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SEAL FOR CONTROLLED ATMOSPHERE MUFFLE FURNACES

Filed April 24, 1945

2 Sheets-Sheet 1

*Fig. 1.*

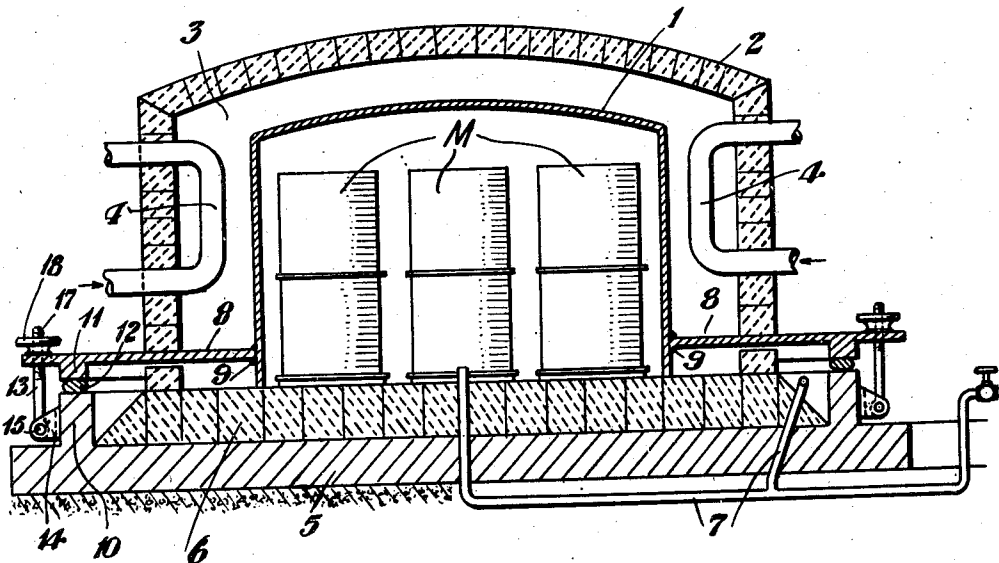
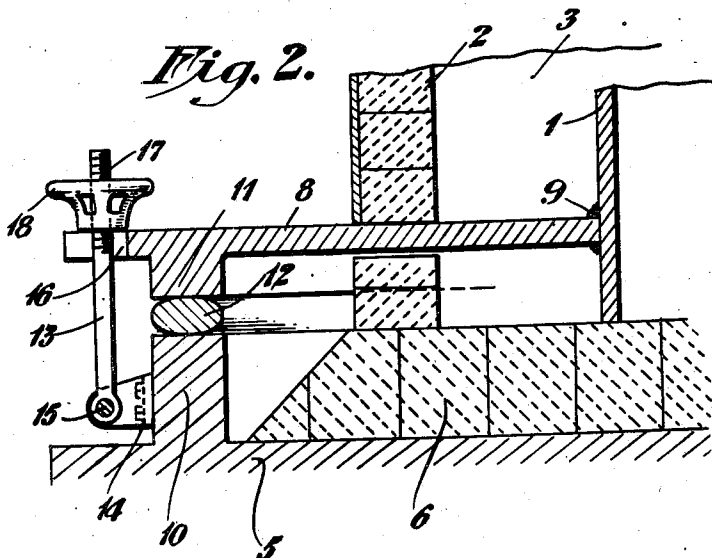


*Fig. 2.*



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2 Sheets-Sheet 2

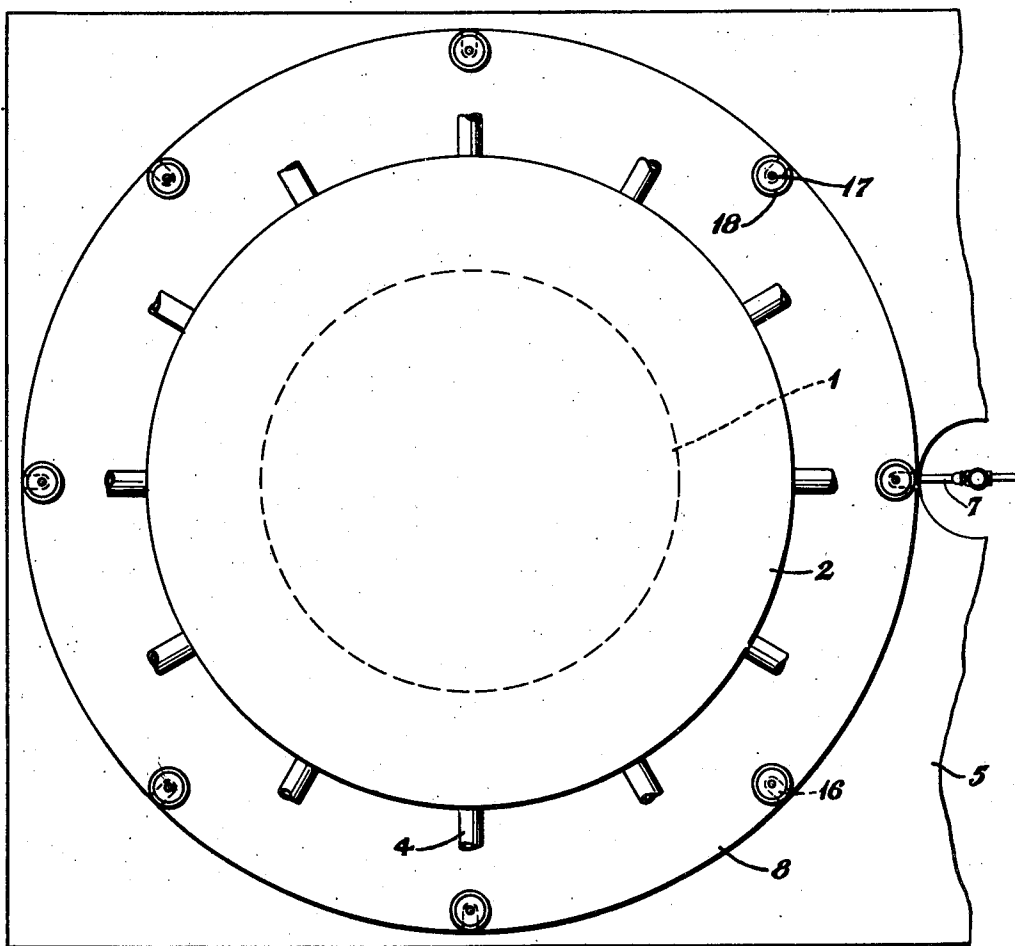


*Fig. 3*

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## UNITED STATES PATENT OFFICE

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SEAL FOR CONTROLLED ATMOSPHERE  
MUFFLE FURNACESPhilip M. Hulme, Stamford, Conn., assignor to  
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6 Claims. (Cl. 263—40)

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This invention relates to controlled-atmosphere muffle furnaces of the bell type in which the muffle is lowered onto a base to enclose the material to be treated within a heating compartment formed by the muffle and the base, and is lifted from the base to permit removal of the material when the heat-treating operation is completed. More particularly, the invention relates to the sealing of such furnaces to make the muffle gas-tight.

The usual method of sealing the muffle of such furnaces is to lower it onto a bed of sand, but this only partly seals its bottom edge. Therefore, a continuous stream of control gas must be passed into the muffle during the entire heat-treating operation. This is wasteful of gas and makes the use of gases having a high nitrogen content prohibitive in most cases, because of the expense per heat-treating operation. Furthermore, the active ingredients of the control gas, such as CO, CO<sub>2</sub>, H<sub>2</sub>, and H<sub>2</sub>O, and various uncracked hydrocarbons, react with the steel or other material being heat-treated, and react with each other, and if fresh gas is constantly being passed into the muffle, these reactions continue to occur throughout the heat-treating operation.

If the muffle is tightly sealed, a single purge, followed by a single filling with the control gas is sufficient for the entire heat-treating operation. Not so much control gas is then necessary; more expensive gas such as one containing a high percentage of nitrogen can be used economically, and since the atmosphere is static the active ingredients of the gas will reach equilibrium early in the heat-treating operation and no more reactions with the steel or other material will take place because no more active ingredients are being put into the furnace.

Efforts have already been made to obtain tight sealing on some types of heat-treating furnaces by employing oil channels in which the lower edge of the muffle is immersed, or by employing lead seals. However, such liquid and semi-liquid seals have the disadvantage that they partly volatilize and add to the complications of the heat-treating atmosphere.

The principal object of my invention is to provide a simple mechanical seal for the muffle of a bell-type muffle furnace which is thoroughly gas-tight; which will eliminate the above-mentioned disadvantages associated with the use of liquid or semi-liquid seals, or seals that are not completely effective; and which makes it possible to use a single filling of control gas for a heat-treating operation and to use greater quan-

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ties of the more expensive gases such as nitrogen.

A muffle furnace embodying the invention is illustrated in the accompanying drawing, in which—

Fig. 1 is a transverse vertical section through the furnace;

Fig. 2 is a portion of Fig. 1, drawn to a larger scale to more clearly illustrate the details of the sealing means for the muffle; and

Fig. 3 is a plan view of the furnace.

The furnace represented in the drawing, except for the muffle sealing means hereinafter described, is a standard bell-type radiant tube furnace comprising an inner shell or muffle 1 and an outer cover 2 of refractory material. The walls of the outer cover are spaced from the walls of the muffle to provide the usual heating space 3 to which heat is supplied by radiant tubes represented at 4.

The muffle 1 and cover 2 are adapted to be lowered, in accordance with conventional practice, onto a base plate 5 made of cast iron and having a facing 6 of brick or other refractory material on which the muffle and refractory cover are supported.

The material to be heat treated, such as coiled strips of sheet steel or other material, is represented at M (Fig. 1). The material is placed on the base and then the muffle and cover are lowered, so that the muffle forms with the base a closed heat-treating or heating compartment. The control gas is supplied to this compartment through the usual piping, represented at 7.

The sealing means for the muffle, provided in accordance with this invention, comprises an external horizontal flange 8, of relatively thin material as shown, which is welded to the muffle a short distance above its lower edge, as indicated at 9. The flange extends completely around the muffle as shown in Fig. 3 and projects outwardly from it beyond the walls of the refractory cover 2. The base 5 has a sealing portion extending completely around the refractory cover 2. Preferably, this sealing portion comprises an upwardly projecting boss 10 (Figs. 1 and 2) which is spaced outwardly from the walls of the refractory cover. The flange 8 on the muffle projects outwardly over the sealing portion or boss 10 on the base and is adapted to be clamped to it with suitable sealing material clamped in between. Preferably, the flange 8 has a downwardly projecting boss 11 at its lower side which coincides with and lies over the boss 10 on the base. The sealing material represented at 12, and which

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may be a gasket of silicone rubber, or other suitable sealing substance, is positioned between the boss 10 on the base and the boss 11 on the horizontal flange 8. The flange is clamped to the base by means of a number of manually operated clamps located at spaced points around the furnace. As best shown in Fig. 2, each clamp may comprise a rod 13 which is pivoted at its lower end to a bracket 14 on the base, as shown at 15. The upper portion of the rod is adapted to be received in a slot 16 in the edge of the flange 8. The rod has a threaded upper end, as shown at 17, on which a hand clamping wheel 18 rotates.

From the foregoing it will be seen that the portion of the horizontal flange extending beyond the wall of cover 2 forms upper and lower heat-radiating surfaces, and the boss 10 extending upwardly from base 5 forms inner and outer heat-radiating surfaces. Additionally, bosses 10 and 11 between which the sealing gasket 12 is compressed are spaced an appreciable distance away from the wall of cover 2. As a result, gasket 12 is protected from excessive heat and therefore will not only have a longer effective life, but may be selected from an assortment of sealing materials which are preferable for the purpose, but not heretofore available because they would not stand up under the heat to which prior furnaces subjected them.

It will now be seen that after the material to be treated is positioned on the base and the muffle and refractory cover are lowered onto the base, the clamping rods 13 may be swung into the slots 16 on the edge of the flange, and then the clamping wheels 18 may be screwed down on the rods 13 to compress the sealing material 12 between the bosses on the muffle flange and the base. A tight mechanical seal is thus effected, so that when control gas is admitted through the piping 7 into the heating compartment within the muffle, it cannot escape. At the end of the heat-treating operation, the clamping wheels 18 are turned on the rods 13 to release the clamps, and the rods 13 are swung outwardly about their pivots to permit the refractory cover and the muffle to be lifted off the base, so that the treated material may be removed.

The invention may be applied to furnaces of other types than that illustrated so long as there is a shell or the like cooperating with a base to form a heat-treating compartment which is to be made gas-tight by means of a seal between the lower edge of the shell and the base.

I claim:

1. A controlled-atmosphere furnace comprising a shell, a base on which said shell is supported to form an enclosed heating compartment, a horizontal external flange on the shell near but spaced from its lower edge, extending completely around the shell and of a length such as to form effective upper and lower heat-radiating surfaces, said base having a sealing portion extending completely around the shell over which said flange is adapted to project, sealing material between said flange and said sealing portion of the base and spaced from said shell substantially by the length of said flange, and means for clamping said flange to said sealing portion on the base with the sealing material clamped in between.

2. A controlled-atmosphere furnace comprising a shell, a base on which said shell is supported to form an enclosed heating compartment, a horizontal external flange on the shell near but spaced from its lower edge, extending completely around the shell and of a length such as to form

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effective upper and lower heat-radiating surfaces, said base having a sealing portion extending completely around the shell over which said flange is adapted to project, sealing material between said flange and said sealing portion of the base and spaced from said shell substantially by the length of said flange, and clamping means adapted to be manually operated either to clamp said flange to said sealing portion on the base with the sealing material clamped in between or to unclamp such parts and permit lifting of the shell from the base.

3. A controlled-atmosphere furnace comprising a shell, a base on which said shell is supported to form an enclosed heating compartment, said base having an upwardly projecting boss extending completely around said shell and spaced externally from the walls thereof and having inner and outer heat-radiating surfaces, a horizontal external flange on the shell near its lower edge and extending completely around the shell and projecting outwardly over said boss on the base so as to form upper and lower heat-radiating surfaces, sealing material between said flange and said boss on the base, and means for detachably clamping said flange to said boss on the base with the sealing material clamped in between.

4. A controlled atmosphere furnace comprising a shell, a base on which said shell is supported to form an enclosed heating compartment, said base having an upwardly projecting boss extending completely around said shell and spaced externally from the walls thereof and having inner and outer heat-radiating surfaces, a horizontal external flange on the shell near its lower edge and extending completely around the shell and projecting outwardly over said boss so as to form upper and lower heat-radiating surfaces, said flange having at its lower side a downwardly projecting boss adapted to lie over the boss on the base, sealing material between the boss on said flange and the boss on the base, and means for detachably clamping said bosses together with the sealing material clamped in between.

5. A controlled-atmosphere muffle furnace comprising an inner muffle, a base on which said muffle is supported to form an enclosed heating compartment, a refractory cover supported on said base and enclosing the muffle, the walls of the cover being spaced from the walls of the muffle to form a heating space, means for supplying heat to said heating space, said base having an upwardly extending boss outside of said cover, extending completely around the same and spaced therefrom to provide inner and outer heat-radiating surfaces, a horizontal external flange on the muffle near its lower edge and extending completely around the muffle, said flange projecting outwardly beyond the refractory cover and over said boss on the base so as to form upper and lower heat-radiating surfaces, sealing material between said flange and said boss on the base, and means for detachably clamping said muffle flange to said boss on the base with the sealing material clamped in between.

6. A controlled-atmosphere muffle furnace comprising an inner muffle, a base on which said muffle is supported to form an enclosed heating compartment, a refractory cover supported on said base and enclosing the muffle, the walls of the cover being spaced from the walls of the muffle to form a heating space, means for supplying heat to said heating space, said base having an upwardly extending boss outside of said cover, extending completely around the same and spaced

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therefrom so as to provide inner and outer heat-radiating surfaces, a horizontal external flange on the muffle near its lower edge and extending completely around the muffle, said flange projecting outwardly beyond the refractory cover and over said boss on the base so as to form upper and lower heat-radiating surfaces, a downwardly projecting boss on the lower side of said muffle flange coinciding with and lying over the boss on the base, sealing material between the boss on said flange and the boss on the base, and means for detachably clamping said bosses together with the sealing material clamped in between.

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