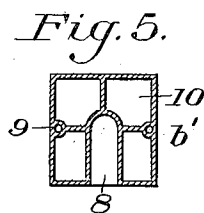
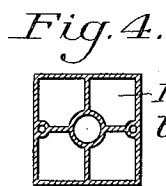
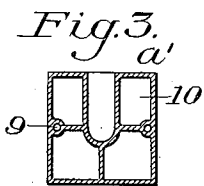
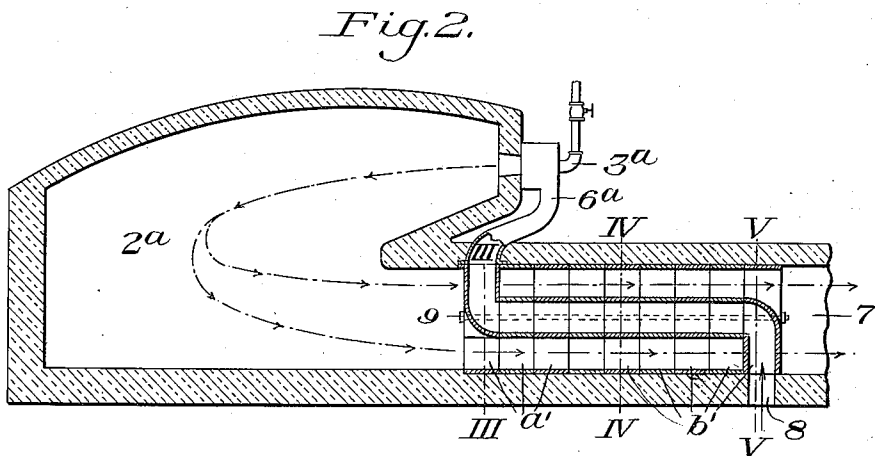
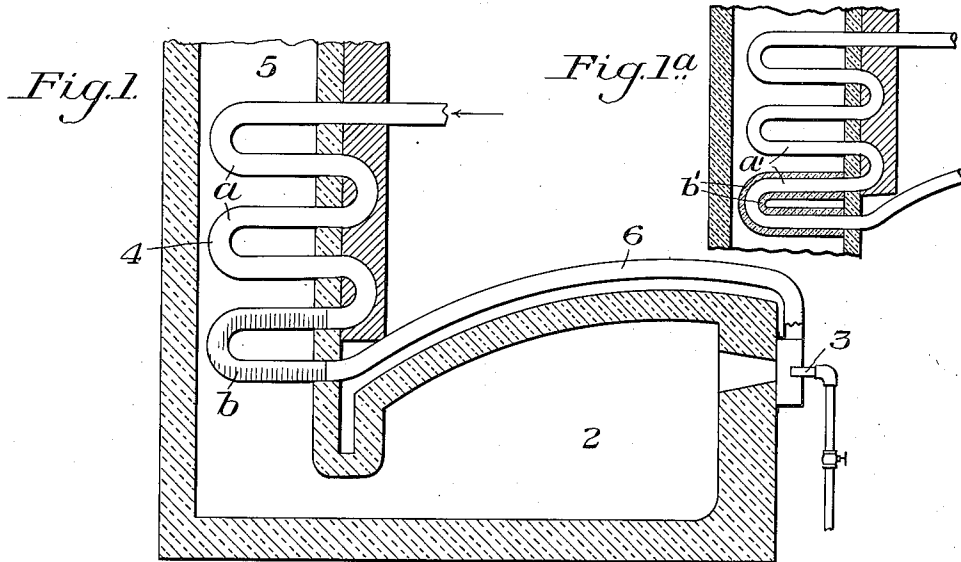


C. L. W. TRINKS.
 RECUPERATOR.
 APPLICATION FILED AUG. 28, 1919.

1,342,073.

Patented June 1, 1920.



WITNESS

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RECUPERATOR.

1,342,073.

Specification of Letters Patent.

Patented June 1, 1920.

Application filed August 28, 1919. Serial No. 320,503.

To all whom it may concern:

Be it known that I, CHARLES L. W. TRINKS, a resident of Pittsburgh, Allegheny county, Pennsylvania, have invented a new and useful Improvement in Recuperators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional view, largely diagrammatic, illustrating one form of the application of my invention;

Fig. 1^a is a view corresponding to Fig. 1, illustrating a modified form of my invention;

Fig. 2 is a similar view showing another application of the invention; and

Figs. 3, 4 and 5 are sections taken respectively on the lines III—III, IV—IV and V—V of Fig. 2.

My invention has relation to recuperators designed for use in furnace work, such as heating or annealing furnaces, although adapted to a wide variety of uses.

The utilization of as large a percentage as possible of the heat which is ordinarily carried off by the waste gases of a furnace is of great importance. The efficiency of many types of furnaces, such as heating and annealing furnaces, is known to be comparatively low, by reason of the fact that the products of combustion must leave the heating chamber of the furnace at a temperature in excess of that of the material to be heated. Heretofore, and particularly where relatively high temperatures are concerned, it has been customary in practice to employ regenerators in order to utilize, as far as possible, the heat of the waste gases for preheating the combustion air of the furnace. Regenerators, however, require a system of reversing valves which must be attended to by an operator, and it is highly desirable to provide some arrangement which will obviate the necessity for such valves and the attention which ordinary regenerators require. For these reasons many attempts have been made to devise a recuperator which would be satisfactory in practice. In this work great difficulties have developed since if the heat transmitting surface of the recuperator is made of metal, the temperature of the preheat is limited, because the metals usually employed for this purpose

burn out at high temperatures. If constructed of metals or alloys capable of withstanding high temperatures, the cost of construction is largely prohibitive. If the heat transmitting surfaces are made of refractory material, cracks soon develop in operation which destroy the efficiency of the device, since the products of combustion and the incoming air will mix and the operation of the furnace must be interrupted. For this reason, refractory recuperators have been limited in their use to low preheating temperatures.

My invention is designed to overcome these difficulties and to provide a metallic recuperator capable of successful operation with relatively high temperatures.

In Fig. 1 I have illustrated, largely diagrammatically, one embodiment of my invention which will clearly illustrate its underlying principle. In this figure the numeral 2 designates the combustion chamber of a furnace supplied by a burner 3 and provided with a recuperator 4 whose coils are located in the stack 5. The air preheated in this recuperator is conveyed to the burner 3 by means of a connection such as illustrated at 6.

Roughly considered, the walls of the recuperator coils 4 have at any point a temperature which is midway between that of the outgoing flue gases which surround them and of the air in said coils. As long as the air in the coils is preheated to only a small amount, the recuperator pipe is kept sufficiently cool to be protected against burning out, but if the recuperator duct is made long, the temperature of the air toward the outgoing end becomes quite high and the duct at this part of the recuperator will be destroyed after a brief period of operation, if made of steel, cast iron, or any other inexpensive metallic material. There are, however, metals which will stand very high temperatures such as platinum, nickel, chromium, or alloys of these metals.

My invention, therefore, is based upon the fact that a high grade or highly heat resistant metal is needed only at the outgoing end portion of the recuperator; while for the remainder of its length, a relatively cheap material, such as cast iron, will answer all purposes. This is illustrated in Fig. 1 where the coil *a* is of ordinary cast

iron, while the coil *b* is of some high grade material such as nickel or nichrome, which is capable of standing high temperatures. In accordance with my invention, therefore, I provide a metallic recuperator of two sections, the low temperature section consisting of a low grade metal, such for instance, as cast iron, and the heat transmitting wall of the high temperature section consisting of a high grade metal. The invention does not concern itself with the shape of the recuperator, except in so far as the shape must be such as to definitely produce a high temperature section and a low temperature section.

In Figs. 2, 3, 4 and 5, I have illustrated another form of my invention in which the combustion chamber 2^a is supplied by the burner 3^a, which, in turn, is supplied with its combustion air by a recuperator located in the outgoing flue 7 of the furnace. The air enters the recuperator at 8. This recuperator is shown as composed of a number of blocks or sections which can be conveniently cast and which, after being removed, can be secured together by through bolts 9, or other suitable means. The form of these sections will clearly appear from Figs. 3, 4 and 5. The central openings in the sections unite to form a continuous duct for the air to be preheated, while the outer cells form flues 10 for the outgoing products of combustion. A number of these blocks or sections at the outgoing end of the recuperator, such as those marked *a'*, are of high heat-resisting material, such as above mentioned, while the remaining blocks or sections marked *b'* may be of low grade metal, such as cast iron. Just how many sections of the recuperator or what portions thereof must be of high grade metal will depend upon the temperature of the products of combustion when leaving the furnace and upon the temperature of preheat in the air. The limit is immaterial, as far as my invention is concerned.

Instead of making the heat-transmitting surfaces at the hot end of the recuperator of a metal capable of resisting high temperatures, I can, within the scope of my invention, construct them of a heat-resisting combination of refractory and metal, as illustrated more particularly in Fig. 1^a. In this embodiment, the refractory coating *b'* is exterior of the structure so that it is subjected to the flue gases, while the base metal *a'* is interior thereof or on the air side. The refractory coating may be held in position in any desired and well known manner, not constituting part of the present invention. In this construction, if the re-

fractory cracks, it will not interfere with the operation of the recuperator, as the base metal on the inside will not allow the flue gas to mix with the air. The refractory coating, being held in place, will protect the metal from the excessive heat at the high temperature position of the recuperator.

The advantages of my invention will be apparent to those familiar with this art, since it provides a metallic recuperator capable of giving a high preheat to the air passing therethrough without destruction and without making the cost prohibitive. The invention readily adapts itself to various constructions and locations of recuperators and is, therefore, of wide availability.

It will be readily understood that the particular instances which I have shown are illustrative only of the principle of my invention, and the method of construction in any given case will differ widely therefrom.

I claim:

1. A recuperator having those surfaces of its low temperature section which are in contact with the air to be heated composed of a metal of low heat-resisting quality, and having those surfaces of its high temperature portion with which the air to be heated contacts of a high heat-resisting quality, substantially as described.

2. A recuperator having metallic members with which the air to be heated contacts, said members at the low temperature portion of the recuperator being of a low heat-resisting quality and at the high temperature portion of the recuperator being of a high heat-resisting quality, substantially as described.

3. A recuperator having metal elements provided with an air passage therethrough and also provided with ducts for products of combustion adjacent to the air opening, some of said elements having the walls of the air opening comprising a high heat-resisting metal and other of said elements having the inner surfaces of said air opening made of a relatively lower heat-resisting metal, substantially as described.

4. A recuperator having heat-transmitting surfaces constructed of a metal on the air side, and of a refractory material on the flue gas side, substantially as described.

5. A recuperator having metallic heat-transmitting surfaces, comprising metal of low heat-resisting quality at the low temperature end, and comprising metal-lined refractory material at the high temperature end, substantially as described.

In testimony whereof I have hereunto set my hand.

CHARLES L. W. TRINKS.