Aug. 8, 1967 SAICHI NISHIDA ET AL 3,334,880

HOT STOVE HAVING A SPHERICAL TOP

Filed Jan. 25, 1965 2 Sheets-Sheet 1

Fig. 1

PRIOR ART

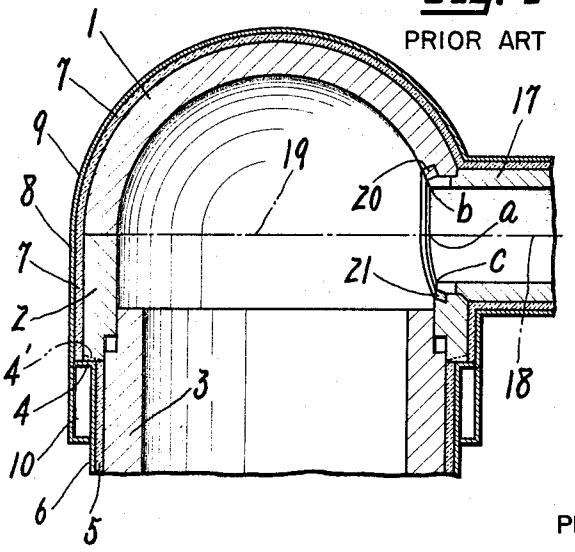


Fig. 3

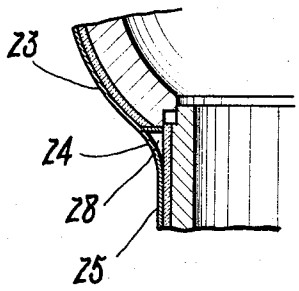


Fig. 4

PRIOR ART

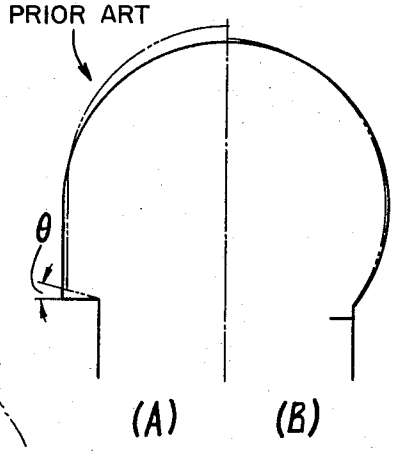
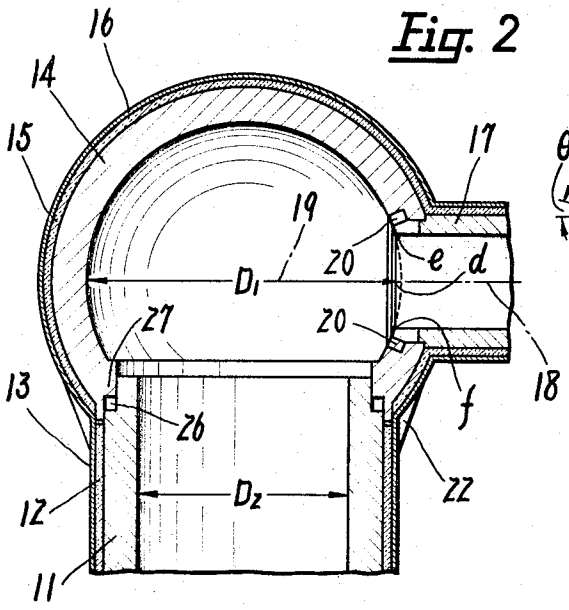


Fig. 2



Saichi Nishida,
Masao Yoshioka
and Haruki Uchiyama
INVENTORS,

BY Wenderoth, Lind & Ponack,

ATTORNEYS

Aug. 8, 1967 SAICHI NISHIDA ETAL 3,334,880

HOT STOVE HAVING A SPHERICAL TOP

Filed Jan. 25, 1965 2 Sheets-Sheet 2

Fig. 5
PRIOR ART

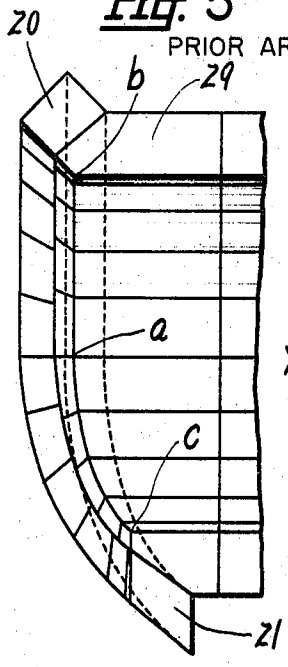


Fig. 6
PRIOR ART

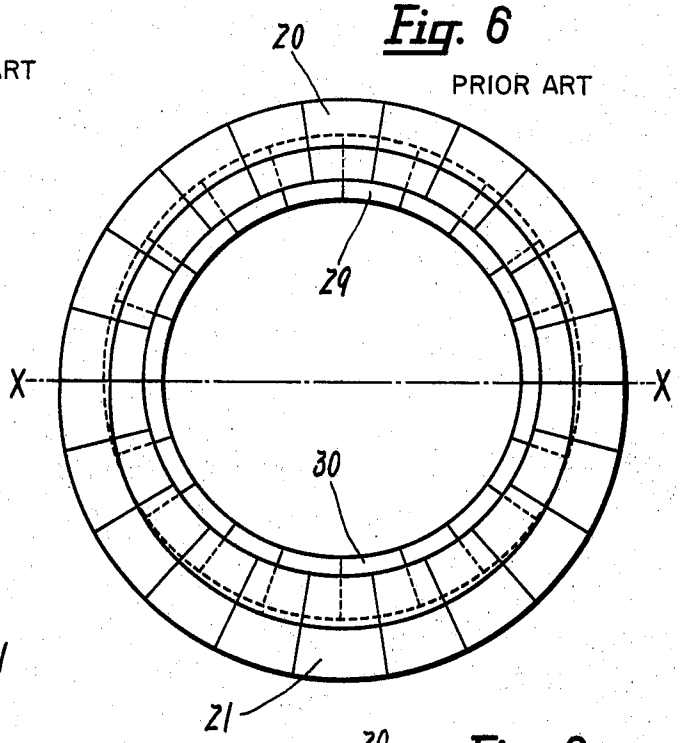


Fig. 7

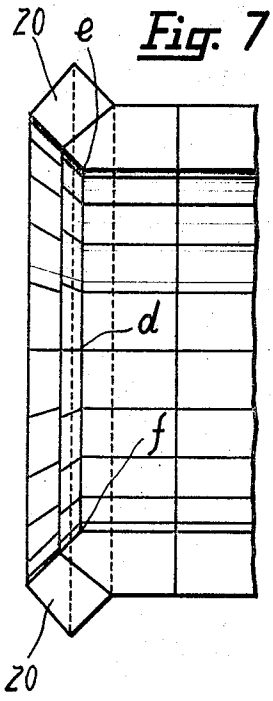
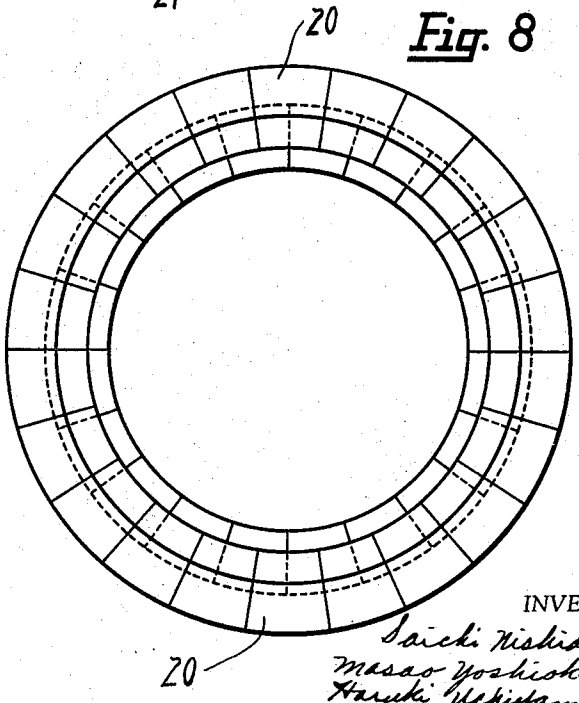


Fig. 8



INVENTOR,
Saichi Nishida,
Masao Yoshioka and
Haruki Uchiyama
BY Wenderoth, Lind & Ponack,
ATTORNEYS

United States Patent Office

3,334,880

Patented Aug. 8, 1967

3,334,880

HOT STOVE HAVING A SPHERICAL TOP

Saichi Nishida, Kitakyushu, Masao Yoshioka, Keisho-machi, and Haruki Uchiyama, Kitakyushu, Japan, assignors to Yawata Iron & Steel Co., Ltd., Tokyo, Japan, a corporation of Japan

Filed Jan. 25, 1965, Ser. No. 427,791
Claims priority, application Japan, Jan. 29, 1964, 39/4,187
5 Claims. (Cl. 263—19)

This invention relates to improvements in hot stoves and more particularly to regenerative hot stoves having spherical tops.

Among the regenerative hot stoves used or known today are a so-called internal combustion type hot stove wherein a combustion chamber and a regenerator are arranged parallel to each other in the vertical direction in the same cylindrical shell, an external combustion type hot stove wherein a combustion chamber and a regenerator are provided respectively in separate cylindrical shells and are connected with each other at one end of each shell and a furnace top combustion type hot stove wherein a space in the upper part of a regenerator serves as a combustion chamber.

The present invention can be applied to any of the above mentioned conventional hot stoves.

In the accompanying drawing:

FIG. 1 is a vertical sectional view of a top of a conventional hot stove;

FIG. 2 is a vertical sectional view of the same part in a stove according to the present invention;

FIG. 3 shows another embodiment of the joint between the stove top part and the stove body wall part on the stove shown in FIG. 2;

In FIG. 4, part (A) shows the deformation in a conventional hot stove and part (B) shows the deformation in the hot stove according to the present invention;

FIG. 5 is a vertical sectional view of the structure of a brick lining in the joint between a connecting pipe and the top of a conventional hot stove;

FIG. 6 is an end elevation view of the brick lining of FIG. 5;

FIG. 7 is a vertical sectional view of the structure of a brick lining in the joint between a connecting pipe and the top of the hot stove of the present invention; and

FIG. 8 is an end elevation view of the brick lining of FIG. 7.

Because the present invention will become clear when it is explained in comparison with the structure of the conventional hot stove, the structure of the conventional hot stove shall be first explained.

As illustrated in FIGURE 1, the top part of a conventional hot stove is always formed of a hemispherical dome **1** and a cylindrical brick lining **2** connected to the lower part of said dome. Said cylindrical brick lining **2** and the body brick lining **3** (which shall be called the stove wall hereinafter) of the hot stove are connected with each other to permit expansion by cutting a ledge in the outer peripheral part of the top part of said stove wall **3**, then cutting a corresponding ledge in the inner peripheral part of the cylindrical brick lining **2** and combining them both so that the stove wall **3** is free to expand and contract in the vertical direction while the joint is kept air-tight. Therefore, the stove top brick lining **2** can be separated from the stove wall **3**. Further, said stove top brick lining **2** is supported by an annular shell **4** which is air-tightly joined at one end with a cylindrical shell **6** protecting the stove wall **3** and positioned over a protective material **5** and at the other end with a cylindrical shell **8** protecting the stove top brick lining **2** through a liner of protective material **7** and integrally connected with a spherical shell **9**.

However, with this kind of shape, in the hot stove, even though there exist the loads of the stove top brick linings **1** and **2**, when a blast pressure is applied during the preheating period (there is a heating period and a preheating period in a hot stove; in the preheating period, usually, a blast pressure of 1 to 3 kg./cm.^{2} will be applied) said annular shell **4** will be deformed as shown in FIG. 4(A) by the chain line with the outer peripheral part being deformed upward and the end part of the cylindrical brick lining being displaced upwardly by an angle θ which will be, in fact, very small as shown by **4'** in FIGURE 1 but which will cause a large load to be applied to the brick lining.

The above mentioned deformations by the blast pressure in the heating period and preheating period will be alternately repeated and therefore the joint between the stove top brick linings **1** and **2** will be likely to become loose and break. Therefore, in order to prevent such deformation, it is necessary to reinforce the outer end part of the cylindrical brick lining and the shell of the stove body by welding the reinforcing member **10**. It not only requires considerable iron material and is uneconomical but also has disadvantages in that, when the hot stove is the stove top combustion type, the position at which the burners can be mounted will be restricted. A more important problem is that, between the joint of a connecting pipe brick lining **17** (or a hot-air pipe or combustion gas pipe) and the stove top part consisting of the hemispherically shaped brick lining **1** and the cylindrically shaped brick lining **2**, when the center **19** of the hemispherical stove top brick lining is on the axis **18** of the connecting pipe brick lining **17**, the intersection *a–b* of the inside of the connecting pipe brick lining **17** and the inside of the hemispherical brick lining **1** will be in the same plane and therefore the individual bricks **20** in the part forming said intersection *a–b* will be of the same size but the intersection *a–c* will not be in the same plane and therefore the individual bricks **21** in the part forming said intersection *a–c* will all be different sizes (in such case, there will be usually more than 20 to 30 shapes of bricks) and it will be complicated and difficult to determine the dimensions of the bricks **21** and to mold and build the brick lining.

The above mentioned problem will be explained with reference to FIGURES 5 and 6. FIGURE 5 shows a vertical section of a brick lining. For example, the bricks **20** and **29** above the section X—X in FIGURE 5 may be respectively of the same shapes but the bricks **21** and **30** below the section must have the dimensions determined on the basis of the curve *a–c* and must all have different shapes. Such a lining is not only different to build but also unstable after it is completed.

As described in the following, the present invention is to eliminate the above described defects by making a spherical stove top part of a diameter larger than that of the stove body part.

The first object of the present invention is to reduce the deformation of the top part of a hot stove.

The second object of the present invention is to make it easy to set a connecting pipe in the top part of a hot stove.

The other effects will be described later.

The features of the present invention are that the top part of a hot stove is substantially spherical with a diameter larger than the diameter of the body part of the stove and that the stove is so formed that the shell of the top part and the shell of the body part are connected to each other in a joint at the lower end of said stove top part and the upper end of the stove body part. The spherical dome (it is not hemispherical), is connected to the upper end of the stove wall and shell at a point lower than the center of said dome wall and shell.

The present invention will be concretely explained in the following with reference to FIGURE 2. In the same manner as in the conventional hot stove in FIGURE 1, the body part is formed of a cylindrical shell **13** protecting a stove wall **11** through layers of protective material **12**. On the other hand, the stove top part is made of a spherical brick lining **14** built separately from the stove wall **11** in order to avoid the influence of the elongation due to the thermal expansion of the stove wall **11**, is protected through layers of protective material **15** and is air-tightly jointed with a supporting spherical shell **16**. The diameter D_1 of the spherical brick lining is always far larger than the diameter D_2 of the stove wall **11**. Further, it is desirable that the position at which the spherical top part and body part is joined is such that a line connecting said joint position and the center of the sphere will always intersect the horizontal centerline **19** at angle of more than 20 degrees. Further, in the joint between the lower end part of the stove top and the upper end part of the stove wall, the shell **16** of the stove top part and the shell **13** of the stove body part are integrally joined to each other by welding or any other means so that the grooved end part **26** of the stove wall and the corresponding part **27** of the stove top will be opposed to each other.

Because the stove top part is thus made substantially perfectly spherical and the shell **16** of the stove top and the iron shell part **13** of the stove wall coincide with each other, even under the blast pressure at the time of the operation of the stove, the stove top will be deformed as is shown by the chain line in FIG. 4(B) and the amount of deformation will be very small. Therefore, the joints of the bricks in the brick lining in the stove top part will be little repeatedly subjected to only small tensile and compressive loads and will not become loose.

As described above, the amount of deformation of the present hot stove is so small that, even if a reinforcing member **22** is required to prevent the deformation it will be much smaller than a conventional one, and it will not be deformed by the internal pressure and the load of the brick lining and will be able to support the brick lining **14** of the stove top part well and in a stable manner.

Another important point of the present invention is the advantage of the brick lining connecting a connecting pipe to the stove top part to serve as a hot-air pipe or combustion gas pipe.

That is to say, as illustrated in FIGURE 2, in the joint between the brick lining **17** of the connecting pipe and the stove top part **14**, the center line **18** of the connecting pipe is made to coincide with the center line **19** of the spherical stove top part, and thereby the intersection *e–d–f* of the brick lining **17** of the connecting pipe with the spherical stove top part **14** will be positioned in the same plane around the entire periphery thereof. Therefore, as illustrated in FIGURES 7 and 8, said joint can be built entirely of individual bricks **20** having a single shape. It is therefore easy to determine the dimensions of the brick and to mold and build the brick lining. Further, the building cost is low and a stable structure can be obtained. Even in a structure wherein the center line **18** of the connecting pipe is in an eccentric direction relative the spherical stove top part, the intersection *e–d–f* will be in the same plane and the above described advantage will be obtained.

FIGURE 3 illustrates another embodiment of the formation of the above described reinforcing member according to the present invention. Therein respective shells **23** and **25** are connected with each other through a bent plate **24** in the joint of the spherical stove top with the stove wall and the space made by using said bent plate **24** is filled with an adiabatic, refractory and compressible material **28** such as, for example, slag wool, rock wool or blue asbestos so that the reinforcing member **22** shown in FIGURE 2 may be replaced with said bent plate **24**.

In the present invention as is described above,

(1) The deformation of the stove top part by blast pressure is very small and
(2) It is easy to attach a connecting pipe in the stove top part.

The effects to be obtained thereby are that

(1) The life of the stove is long;
(2) The reinforcing member can be made small or can be entirely eliminated;
(3) The burner mounting position in the stove top combustion system is not unduly restricted; and
(4) The brick lining is very economical.

What we claim is:

1. A hot stove comprising a cylindrical body part having an iron shell and a refractory wall within the iron shell, and a top part connected to the upper end of said cylindrical body part and having an iron shell and a refractory wall within the iron shell, said stove top part being spherical in form and having the inside surface thereof curving outwardly from the upper end of said body part to an inside diameter in a plane parallel to the plane of the said upper end of the body part.

2. A hot stove as claimed in claim **1** further comprising a communicating pipe having a center axis extending radially of the center of the spherical stove top and lying in said parallel plane.

3. A hot stove as claimed in claim **1** wherein a line between the joint between the upper part of the body and the said top part and extending through the center of the sphere is at an angle with the said parallel plane larger than 20 degrees passing through the center of the sphere.

4. A hot stove as claimed in claim **1** wherein the iron shell portions at the lower end of said top part and the upper end of said body part are connetced at an angle to each other and a plate extends across the angle enclosing a space in the angle, and the space is filled with an adiabatic, refractory and compressible material.

5. A hot stove as claimed in claim **4** wherein the said adiabatic, refractory and compressible material is a material taken from the group consisting of slag wool, rock wool and blue asbestos.

References Cited

UNITED STATES PATENTS

2,104,201	1/1938	Koppers	263—19
2,141,036	12/1938	Daniels	263—19
2,391,491	12/1945	Totzek	263—19
3,173,666	3/1965	Petit	263—19
3,260,020	7/1966	Patin	52—80 X

FREDERICK L. MATTESON, JR., *Primary Examiner.*
JOHN J. CAMBY, *Examiner.*