United States Patent

[11] 3,601,384

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[54] **TUYERES**
10 Claims, 11 Drawing Figs.

[52] **U.S. Cl.** **266/41, 165/169**
[51] **Int. Cl.** **C21b 7/16**
[50] **Field of Search** 29/504, 474.3; 266/41; 110/182.5; 122/6.6, 6.7; 165/169

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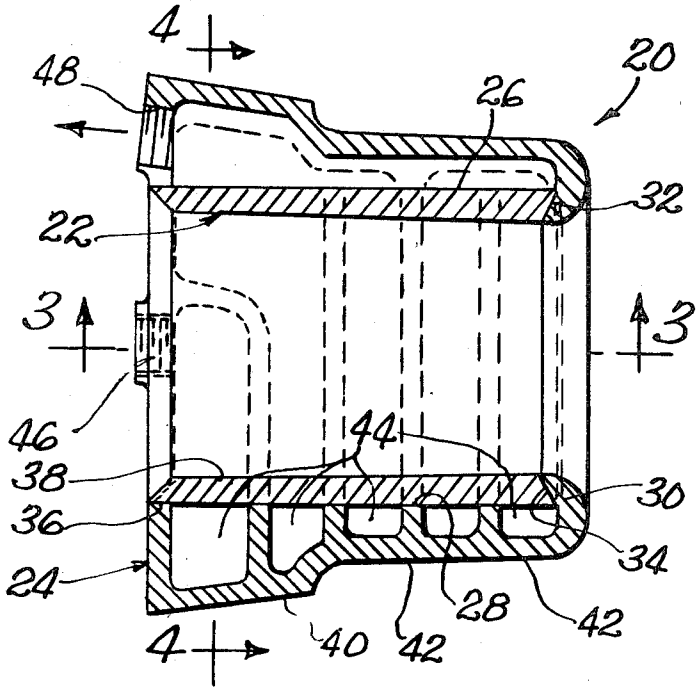
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Attorney—Burmeister, Palmatier and Hamby

ABSTRACT: Each of the disclosed tuyeres or other tubular members comprises inner and outer tubular elements, preferably in the form of copper castings, having mating cylindrical surfaces. A series of channels are formed in one of said tubular elements along one of said surfaces to provide fluid coolant passages between the tubular elements. The channels are preferably cast into the corresponding element. Connections are provided for fluid coolant conduits. Welded or soldered joints are provided between the elements.



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SHEET 1 OF 2

FIG. 1

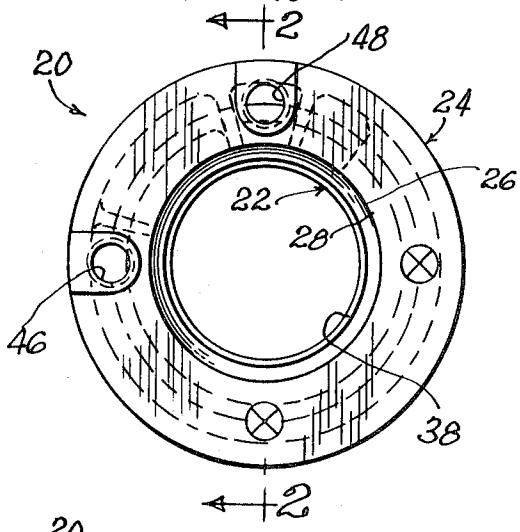


FIG. 2

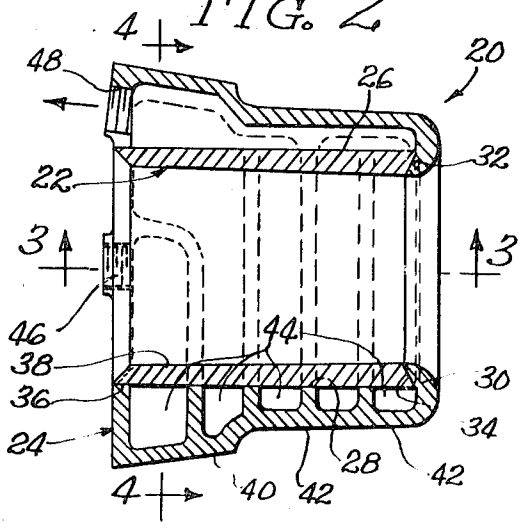


FIG. 3

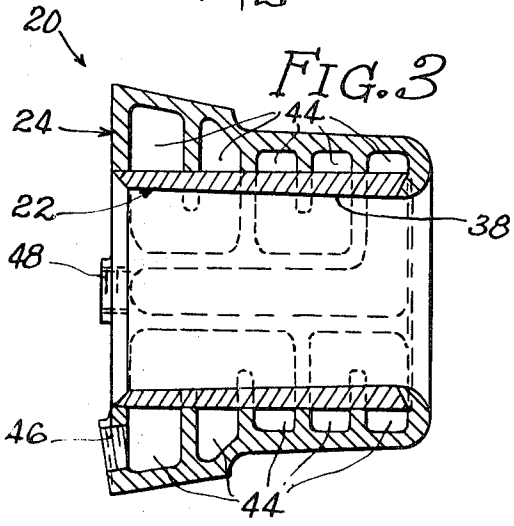


FIG. 4

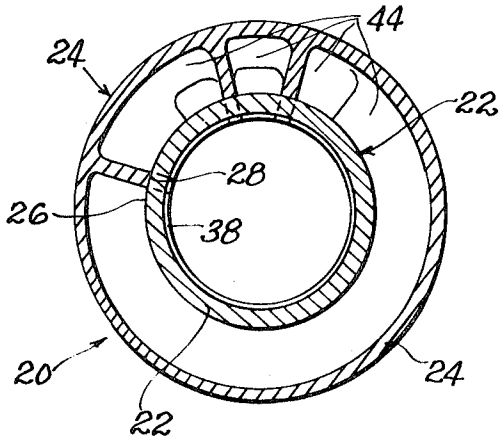
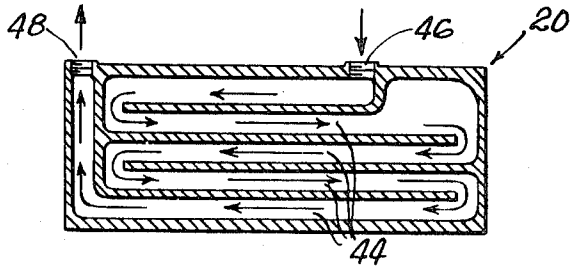


FIG. 5



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FIG. 6

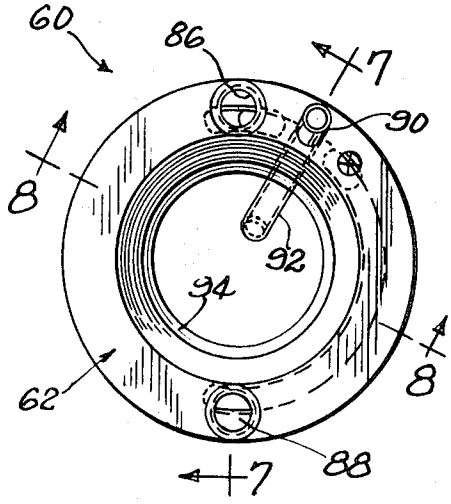


FIG. 7

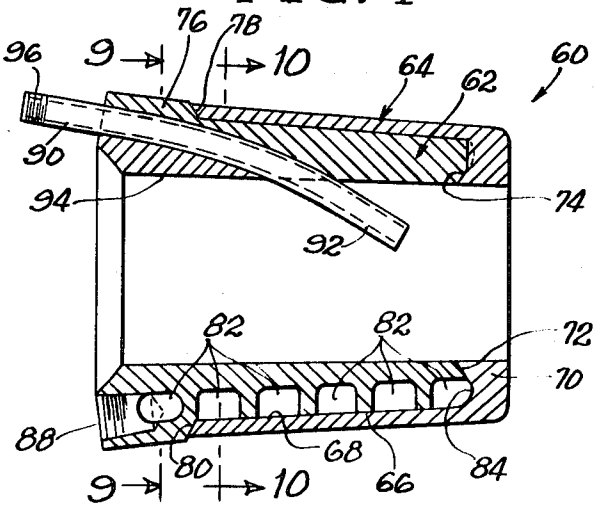


FIG. 8

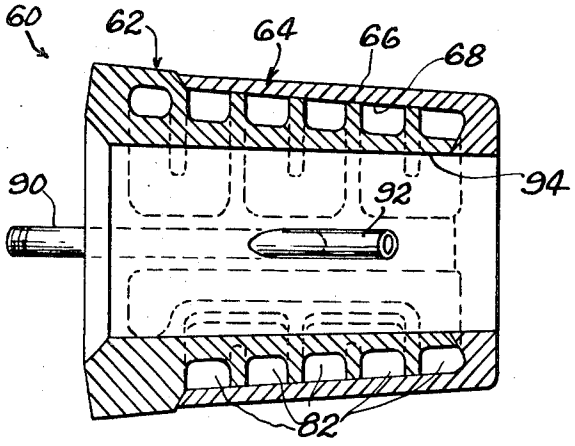


FIG. 9

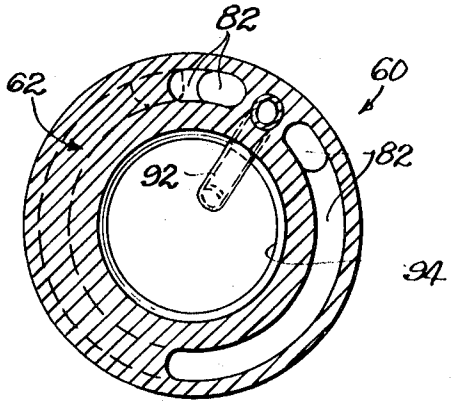


FIG. 10

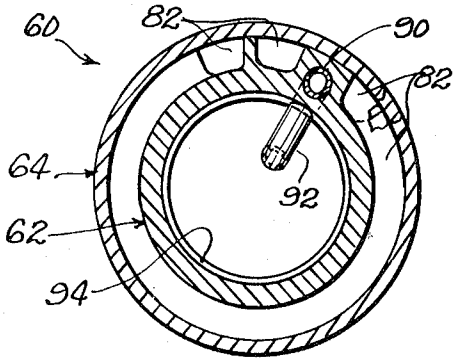
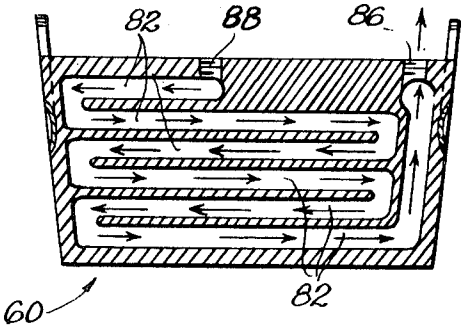


FIG. 11



TUYERES

This invention relates to tuyeres or other similar hollow tubular members.

Tuyeres are used in blast furnaces and the like for introducing streams of air into the hot furnaces. Similar hollow tubular members are employed in other types of furnaces for introducing streams of air, oxygen, or other gases.

It will be evident that tuyeres and other similar devices are subjected to extreme heat. Consequently, tuyeres have been provided in the prior art with passages therein to carry cooling water, or some other fluid coolant. It has been the practice to make such tuyeres of cast metal, and to core out the cooling passages. This is an extremely difficult technique which often leads to faulty castings. Moreover, the cooling passages are restricted in size and resistant to the flow of the fluid coolant.

One principal object of the present invention is to provide such tuyeres or other tubular members having fluid coolant passages which do not have to be cored out, and that can be formed with much greater precision, and of ample size.

In accordance with the present invention, the tuyere or other tubular member is made in two pieces, comprising inner and outer tubular elements, having mating annular surfaces, preferably cylindrical in shape. At least one of the tubular elements is formed with a series of channels which cooperate with the other element to form the fluid coolant passages. Means are provided in one of the tubular elements to connect the supply and return conduits for the fluid coolant. The tubular elements are preferably in the form of copper castings. Welded, brazed or silver soldered joints are preferably provided between the tubular elements. The channels are preferably cast into the inner side of the outer element, or the outer side of the inner element, so that no coring is necessary in this regard. Accordingly the cooling passages can be very large and precisely formed so that the fluid cooling of the tuyere can be accomplished much more efficiently than heretofore.

Further objects, advantages and features of the present invention will appear from the following description, taken with the accompanying drawings, in which:

FIG. 1 is an end elevation of a tuyere to be described as the first illustrative embodiment of the present invention.

FIG. 2 is a longitudinal section, taken generally along the line 2—2 of FIG. 1.

FIG. 3 is another longitudinal section, generally along the line 3—3 in FIG. 2.

FIG. 4 is a cross section, taken generally along the line 4—4 in FIG. 2.

FIG. 5 is a developed diagrammatic section showing the layout of the cooling passages.

FIG. 6 is an end elevation showing a second embodiment, comprising a modified tuyere.

FIGS. 7 and 8 are longitudinal sections along the lines 7—7 and 8—8 in FIG. 6.

FIGS. 9 and 10 are cross sections along the lines 9—9 and 10—10 in FIG. 7.

FIG. 11 is a developed diagrammatic section showing the cooling passage layout for the second embodiment of FIGS. 6–10.

It will be seen that FIGS. 1–5 illustrate a tuyere 20 of the type commonly employed in blast furnaces or the like. However, the invention is applicable to other tubular members, in addition to tuyeres. The illustrated tuyere 20 comprises inner and outer tubular elements 22 and 24. This construction differs from prior tuyeres, which have generally been cast in one piece. The inner and outer elements 22 and 24 have mating annular surfaces which preferably are cylindrical in shape. Thus, the illustrated inner element 22 has an outer cylindrical surface 26, adapted to mate with an inner cylindrical surface 28, formed in the outer element 24. The inner element 22 is adapted to be inserted into the outer element 24, in the assembly of the tuyere.

One of the elements 22 and 24 is preferably provided with a flange, adapted to engage one end portion of the other element. As shown, the outer tubular element 24 has an inwardly projecting flange 30 which is engageable with one end surface 32 of the inner tubular element 22. Preferably, the end surface 32 is internally beveled or frustoconical, as illustrated. The flange 30 has an oppositely tapered frustoconical surface 34 adapted to mate with the surface 32. In the assembly of the tuyere 20, a welded, brazed or silver soldered joint is preferably formed between the surfaces 32 and 34. Other means may be employed to join the inner and outer elements 22 and 24.

At the opposite end of the tuyere 20, a welded, brazed or silver soldered joint 36 is preferably formed between the extreme end portions of the mating cylindrical surfaces 26 and 28. Here again, other means may be employed to connect the inner and outer elements 22 and 24 together.

Both of the inner and outer elements 22 and 24 are preferably in the form of copper castings, but they may be made of other materials and by methods other than casting. The inner element 22 has an inner bore 38 adapted to carry the stream of air or other gases into the blast furnace. The illustrated bore 38 is slightly tapered in shape.

The outside of the outer element 24 is shaped to fit into the desired opening in the wall of the furnace. As shown, the outer element 24 has an enlarged tapering rear portion 40 and a reduced generally cylindrical nose portion 42 which may also be slightly tapered.

To provide for cooling of the tuyere 20, passages are formed in the tuyere for the circulation of a fluid coolant. In accordance with the present invention, these passages are provided by forming channels in one or both of the mating cylindrical surfaces 26 and 28. In this way, the passages are easily formed in the casting of the tubular elements.

In the tuyere 20 of FIGS. 1-5 the outer tubular element 24 is formed with a series of interconnected channels 44. The inner tubular element 22 forms one wall for all of these channels 44 so that they constitute a continuous passage for the circulation of water or some other fluid coolant.

The tuyere 20 is provided with means for connecting the supply and return conduits for the fluid coolant. Such means may include openings in either or both of the inner and outer tubular elements 22 and 24. In this case, the outer element 24 is supplied with such openings 46 and 48, which may be appropriately threaded to receive connecting pipes or the like.

The inner and outer elements 22 and 24 are cast separately. It is easy to form the channels 44 on the inside of the outer element 24, because the channels may simply be molded without any need for coring out. The inner and outer elements 22 and 24 are assembled, preferably by heating the outer element, inserting the inner element, and cooling the outer element so that it shrinks into firm contact with the inner element. The inner and outer elements 22 and 24 are then suitably joined, preferably by brazing or silver soldering between the surfaces 30 and 34, and in the joint area 36. The cylindrical surfaces 26 and 28 make a sufficiently good seal to prevent any objectionable leakage of cooling water between the adjacent channel portions 44.

FIGS. 6–11 illustrate a modified tuyere 60 which also comprises inner and outer tubular elements 62 and 64. Mating annular surfaces 66 and 68 are formed in the elements 62 and 64. In this case the surfaces 66 and 68 are tapered or frustoconical.

The outer tubular element 64 has an inwardly projecting flange 70 at one end, engageable with an internally beveled end surface 72 on the inner element 62. The flange 70 has an oppositely tapered end surface 74 which mates with the surface 72. A welded, brazed or silver soldered joint is preferably formed between the surfaces 72 and 74.

The opposite end of the inner element 62 is preferably formed with an outwardly projecting flange or head 76 having a tapered surface 78 on which is engageably with an oppositely tapered surface 80 on the outer element 64. A welded,

brazed or silver soldered joint is preferably formed between the surfaces **78** and **80**.

In the case of the second tuyere **60**, the fluid coolant passages are provided by forming a series of interconnected channels **82** in the inner tubular element **62**. These channels are formed into the tapered surface **66** which mates with the oppositely tapered surface **68** within the outer element **64**. A channel **84** is also formed in the flange **70** of the outer tubular element **64**. The channel **84** is opposite one of the channels **82** in the inner element **62**.

As before, means are provided for connecting the supply and return conduits for the fluid coolant. As shown, suitable openings **86** and **88** are formed in the outer tubular element **64**. These openings may be appropriately threaded to receive pipes or the like.

A slightly curved injection tube **90** is cast into the inner tubular element **62** in this case. The injection tube **90** has a discharge end portion **92** which extends at an angle into the internal bore **94** within the inner element **62**. The other end of the pipe **90** may have a threaded portion **96** for connection to a supply pipe.

Here again, the elements **62** and **64** are cast separately, preferably from copper. The channels **82** and **84** are easily cast by simple molding operations, without any need for coring out.

The channels may be cast with a high degree of precision. Moreover, they may be of generous size, to provide for the maximum circulation of water or other fluid coolant. Thus, the tuyere may be cooled much more efficiently than heretofore. Accordingly, it will have a high capacity and a long life.

I claim:

1. A tuyere for a furnace or the like,
including an inner member having a generally cylindrical nozzle passage extending axially therethrough,
said inner member having an outer generally cylindrical joint surface,
an outer member having an inner generally cylindrical joint surface received around and mating with said outer joint surface of said inner member,
at least one of said members having a system of coolant channels formed into the cylindrical joint surface thereof,
said channels forming coolant passageways between said members,
at least one of said members being formed with entrance and exit ports connecting with said passageways,
said outer member having a nose portion including an annular flange directed inwardly and formed with an annular rearwardly facing end surface,
said inner member having a forwardly facing annular end surface mating with said rearwardly facing end surface,
said flange forming a circular nozzle opening therein aligned with said nozzle passage,
and a sealing joint material between said inner and outer members to prevent leakage of the coolant from said passageways.

2. A tuyere according to claim **1**,
in which said rearwardly and forwardly facing end surfaces are frustoconically beveled.

3. A tuyere according to claim **1**,
in which said channels are formed in said outer member.

4. A tuyere according to claim **1**,
in which said channels are formed in said inner member.

5. A tuyere according to claim **1**,
in which said cylindrical joint surfaces are appreciably tapered.

6. A tuyere according to claim **1**,
in which said joint material is provided by weld material.

7. A tuyere according to claim **1**,
in which said joint material is provided by solder material.

8. A tuyere according to claim **1**,
in which said members are made of copper.

9. A tuyere according to claim **1**,
in which said outer member has an annular rear end surface,
said inner member having a rear portion comprising an outwardly projecting annular flange having an annular front surface mating with said annular rear end surface.

10. A tuyere for a furnace or the like,
including an inner member having a generally cylindrical nozzle passage extending axially therethrough,
said inner member having an outer generally cylindrical joint surface,
an outer member having an inner generally cylindrical joint surface received around and mating with said outer joint surface of said inner member,
said outer member having a system of coolant channels formed into the cylindrical joint surface thereof,
said channels forming coolant passageways between said members,
said outer member being formed with entrance and exit ports connecting with said passageways,
said outer member having a nose portion including an annular flange directed inwardly and formed with an annular frustoconical rearwardly facing end surface,
said inner member having a forwardly facing annular frustoconical end surface mating with said rearwardly facing end surface, said flange forming a circular nozzle opening therein aligned with said nozzle passage,
and a sealing joint material between said inner and outer members to prevent leakage of the coolant from said passageways.