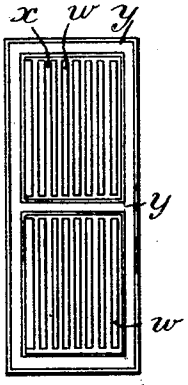
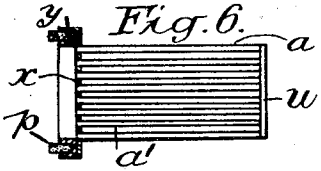
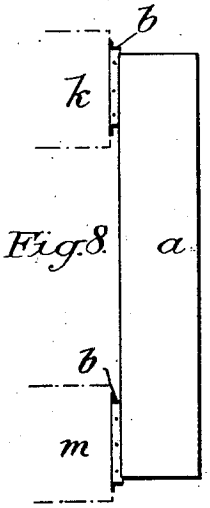


Fig. 5.

Fig. 6.





Inventor:
William Henry Owen
per C. Barnard Burton
Attorney

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UNITED STATES PATENT OFFICE

WILLIAM HENRY OWEN, OF WIMBLEDON, ENGLAND

AIR HEATER

Application filed March 30, 1927, Serial No. 179,668, and in Great Britain April 8, 1926.

This invention relates to that class of air heaters in which the heating elements or cells, in any convenient number are assembled together to form several groups or bundles which are contained in a casing provided with doors for access etc. The side of the casing has openings or ports for the entrance and exit of the air to and from the cells, which have suitable openings in their back edges for this purpose. The air is led to the ports by an exterior longitudinal duct.

For the purpose of preventing the escape of air into the gas spaces, or from the cold air inlets to the heated air outlets, it is necessary to make an air tight joint between the back face of the bundles and the surface of the casing. It is an object of the present invention to provide a simple and an effective method of making this joint, which whilst readily detachable at the same time gives a rigid construction for holding the cells together.

In order to carry the invention into effect, I propose to attach, by welding or otherwise, to the back face of the bundles, a channel or an angle iron frame situated on the periphery of the bundles, and exterior to the air orifices. In the space left between the webs of the channel iron, a strip of rope of asbestos, or other elastic and heat resisting material, is fixed projecting above the webs so that when the bundle is forced against the side of the casing, by screws, crossbars or other suitable means, the asbestos is squeezed between the two parts and the joint is made. This prevents escape of the heating medium or hot waste gas which flows through the casing, and also prevents air from the air-inlets leaking into such casing. Alternatively, instead of asbestos or the like material, a quantity of heat resisting cement may be put into the space of the channel iron.

An alternative construction is to fix to the back face of the bundles a plate pierced with slots having the desired pitch of the cells. The open edges of the air cells would be placed in the slots, and the edges of the cells would then be welded or otherwise secured to the sides of the slots thus forming a secure and an air tight connection binding the whole rigidly together. An angle or channel iron frame is fixed to the face of the plate exterior to the air orifices, by riveting, welding or other convenient means. In some cases these frames may be dispensed with and the asbestos be fixed directly onto the face of the plate, or heat resisting cement only may be used.

It is obvious that the arrangement may be reversed and that the channel or angle iron frames may be fixed onto the casing instead of to the bundles or to the plate fixed to the latter. In all cases a cross joint, between the orifices for the air, is provided in order to prevent leakage of cold air to the hot air exit.

In this way the bundle forms a self-contained unit in which alternate cells form through passages for the heating medium or hot waste gas, whilst the intervening cells with openings only at one side serve as heaters for the medium to be heated. This self contained unit is easily detachable and replaceable.

In order to give a more intense pressure on the asbestos packing an angle or channel iron frame may be fixed onto the bundle or to the casing so that the asbestos in the opposite channel or angle iron frame would be indented by the narrow projecting web or, if cement be used, it would be squeezed out as the web entered and thus make a sound joint all round the edges.

In order that the invention may be clearly understood and readily carried into effect reference will now be had by way of example to the accompanying diagrammatic drawings in which:

Fig. 1 is a side view of one arrangement according to the invention.

Fig. 2 is an elevation of the bundle or heat-transfer unit looking towards the left (Fig. 1).

Fig. 3 is a horizontal section thereof taken on the line 3—3 of Fig. 1.

Fig. 4 is a side view partly in section of a modification hereinafter referred to.

Fig. 5 is a front view, and

Fig. 6 is a horizontal section thereof.

Figs. 7 and 8 illustrate in side view, further modifications.

Referring more particularly to Figs. 1 to 3:—

a indicates a bundle, group or box of cells, which is provided with an angle-iron frame *b*. *c c* are tie-bolts which pass through the frame and have tightening nuts *d* at each end. These bolts pass through distance pieces, rings or washers *e* in the mouths of the air spaces between the edges of the thin plates a^1 of the heater, and through closing bars *f* in the waste gas spaces, the whole being thus clamped securely together to form a permanent bundle or group of cells.

The edges of the plates of each heating cell are bent together so that they meet centrally, where they are seamed or welded, so as to close three sides of the cell. The fourth side, or mouth, is of course open. To keep the cells together and in proper relative position, the vertical closed edges (that is, those on the right in Fig. 1) are spot welded to a bar *u* running across the middle of the bundle or unit, as indicated also in Fig. 2.

The air-heating cells are thus formed by the alternate spaces corresponding to the distance rings *e*, whilst the intervening spaces or cells (corresponding to the closing bars *f*) serve as direct-through passages for the upflow of the waste-gases, being open at the top and bottom. Any other convenient way of keeping the cells in position, and holding them together, may be employed however, if desired, instead of the centre cross-bar (Fig. 2).

The angle-iron-frame may be welded to the cells all around the edges, and the edges of the cells may be welded to the vertical spacing bars *f* in the gas spaces. The bundles are arranged in an outer casing *s* provided with one or more doors s^1. *k* is the duct for supplying cold air, whilst *m* is the duct for taking away the heated air, suitable openings *n* in the casing being provided for conducting the air to and from the cells.

The hot waste gases and smoke pass straight up through the casing *s* and the bundles by means of the alternate spaces, viz, those which have the bars *f* in their left-hand edges (Fig. 3).

Asbestos or other suitable packing *p* placed between the faces of the angle-iron frame *b* and the inside of the casing of the ducts to prevent leakage of air, such angle-iron framing being forced onto the asbestos by bolts *q*. The frame may be of channel section, as at *y* (Figs. 4 to 6) and the asbestos or the like packed into it so as to project normally as shown. The frame may however be set back as at *b* (Fig. 7) slightly onto the casing, and strip p^1 be provided at the middle. An alternative method is to provide a crossbar *v* fixed in the outer casing *s* with screws *t* to force the bundle on to the face of the casing, a bar (*u*) welded to the edges of the cells being provided to distribute the pressure and to bind the cells together.

Another method of forming the joint is to fix the mouths of the cells, or rather the pairs of plates a^1, at their edges, into a plate provided with slots *w* for the entrance and exit of air.

The edges of the cells may be welded to the strips or bars *x* left between the slots *w*.

The channel-iron frame *y* is fixed to the slotted plate in any convenient manner, the packing *p* being held in the groove of the channel iron.

In some cases, when the cells *a* and plates a^1 are of considerable length, the ducts *k* and *m* may be placed near the top and bottom (Fig. 8) but otherwise made air tight at the joints, as in the manner illustrated in the preceding figures. Moreover if desired, or on account of considerations of space, the door a^1 may be placed at the end of the casing, so that the boxes or bundles *a* may be inserted or drawn out sidewise.

I claim:—

1. In an air heater, the combination of a casing serving as a flue for waste gases, inlet and outlet air-ducts arranged at one side of said casing and opening thereto, a detachable bundle of plates forming a single unit and comprising alternate cells to receive respectively the waste gases and the air to be heated, packing arrangements at one and the same side of said bundle to form joints around the openings of the casing and air-ducts, means for securing said bundle in place and for compressing said packing, and a door arrangement opposite the bundle for permitting its ready insertion into and removal from the casing, substantially as described.

2. In an air-heater, the combination of a casing through which the heating medium passes, ducts at one side thereof for the admission and withdrawal of the air to be heated, a bundle of plates forming a single unit arranged inside said casing and communicating with said ducts, alternate cells in said bundle forming direct through passages for the heating medium, intervening cells open on one side only to both the air-ducts, an angle-iron frame for holding packing around the joint between the edge of the bundle and the aforesaid casing, and means for simultaneously compressing such packing and fixing said bundle in position, substantially as described.

3. In an air-heater, the combination of a casing for the passage of waste gases, inlet and outlet air ducts at one side of said casing, a bundle of plates forming a single detachable unit and comprising cells of which alternate ones serve for the direct flow of the waste gases whilst the intervening ones serve for the air to be heated, such intervening cells having inlet and outlet openings at one

side communicating with the aforesaid inlet and outlet ducts, and an angle-iron frame provided with packing for the joints around the edge of the detachable bundle and between the said bundles and the air ducts, substantially as described.

4. A heat-transfer unit comprising a plurality of similar cells arranged side by side at spaced intervals, the cells being closed except as to one edge, the open edges of the cells being similarly directed and provided with closing means between them, a transverse strip across the open edges of the cells intermediate the top and bottom to provide inlet and outlet ports to said cells, and jointing frames surrounding all the aligned inlet ports and all the aligned outlet ports, said frames having jointing flanges lying in a single plane, substantially as described.

5. A heat-transfer unit comprising alternate parallel cells spaced apart with lateral openings for the medium to be heated, the spaces between the cells having upper and lower openings for the direct passage through them of the heating medium, and a rigid jointing frame secured to the unit around the openings of the heating cells to strengthen the unit, and to serve for compressing packing, when the unit is clamped in position for use, substantially as described.

6. A heat-transfer unit consisting of a bundle of parallel plates the alternate spaces between which form heating cells, means for closing the intervening spaces between the mouths of said cells, and a jointing face surrounding said mouths and adapted to compress packing material when the unit is forced against such packing, substantially as described.

In testimony whereof I affix my signature.

WILLIAM HENRY OWEN.