

April 15, 1941.

J. K. CLUTTS

2,238,036

WATER COOLED CUPOLA

Filed July 3, 1939

3 Sheets-Sheet 1

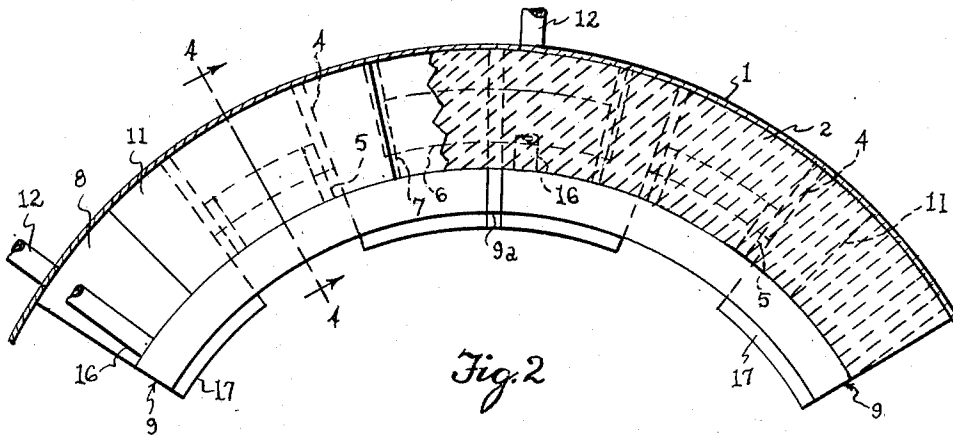


Fig. 2

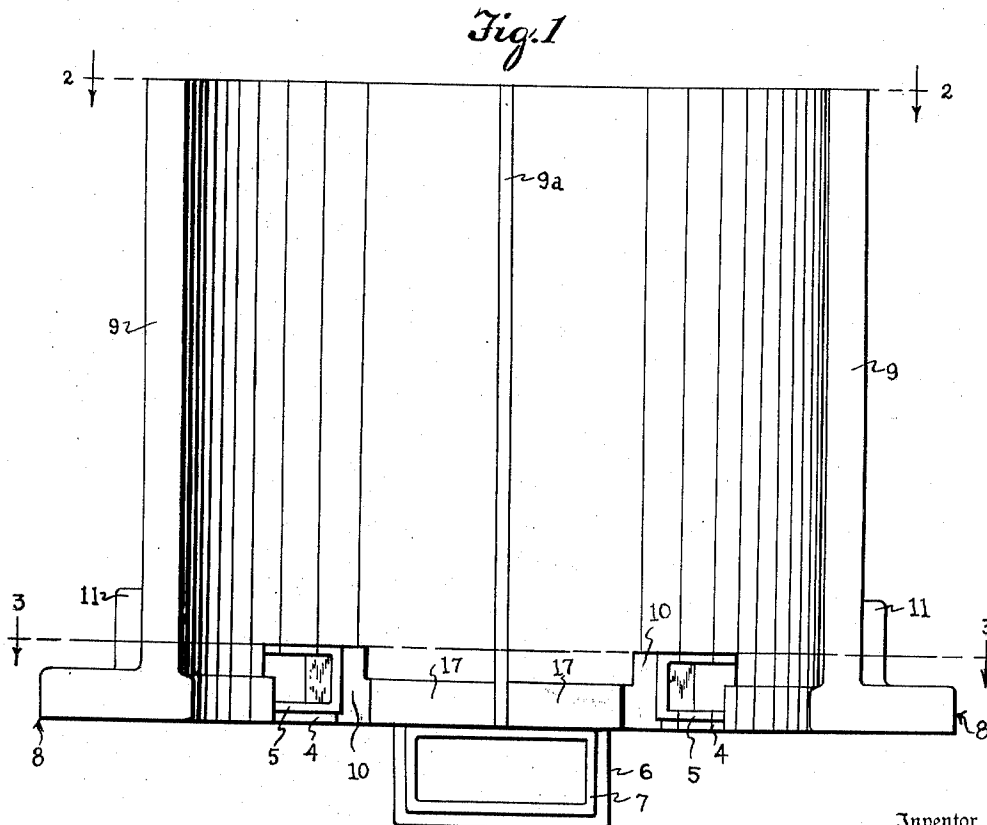


Fig. 1

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3 Sheets-Sheet 2

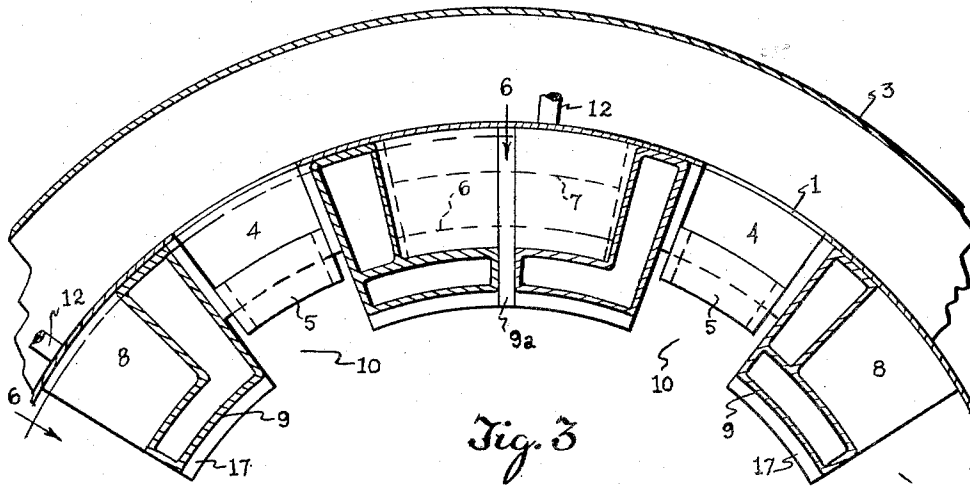


Fig. 3

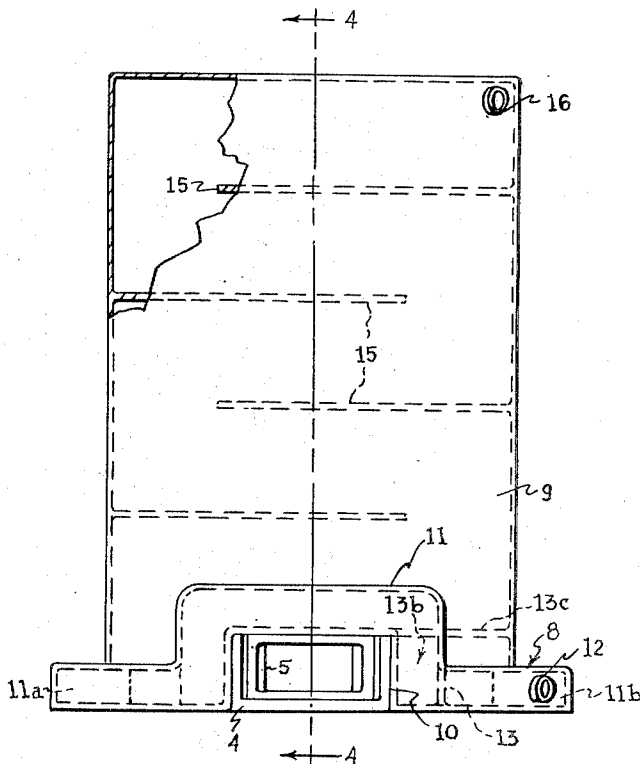
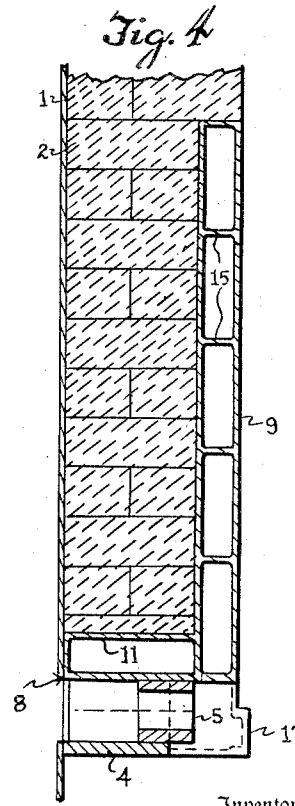


Fig. 5



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3 Sheets-Sheet 3

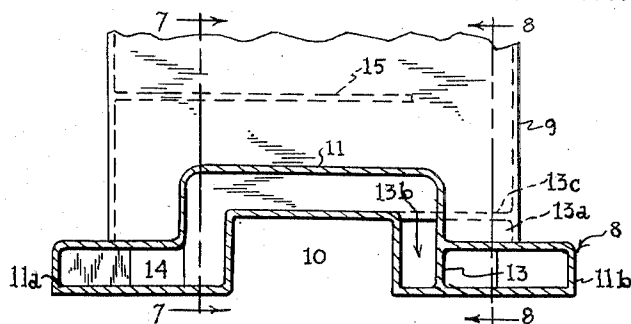


Fig. 6

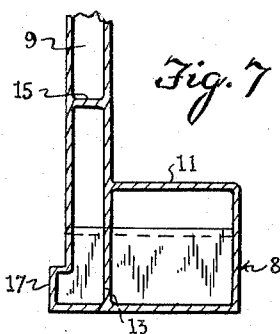


Fig. 7

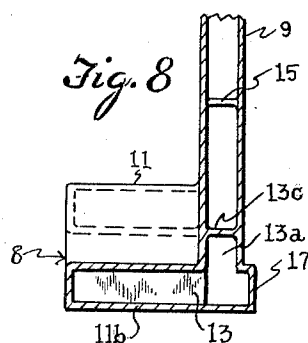


Fig. 8

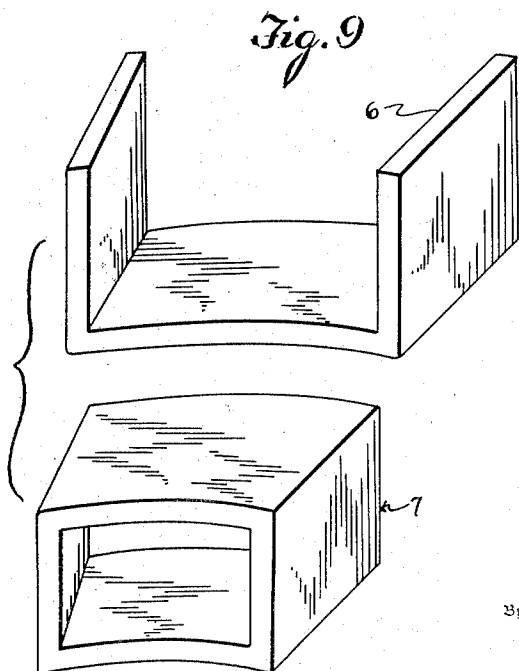


Fig. 9

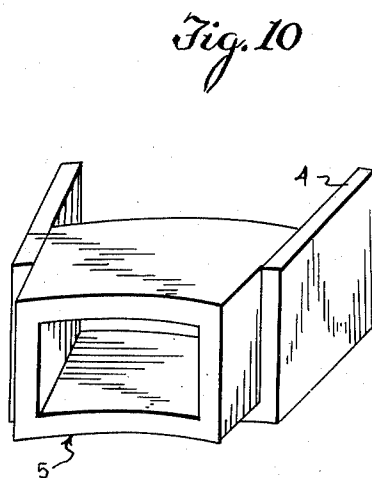


Fig. 10

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UNITED STATES PATENT OFFICE

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WATER COOLED CUPOLA

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5 Claims. (Cl. 122—6)

This invention relates to foundry cupolas and particularly to provisions for cooling such cupolas in use.

Firebrick as a lining for cupolas is subject to very rapid deterioration as the result of extremely high temperatures together with heavy wear. Water-cooled metal linings, because of their far superior durability, have to some extent superseded firebrick.

An object of the present invention is to form a unit a furnace wall liner and a tuyère cooler, having a single circulatory system for coolant water.

Another object is to provide an improved baffle arrangement for establishing a desired coolant flow through such a unit.

Another object is to render such a unit effective to cool a plurality of adjacent tuyères.

A further object is to dispose the cooled tuyères in a set back relation to the unit such as to afford them a maximum protection from heat and wear.

A further object is to utilize a cooling unit as one of the walls of a separately formed tuyère.

These and various other objects are attained by the construction hereinafter described and illustrated in the accompanying drawings, wherein:

Fig. 1 is a fragmentary interior elevational view of a foundry cupola equipped with the improved cooling units.

Fig. 2 is a horizontal sectional view of the cupola, taken on the line 2—2 of Fig. 1.

Fig. 3 is another horizontal sectional view, taken on the line 3—3 of Fig. 1.

Fig. 4 is a radial sectional view taken on the line 4—4 of Fig. 2.

Fig. 5 is an exterior view of one of the cooling units.

Fig. 6 is a vertical sectional view taken on the line 6—6 of Fig. 3 of the tuyère cooling element of said unit.

Fig. 7 is a radial sectional view of the lower portion of the unit taken on the line 7—7 of Fig. 6.

Fig. 8 is another radial section of said portion taken on the line 8—8 of Fig. 6.

Fig. 9 is a perspective view, showing the sections of one of the larger tuyères disassembled.

Fig. 10 is a perspective view showing one of the smaller tuyères with its sections assembled.

In these views, the reference character 1 designates the cylindrical steel shell of a cupola, and 2 the usual lining formed of firebrick or like refractory material. A wind jacket 3 surrounds the shell in the usual manner, delivering air to an

upper set of tuyères 4, 5 and a lower set of larger tuyères 6, 7. Each upper tuyère comprises an open-topped U-shaped outer section 4 and a box-shaped open-ended inner section 5 having its outer end portion removably fitted into the section 4. Each lower tuyère similarly comprises an outer U-shaped section 6 and an inner box-shaped section 7.

My improved water cooled unit comprises a tuyère cooler 8 and a wall liner 9 upwardly projecting from and integrally connected to the tuyère cooler, the cooler and the liner both being hollow and water conducting. A circular series of these units, occupying a slightly spaced relation, extends around the cupola at its melting zone, conforming to the curvature of its wall, the liners 9 defining said melting zone and being spaced from the shell 1 by a portion of the firebrick lining 2. The spaces between the units are filled with broken firebrick or other suitable refractory material 9a. The tuyère cooler of each unit extends outwardly from the lower end of the liner 9 of such unit, terminating at the shell. An arched opening 10 is formed in the lower end of each unit to accommodate one of the tuyères 4, 5, such opening interrupting the bottom face of the unit and extending from the outer end of the tuyère cooler to the inner face of the liner 9. The tuyère thus housed within each unit occupies the mid portion of the opening 10, being set back preferably at least three inches from the inner face of the unit so as to be considerably protected from the wear effect and high temperature of cupola load. To form the opening 10, the tuyère cooler of each unit is arched, midway between its radial margins, the walls of this arch 11 being hollow and water conducting and communicating with a lateral portion 11a of the cooler as best appears in Fig. 6. Water under suitable pressure is admitted through a pipe 12 to the other lateral portion 11b of the tuyère cooler at its outer end, and is compelled to flow inwardly through such portion by provision of a partition 13 closing off such portion from the arch (Fig. 6). As disclosed by Fig. 8, this partition terminates at the inner wall of the liner 9, whereby the water may flow around the inner end of said partition through a chamber 13a (Fig. 8) in the liner and may be delivered forwardly into a leg of the arch through an opening 13b in the outer wall of the liner. The chamber 13a is partitioned off from the overlying space in the liner as indicated at 13c. The water now flows through the bridge wall and other leg of the arch into the lateral portion 11a of the tuyère cooler and discharges

finally into the liner 9 through an opening 14 in the outer wall of the liner. Confined by the lowermost of a series of vertically spaced baffles 15 in the liner, the water now flows over the arched opening 10 and circuitously ascends in the liner through waterways formed between said baffles. A circuitous flow is assured by terminating alternate baffles in spaced relation to opposite radial walls of the liner 9, as best appears in Fig. 5, so that water flows the length of each waterway before rising into the overlying waterway, wherein a reversed flow occurs. A pipe 16 serves to discharge water from the upper end portion of each liner 9.

The lower tuyères form seats for the cooling units, each such tuyère having its radial axis underlying the space between two adjacent units. Similarly to the upper tuyères, each lower tuyère has its outer U-shaped section 6 extending inwardly from the shell, and its outer box-shaped section 7 extending some distance into the outer section, the section 7 extending toward the melting zone several inches beyond the section 6 and terminating preferably at least three inches from such zone. Thus similarly to the upper tuyères, the lower ones are protected from the cutting action and high temperature of the cupola load.

Preferably each cooling unit is formed at the lower end of the liner 9 with a hollow ledge 17 interiorly communicating with the water space of the unit and projecting sufficiently into the cupola chamber to serve as a support for a temporary facing of firebrick or the like, to be applied preliminary to each heat.

It will appear from the foregoing description that the tuyère cooling members of the described units not only extend in close heat-absorbing proximity to the tuyères, but serve to a very material extent to form the air passages. Thus the U-shaped outer sections of both the upper and lower tuyères are roofed by the coolers 8, and the manner in which both sets of tuyères are set back from the cupola chamber imposes on the units the function of largely forming the discharge end portions of the air passageways.

Very efficient protection of the tuyères results from thus setting them back within or beneath the cooling units, it being equally feasible to deliver either cold or heated air to the tuyères without affecting their protection. There accrues the advantage that the tuyères require replacement far less frequently than in present practice.

Formation of a water cooled wall liner and tuyère cooler as a single unit simplifies both the construction and installation of these elements as compared to the employment of such elements separately formed, and also materially simplifies the delivery and discharge of water to and from

such elements. Also a maximum conductivity of heat between said elements is attained by their formation as a single unit.

The tuyères illustrated and described are of a sectional form that avoids necessity for discarding an entire tuyère when its portion adjacent the melting zone becomes unduly deteriorated. It is apparent, however, that the described unit is not limited in its application to any particular type of tuyère, but it is preferred to employ tuyères of a nozzle type, such as progressively impose increasing velocity on delivered air.

The invention is presented as including all such modifications and changes as come within the scope of the following claims.

What I claim is:

1. In a cupola, the combination with a tuyère installed in the cupola wall and delivering air to the cupola, of a tuyère cooler formed with a passage for a coolant fluid and arched to form an opening receiving said tuyère, and a pair of tuyères installed in said wall at a lower level than the first mentioned tuyère and jointly providing a seat for the tuyère cooler.

2. A cupola as set forth in claim 1, the two lower tuyères being at least partially open-topped and the tuyère cooler forming a closure for such tops.

3. In a cupola, the combination with a vertically elongated cooler for the wall of said cupola and a tuyère cooler connected to the lower end portion of the wall cooler and outwardly projecting from the wall cooler, and formed with an opening extending substantially radially through both coolers, the two said coolers being jointly formed with a passage for a coolant fluid, of a tuyère installed in said opening and set back from the inner end of such opening a distance approximately equal to the radial thickness of the wall cooler.

4. In a cupola, the combination with a vertical elongated cooler for the cupola wall, and a tuyère cooler integrally connected to the lower end portion of the wall cooler and outwardly projecting from said end portion and formed with an opening extended substantially radially through both coolers, the two coolers being jointly formed with a passage for a coolant fluid, of a tuyère installed in said opening and delivering air through said wall.

5. In a cupola, a cooling unit for the cupola wall set into said wall substantially flush with an adjacent interior face of the wall, and formed at its bottom with a ledge projecting into the cupola chamber and forming a support for a coating of protective material applied to the inner face of the unit.

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