C. J. ATKINSON.

PREHEATER FOR GASES.

APPLICATION FILED AUG. 11, 1913.

1,106,611.

Patented Aug. 11, 1914.

3 SHEETS—SHEET 1.

Fig. 1.

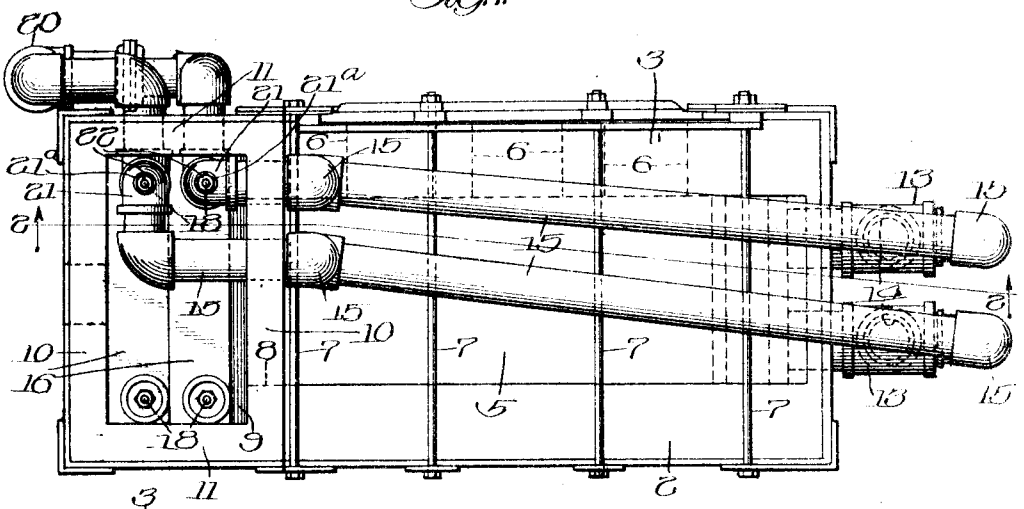
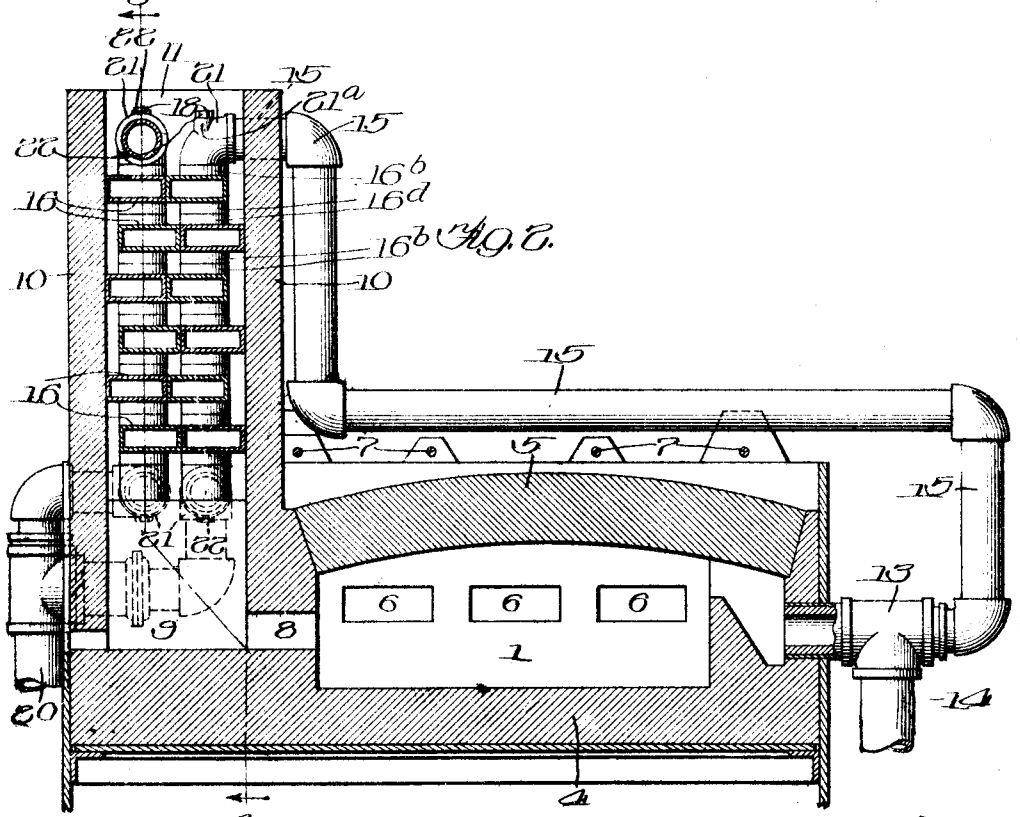


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

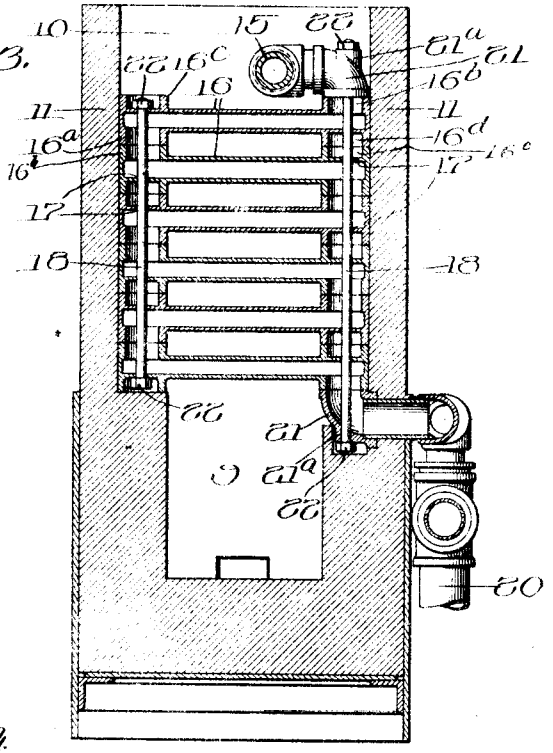


Fig. 4.

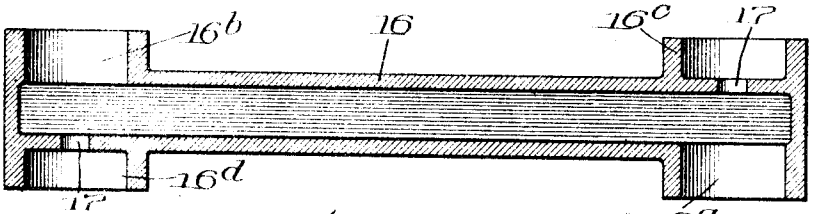


Fig. 5.

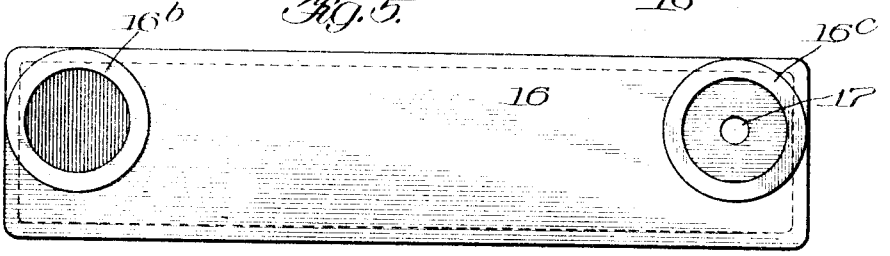
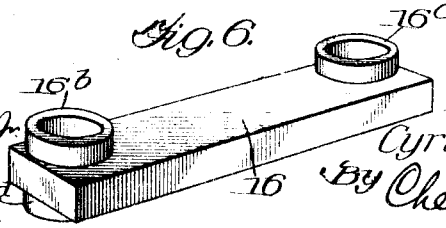


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 8.

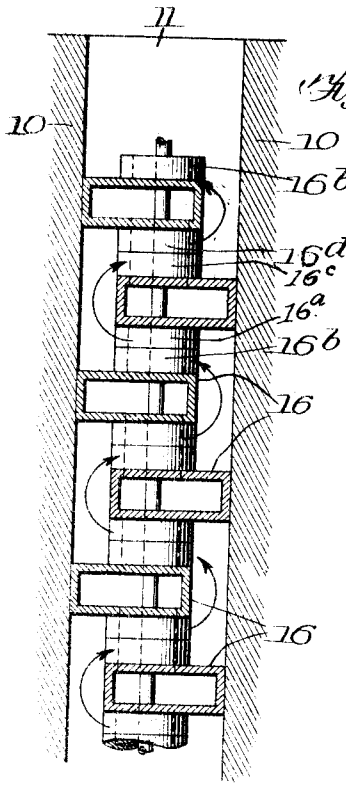


Fig. 7.

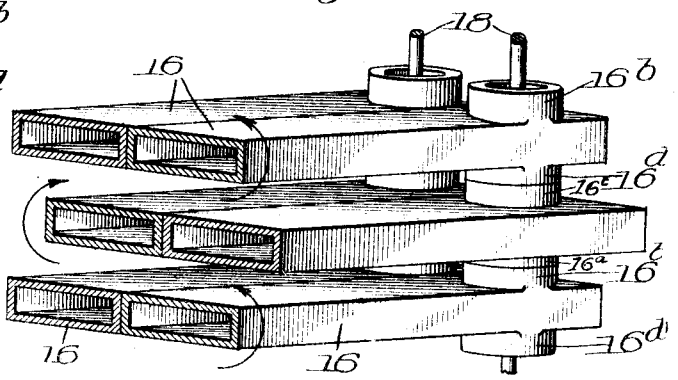
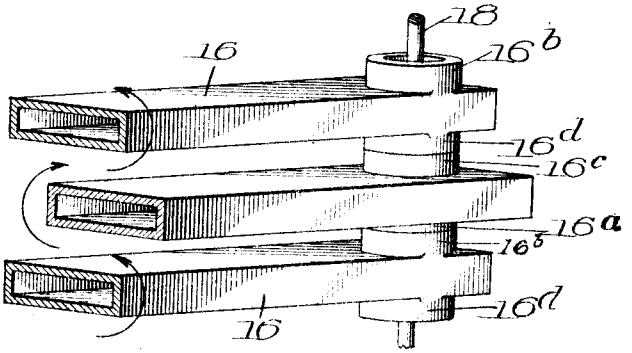


Fig. 9.



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UNITED STATES PATENT OFFICE.

CYRIL J. ATKINSON, OF BELOIT, WISCONSIN, ASSIGNOR TO FAIRBANKS, MORSE & COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

PREHEATER FOR GASES.

1,106,611. Specification of Letters Patent. Patented Aug. 11, 1914.

Application filed August 11, 1913. Serial No. 784,075.

To all whom it may concern:

Be it known that I, CYRIL J. ATKINSON, a subject of the King of Great Britain, residing at Beloit, in the county of Rock and State of Wisconsin, have invented a certain new and useful Improvement in Preheaters for Gases, of which the following is a specification.

My invention relates to means for heating or cooling fluids.

In order to illustrate a specifically appropriate use to which my invention may be put, I have shown it in the form of a preheater for gases. It is well known that producer gas, for example, frequently has comparatively low heating value, and in the accompanying drawings I have illustrated means for preheating air or preheating a combustible gas, and introducing it in heated condition into a furnace using producer gas so as to secure high temperature in the furnace. The furnace illustrated is particularly adapted for hardening and tempering articles of steel.

The object of my invention is to produce an efficient and inexpensive construction, especially of those parts in which the conduction or heat transference occurs.

In one of its more specific aspects, the object of my invention is to provide a section or unit of such configuration that by properly assembling a number of such units between parallel walls, two non-communicating tortuous passages may be formed, one for conveying the gas or other fluid to be heated or cooled, and the other for separately conveying the gas or other fluid which is to give up its heat or abstract heat from the first mentioned fluid.

In the construction illustrated, the internal passages within the sections are for conveying the combustible gas or air to the furnace, and the external passages are for causing the heated gases from the furnace to bathe the units and thereby cause them to conduct the heat to the gases within them.

I accomplish my objects by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of an annealing or tempering furnace embodying my invention. Fig. 2 is a longitudinal sectional elevation thereof on the line 2—2 of Fig. 1. Fig. 3 is a transverse sectional elevation on the line 3—3 of Fig. 2. Fig. 4 is a longitudinal section of a heater unit. Fig. 5 is a plan view of a heater unit. Fig. 6 is a perspective view of a heater unit. Fig. 7 is a perspective view, partly in section, illustrating the arrangement of the assembled units. Fig. 8 is a detail sectional elevation showing a single stack of units in distinction to the double stack shown in Fig. 2. and Fig. 9 is a perspective view of the single stack of units shown in Fig. 8.

Similar reference numerals refer to similar parts throughout the several views.

In the heater selected to illustrate the invention, the interior 1 of the furnace is surrounded by side walls 2 and 3, a bottom 4 and an arched top 5. Apertures 6 are formed in one of the walls for introducing the articles to be annealed or tempered, and means, such as the rods 7, are provided for bracing the walls. The furnace chamber 1 communicates through a passage 8 with a flue 9 formed by the walls 10, 10 and 11, 11. It will be understood that the form of the furnace proper is immaterial and may be varied to suit conditions.

Let it be assumed that producer gas is to be burned in the furnace and that the air with which it is to be mixed for burning is to be preheated. The producer gas will be led to the T's 13 through supply pipes 14, said T's communicating with the furnace chamber. The heated air will be delivered to the T's through the air ducts 15. The heated air is supplied to ducts 15 through stacks of heater units located between the flue walls 10 and 11 as best shown in Figs. 2 and 3. These heater units which embody essential features of my invention are illustrated separately in Figs. 4, 5 and 6. The units are all of the same form and each has a hollow body 16 which is supplied with air through a riser 16^a entering at the bottom and which delivers this air through a riser 16^b issuing from the top. These risers are formed by hollow bosses forming necks of appreciable length. The riser necks are remote from each other, lengthwise of the unit, and by preference are located actually at the ends of the unit to thereby increase the length of the passage through it. By preference also the body of the unit is substantially rectangular in cross section and the riser necks annular in cross section. The body of the unit is wider than the necks and the necks are placed eccentrically, with the

result that the bodies extend farther on one side from the necks than on the other. By preference the sides of the necks are substantially tangential both to the end and to the side of the unit.

In the complete structure the units are assembled in such manner that the in-riser 16^a of one unit will rest upon the out-riser 16^b of the unit below. The result is that the bodies of the units are spaced apart, vertically, and leave a passage between them for the flow of the hot gases leaving the furnace. Spacers 16^c and 16^d are provided, the lower spacer 16^d resting upon the upper spacer 16^c of the unit beneath. By preference the spacers are integral with the body of the unit and are of the same height and external configuration as the riser necks 16^a and 16^b. The spacers are so placed on the unit that the upper spacer 16^c is directly opposite to the in-riser 16^a while the lower spacer 16^d is directly opposite to the out-riser 16^b. There is no communication between the inside of the unit and the inside of the spacer, although there is a small aperture 17 formed, preferably at the center of each spacer, for the passage of tie rods 18 by which the units are held together when assembled. These rods, as best shown in Figs. 3 and 7 to 9, make a comparatively close fit with the apertures 17 so as to substantially prevent the flow of gas from the risers straight up through a unit.

From the foregoing it is manifest that as a result of the configuration described, the units may be stacked one above another in such manner that the in-riser 16^a of one unit will register with the out-riser 16^b of the unit below, and a continuous passage will be formed passing up into one unit then horizontally along it and then vertically up and out into the next unit and then horizontally in the return direction. In other words, a long tortuous passage is formed in which the direction of flow is reversed in each succeeding section. It will also be evident that the units will be spaced apart vertically, and the extension side of one unit will project in one direction from the median line of the stack while the extension sides of the units next above and next below will project in the opposite direction. In the structure containing my units the walls are at such distance apart as to touch the extended sides of the units, and they therefore form part of the external passage and serve to deflect the flue gases at each unit.

If a single stack is employed, as shown in Figs. 8 and 9, each wall touches each alternate unit in the stack. If a double stack is employed, as shown in Fig. 2, one wall will touch each alternate unit in one stack and the other wall will touch each alternate unit in the adjacent stack. In the latter case, the units whose extension sides project away from the wall will touch the side of the unit adjacent to it in the corresponding tier of the adjacent stack.

The air to be heated is supplied to the stack of units through a supply pipe 20 leading to the bottom of each stack and the air is delivered from the stack to one of the ducts 15, previously mentioned. At the top and bottom of each stack are elbows 21 of special form, as best shown in Figs. 1, 2 and 3. These elbows are provided with bosses 21^a which are apertured to accommodate the tie rods 18. These bosses form seats for nuts 22 by which the elbows and the units are bolted together. It will be noted that in my construction, the rods are protected from the action of the hot flue gases. This is important as it is desirable to make the tie rods of steel or wrought iron which metals do not withstand the action of hot flue gases as well as cast iron which is the preferred metal for constructing the heater units.

In operation, combustion takes place in the furnace chamber 1 and the hot gases pass from said chamber up through the flue formed by the walls 10 and 11. These gases bathe the external surface of the units and heat the air or gas within. The air thus heated flows up through the units and through the ducts 15 to the T 13 where the mixture with the producer gas occurs. The resulting mixture then enters the furnace and continues the operation.

The general principle of operation is the same whether a single stack be employed, as shown in Fig. 8, or a plurality of stacks be employed, as shown in Fig. 2.

It is obvious that liquids as well as gases may be heated and that liquid as well as gas may be used for furnishing the heat. Likewise, the apparatus may be used for cooling fluids as well as heating them.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. A heater unit having a hollow body and necks extending in opposite directions therefrom, said necks being narrower than the body of the unit and located nearer to one side thereof than to the other.

2. A heater unit having a hollow body and necks extending in opposite directions therefrom, said necks being narrower than the body of the unit and located nearer to one side thereof than to the other, said necks being near the opposite ends of the unit.

3. A heater unit having a hollow body and necks extending in opposite directions therefrom, said necks being narrower than the body of the unit and located nearer to one side thereof than to the other, said necks being near the opposite ends of the unit, and said unit having a spacer opposite to each

neck on opposite sides of the body of the unit.

4. A heater unit having a hollow body and necks extending in opposite directions therefrom, said necks being narrower than the body of the unit and located nearer to one side thereof than to the other, said necks being near the opposite ends of the units, and said unit having a spacer opposite to each neck on opposite sides of the body of the unit, the height and external shape of the spacers being similar to the height and external shape of the necks.

5. In a structure of the class described, a unit having a top, bottom, sides and ends, a hollow boss rising from the top of the unit substantially tangential to one side thereof, a hollow boss descending from the bottom of the unit substantially tangential to the same side of the unit, said bosses communicating with the interior of the unit and being of less width than the unit and being located at the opposite ends of the unit, a spacer descending from the unit with its center in line vertically with the center of the ascending boss, and a spacer ascending from the unit with its center in line vertically with the center of the descending boss.

6. In a device of the class described, a unit having a top, bottom, sides and ends, a hollow boss rising from the top of the unit substantially tangential to one side thereof, a hollow boss descending from the bottom of the unit, substantially tangential to the same side of the unit, said bosses communicating with the interior of the unit and being of less width than the unit and being located remote from each other endwise of the unit, and spacers of approximately the same external configuration as the bosses, one of said spacers rising from the unit in line vertically with the descending boss and the other of said spacers descending from the unit in line vertically with the ascending boss, there being a small aperture through each spacer and through the unit wall at the base thereof for the purpose described.

7. A heater unit having a hollow body, a riser leading thereinto, the sides of the riser being substantially tangential to one side and one end of the body, a second riser leading out from the opposite side of the body, the second riser being substantially tangential to the same side and to the opposite end of the body of the riser, said risers being narrower than the body of the unit, and spacers projecting in opposite directions from the body of the unit and each having its median line coincident with the median line or axis of the riser on the opposite side of the body of the unit.

8. A heater unit having a hollow body, an in-riser leading thereinto, an out-riser leading thereout of, said risers projecting in opposite direction from the body of the unit and being substantially tangential to the same side and to opposite ends of the unit, said risers having annular cross-sections and having a diameter less than the width of the unit, said risers both being of substantially the same height.

9. A structure for heating or cooling fluids comprising a pair of parallel walls and a plurality of duct units arranged in tiers for forming in connection with said walls two separate and independent passages for the flow of fluid, said units being of less width than the space between the walls and being arranged in staggered relation, one unit touching one of said walls and units in the tier next above and next below touching the other of said walls, each unit having a riser leading into it from below and a riser leading out from it at the top, said risers being of appreciable length whereby the bodies of the units are spaced from each other and a passage is thus formed between them, the risers on any given unit being remote from each other, longitudinally of the unit, and being substantially tangential to the same side of the unit.

10. A structure for heating or cooling fluid comprising a plurality of individual units of similar configuration arranged in tiers, each unit having an in-riser and an out-riser located at opposite ends of the unit and tangential to the same side thereof, the risers being narrower than the body of the unit, the in-riser of one unit resting upon the out-riser of the unit in the tier below, a flue wall contacting the side of a unit in each alternate tier, and a second flue wall opposite and parallel to the first and contacting the side of a unit in each alternate tier.

11. A structure for heating or cooling fluid comprising a plurality of individual units of similar configuration arranged in tiers, each unit having an in-riser and an out-riser located at opposite ends of the unit and tangential to the same side thereof, the risers being narrower than the body of the unit, the in-riser of one unit resting upon the out-riser of the unit in the tier below, a flue wall contacting the side of a unit in each alternate tier, a second flue wall opposite and parallel to the first and contacting the side of a unit in each alternate tier, and means in addition to the risers for holding said units spaced one above the other.

12. A structure for heating or cooling fluid comprising a plurality of individual units of similar configuration arranged in tiers, each unit having an in-riser and an out-riser located at opposite ends of the unit and tangential to the same side thereof, the risers being narrower than the body of the unit, the in-riser of one unit resting upon the out-riser of the unit in the tier below, a flue wall contacting the side of a

...f in each alternate tier, a second flue wall opposite and parallel to the first and contacting the side of a unit in each alternate tier, protuberances on each unit located opposite to each riser and extending in opposite directions therefrom, and tie rods passing through said units and surrounded by said risers and said protuberances whereby said rods are protected from gases outside of said units.

13. In apparatus of the class described, the combination of parallel walls, and a stack of hollow units all of the same configuration and assembled with every other unit arranged end for end with their ends in register, each unit having an in-riser neck below and an out-riser neck above and at the opposite end, and said necks being eccentric with the body of the unit and both being nearer the same side of the unit.

14. In apparatus of the class described, the combination of parallel walls, and a stack of hollow units all of the same configuration and assembled with every other unit arranged end for end with their ends in register, each unit having an in-riser neck below and an out-riser neck above and at the opposite end, and said necks being eccentric with the body of the unit and both being nearer the same side of the unit, hollow elbows at the ends of the stack communicating with the risers there, and tie rods passing up through the risers, said units and elbows having registering apertures for receiving said rods.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

C. J. ATKINSON.

Witnesses:
T. B. FAUQUIER,
GEO. B. INGERSOLL.