Aug. 22, 1950 C. H. WATKINS 2,519,616

HEATING APPARATUS

Filed June 15, 1946

Fig. 1.

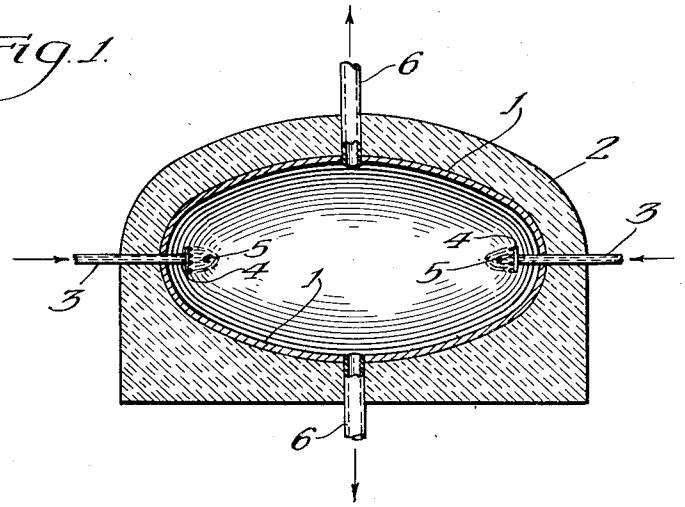
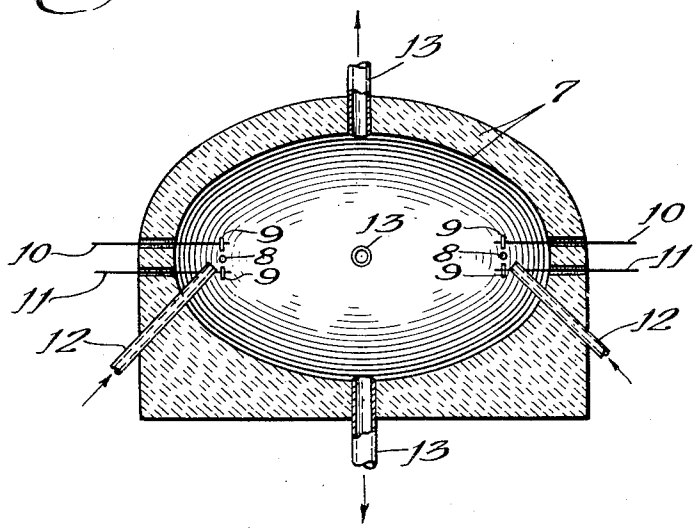


Fig. 2.



INVENTOR.
Charles H. Watkins
BY
Maynard P. Venema
Attorney.

Patented Aug. 22, 1950

2,519,616

UNITED STATES PATENT OFFICE

2,519,616

HEATING APPARATUS

Charles H. Watkins, Brookfield, Ill., assignor to Universal Oil Products Company, Chicago, Ill., a corporation of Delaware

Application June 15, 1946, Serial No. 676,914

6 Claims. (Cl. 263—40)

1

This invention relates to an improved furnace design and construction, wherein is provided definitely positioned zones of greater heat intensities. More specifically, the improved heater or furnace is one having a combustion chamber ellipsoidal in shape, with burners or heat generating means being positioned at the geometrical foci of the ellipsoidal chamber.

It is well known that heat rays or light rays emitted from one focus point of an ellipsoid will be reflected directly to the other focus regardless of the direction of its travel from the original focus. Therefore, a furnace of this improved design takes advantage of this principle and the heat from one flame or heat source is reflected to the opposing flame or heat source and thereby produces a very high flame temperature or highly heated zone. Furnaces or heaters of this type are particularly desirable for various industrial or laboratory conversion processes requiring controlled conditions of oxidation or combustion.

The amount of reflected heat, which will govern the temperature increase or build-up at each of the opposing foci and the heat generating means, will of course depend on the internal surface of the ellipsoidal combustion chamber, as well as the accuracy attained in providing a true ellipsoidal shape. The reflecting power of the material is the complement of its adsorbing or radiating power, that is, when a body is struck by a ray of heat, it adsorbs part of the heat and reflects the rest. Thus, in a preferred construction of the furnace, the surface on the interior of the combustion chamber will be very smooth and mirror-like in nature. However, such a high degree of smoothness and reflectivity would be impossible or impractical in large industrial heaters, or in extremely high temperature furnaces. The type of material which may be used for the internal surface of the combustion chamber will determine the amount of reflectivity and therefore the amount of temperature increase at each of the focus points, where the heat sources are located. Various metals, even though polished, will have varying heat reflectivity and adsorptivity characteristics; this also is true for various refractory materials which are commonly used in high temperature furnaces. For low temperature conditions of only a few hundred degrees F., polished metals or heat resisting alloys, or metal plating, such as chrome plate and the like, will be found very efficient and desirable. For intermediate temperatures, materials such as procelain, and insulating cement, may be used, which are relatively dense and smooth and light in color.

2

While for high temperature service, of say 1200° F. and upward, the commonly used refractory oxides and like types of material may be employed with particular effort being made to provide a smooth interior to the inside of the combustion chamber.

It is a principal object of this invention to provide a furnace having definitely positioned zones of high temperature concentration.

It is also an object of this invention to provide a furnace having high temperature zones wherein reactant materials may be subjected to combustion or oxidation for extremely short periods of time.

A still further object of the invention, is to provide a furnace which is particularly adapted for operation under superatmospheric pressure conditions.

The ellipsoidal shaped furnace, such as the one comprising this invention, is of particular advantage for various oxidation and combustion reactions where high temperature and short contact time is necessary to the conversion process. For example, certain hydrocarbons or natural gases and oxygen may be oxidized together at a high temperature, in the range of 1200 to 1600° C., to form hydrogen and carbon monoxide, and in such a process, it is desirable to have the oxidation products discharged from the high temperature zone as quickly as possible. In this ellipsoidal furnace, the high temperature zone is relatively small and is concentrated around the foci where the heat generating means are positioned. Thus, by charging reactants through these relatively concentrated zones, at high controlled velocities, it is possible to obtain contacts for only a small fractional part of a second. In this particular process and at the temperature range specified, it would be necessary to employ refractory types of liner for the combustion chamber. However, it may be noted that a liner providing only a 10% reflecting power from one focus point to the other, would produce a substantial temperature increase within the zones of the foci, where high temperatures are employed, of the order of 200° F. and upward.

An ellipsoidal shaped furnace may also be constructed to withstand high pressure conditions far easier than the conventional rectangular or boxed shape furnaces. The furnace housing may be designed in the manner of a pressure vessel, to withstand pressures of several hundred pounds per square inch and at the same time be of relatively "light" construction.

Another advantage found in this improved

furnace construction, where fuel burners are employed, is that carbon formation will be minimized. The increased temperature at each of the heat sources, where gas burners and the like are used, will tend to bring about more complete combustion of the products to carbon monoxide.

Conventional types of furnaces or heaters do not usually obtain high temperature zones by means of reflected heat, but more generally depend on direct radiation from their heat generating sources or indirectly from radiating bodies. Conventional type heaters, also, are not usually constructed in a shape which makes them suitable for maintaining superatmospheric pressures therein.

One embodiment of the improved furnace of this invention comprises an insulated furnace housing, an internal combustion chamber having a true ellipsoidal shape, fuel burners or other heat generating means producing heat at the foci of said ellipsoidal shaped combustion chamber, inlets to said chamber which are arranged to discharge reactants to the high temperature zones at each of the foci, and combustion product outlets from said chamber. The outlets from the combustion chamber are preferably positioned equidistantly from each of the high temperature zones, in other words, the outlets are centrally located around the periphery of the chamber in a plane perpendicular to and bisecting a line joining the foci. Also, in a preferable embodiment of the heater, the internal surface of the combustion chamber is made as smooth as possible and is of a material that provides a substantially high degree of reflectivity.

The construction of the improved ellipsoidal furnace, as well as additional advantages, will be made more apparent upon reference to the accompanying drawings and the following description thereof.

Figure 1 of the drawing is a sectional elevational view through one form of the ellipsoidal type of furnace.

Figure 2 of the drawing is a sectional view of a somewhat different form of the ellipsoidal type of furnace.

In Figure 1 of the drawing the shell 1 of the combustion chamber is shown to be ellipsoidal in shape and is covered with an insulating material 2. The insulating material 2 may be of any of the commonly used types such as mineral wool, magnesia block, asbestos, or various mixtures of insulating cements and the like. Inlet pipes 3 pass through the ends of the ellipsoid into the combustion zone and connect with burners 4. The burners 4 are placed such that the flames produced are opposed to each other and concentrated at the geometrical foci 5 of the ellipsoidal shaped combustion chamber 1. By thus concentrating the flames at each of the foci, reflected heat will tend to increase the heat intensity at each of the two zones of the focus points 5. Outlet ports or conduits 6 are spaced around the periphery of chamber 1, in a plane perpendicularly bisecting a line joining the foci of the ellipsoidal shaped chamber 1. The outlet ports serve to discharge combustion products from the chamber to suitable receiving apparatus. In this particular form of the heater, the reactant and the combustible materials are charged together through each of the lines 3, thus the reactant materials are contacted in the high temperature zone of the flames and of the reflected heat, for a short period of contact time only, prior to being discharged from the combustion zone by way of conduit 6. It may be noted, that by positioning the outlet conduits 6 in a plane which perpendicularly bisects a line joining the foci of the chamber, that each of the outlets are positioned equidistantly from the foci 5 or high temperature zones of the furnace.

In Figure 2 of the drawing a slightly different form of the ellipsoidal heater is shown wherein an ellipsoidal combustion chamber is formed within a furnace housing 7, which may in turn be of a solid heat resisting material such as porcelain, Carborundum or of a refractory-like material. At the foci 8 of the ellipsoidal chamber, heat sources are provided by means of electric arcs between electrodes 9. The electrodes 9 are served by electric power lines 10 and 11, and are positioned such that the arc produced between the electrodes will pass through the focus points 8. Inlet conduits 12 pass through the housing 7 and terminate just short of the foci 8 so that reactant materials may be discharged directly to the high temperature zones. Outlet conduits 13, like those of Figure 1, are positioned around the periphery of the ellipsoidal combustion zone, so that they are each equally spaced from the high temperature zones at the foci 8, and the products of combustion are thereby subjected to equal periods of contact and equal temperature conditions.

In this second form of heater or furnace, illustrated in Figure 2, very concentrated high temperature zones may be obtained by means of the electric arcs and by means of reflected heat energy from one to the other, such that very short time contacts may be obtained in the relatively concentrated zones for materials discharged thereto. As has previously been noted, short contact times are particularly desirable in many hydrocarbon oxidation or combustion processes and that superatmospheric pressure operation at increased temperatures may also be very desirable.

It is obvious that other and additional modifications than those shown may be made in the ellipsoidal type of heater. The ellipsoidal combustion zone need not always be horizontally positioned, as illustrated, for it may be mounted angularly or vertically, with the opposing heat sources vertically aligned one above the other. The positioning of the inlet and outlet conduits may be modified, other types of burners or heat generating means may be employed, and many types of materials which have not been specifically mentioned, may be used for the combustion chamber or for heat insulating purposes. However, such modifications and substitutions are held to be within the broad scope of this invention.

I claim as my invention:

1. A furnace of the class described comprising an ellipsoidal shaped combustion chamber, means for maintaining an independent heat source at each of the foci of said ellipsoidal chamber, a pair of inlet conduits to said chamber, each of said conduits being arranged and positioned to terminate at a point adjacent one of said heat sources whereby reactant materials are passed through said heat sources and said foci, outlets from said combustion chamber, each of said outlets being spaced equidistant between said foci, and discharge conduits connecting with said outlets.

2. A furnace of the class described comprising a pressure tight ellipsoidal shaped combustion chamber, means for maintaining an independent

heat source at each of the foci of said ellipsoidal chamber, a pair of inlet conduits to said chamber, each of said conduits being arranged and positioned to terminate at a point adjacent one of said heat sources whereby reactant materials are passed through said heat sources and said foci, outlets from said combustion chamber, each of said outlets being spaced equidistant between said foci, and discharge conduits connecting with said outlets.

3. A furnace of the class described comprising a furnace housing, an ellipsoidal shaped combustion chamber, burners positioned within said chamber, said burners being arranged to provide opposing heat sources at the geometrical foci of said ellipsoidal combustion chamber, inlet conduits connecting with said burners, a plurality of outlets from said composite chamber, said outlets being spaced around the periphery of said combustion chamber in a plane which perpendicularly bisects a line joining the foci and discharge conduits connecting with said outlets.

4. A furnace of the class described comprising a furnace housing, a pressure tight ellipsoidal shaped combustion chamber, burners positioned within said chamber, said burners being arranged to provide opposing heat sources at the geometrical foci of said ellipsoidal combustion chamber, inlet conduits connecting with said burners, a plurality of outlets from said composite chamber, said outlets being spaced around the periphery of

said combustion chamber in a plane which perpendicularly bisects a line joining the foci and discharge conduits connecting with said outlets.

5. The furnace of claim 1 further characterized in that said heat sources are provided by electric arcs located at the foci of said chamber.

6. A furnace of the class described comprising an ellipsoidal shaped combustion chamber, means for maintaining an independent heat source at each of the geometrical foci of said ellipsoidal chamber, means for introducing fluid to said chamber at points adjacent said foci, and spaced outlet ports at the periphery of the chamber in a plane perpendicularly bisecting a line joining said foci.

CHARLES H. WATKINS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
991,404	Woodworth	May 2, 1911
1,232,362	Miner	July 3, 1917

FOREIGN PATENTS

Number	Country	Date
122,395	Great Britain	Sept. 19, 1918
510,193	France	Nov. 29, 1920
559,709	Great Britain	Mar. 2, 1944