(12) UK Patent Application (19) GB (11) 2 101 724 A

(21) Application No **8208610**
(22) Date of filing **24 Mar 1982**
(30) Priority data
(31) **8110332**
(32) **2 Apr 1981**
(33) **United Kingdom (GB)**
(43) Application published
19 Jan 1983
(51) **INT CL³**
F27D 3/16
(52) Domestic classification
F4B JC
U1S 1453 1465 F4B
(56) Documents cited
GB 1579522
GB 1566628
GB 1484745
(58) Field of search
F4B
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(54) Metallurgical lance

(57) Normally metallurgical lances are formed by a heavy metal tube encased in a refractory sleeve and because of their relatively long length such lances flex in use thereby propogating cracks in the refractory and encouraging the growth of cracks that are otherwise formed during shock loading of the lance as it enters the bath of metal and because of the differential expansion that occurs between the refractory and the tube. This invention provides a lance of high rigidity and reduced tendancy to cracking and spalling. The lance has a tubular member 2 for the passage of gas or a mixture of gases and solids encased in a sleeve 3 of an appropriate refractory material, there being secured to and spaced around the periphery of the tubular member, a number of secondary tubular members 6. The members 6 may be used for the passage of coolant.

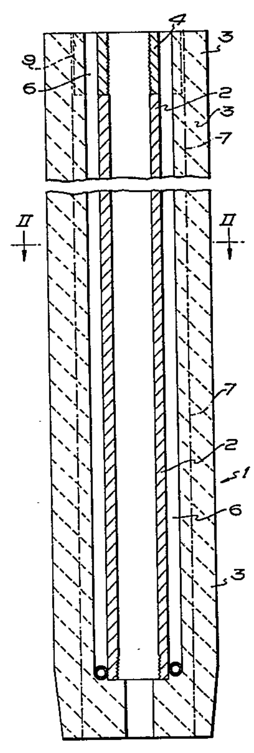

FIG.1

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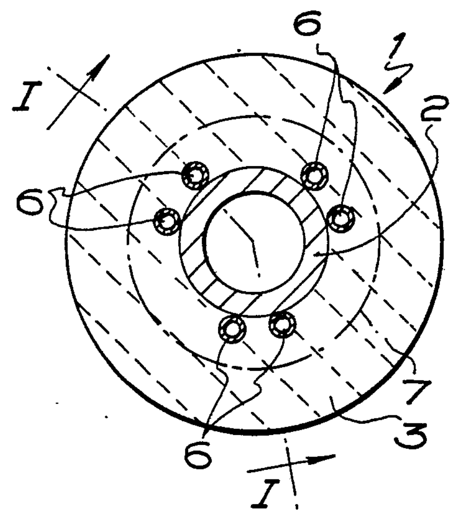

FIG. 2

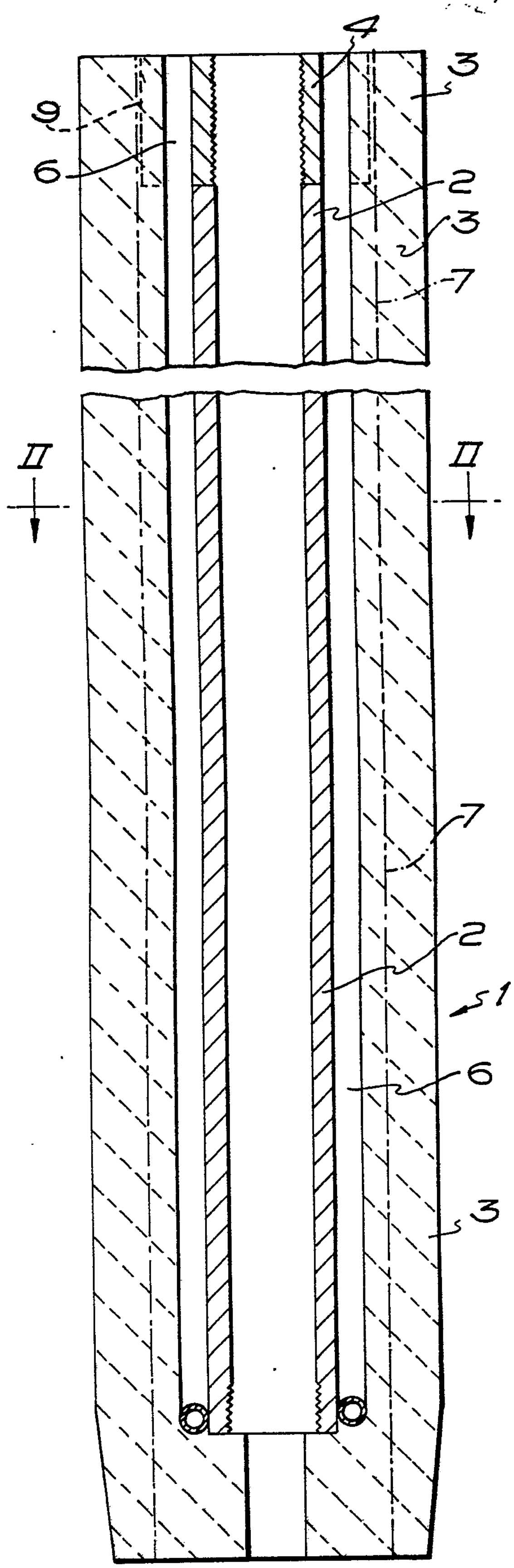

FIG. 1

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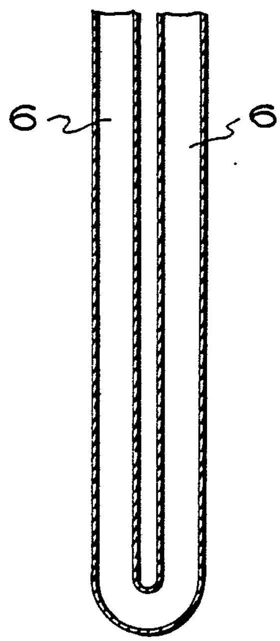

FIG. 3

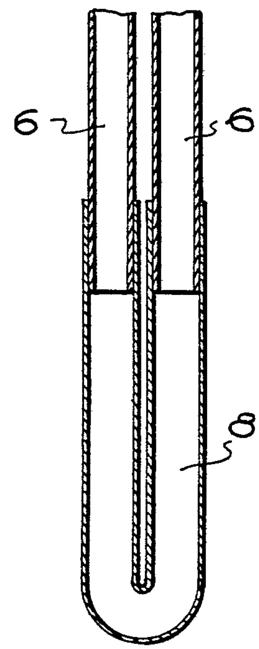

FIG. 4

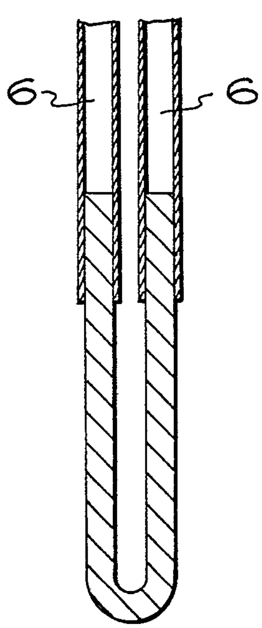

FIG. 5

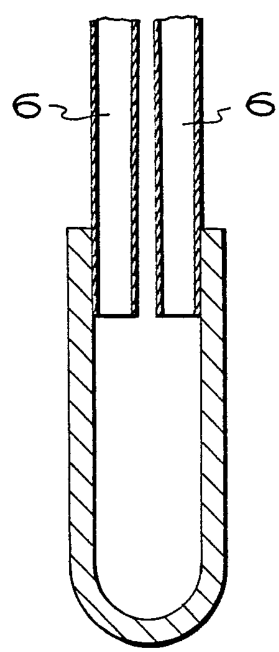

FIG. 6

SPECIFICATION

Metallurgical lance

This invention relates to metallurgical lances such as are used to inject gases or mixtures of gases and solids below the surface of molten metal in a furnace or ladle.

Normally lances are formed by a heavy metal tube encased in a refractory sleeve, and frequently such lances are relatively of long length. Because of the arduous conditions to be found in a furnace or ladle, and the shock loading of the lance as it is introduced, e.g., through a slag layer and into the bath of molten metal, the refractory sleeve frequently cracks and spalls, thereby reducing the life of the lance, and it is not unknown for a lance to be unusable after a single lancing operation. With lances of relatively long length, this problem is compounded, the inevitable flexing of the lance during use itself propogating cracks in the refractory and encouraging the growth of cracks that are otherwise formed, e.g., because of the differential expansion that occurs between the refractory and the metal tube.

The object of the present invention is to provide a metallurgical lance that has a reduced tendancy to crack and spall in comparison with lances known hitherto.

According to the present invention, a metallurgical lance comprises a tubular member for the passage of gas or a mixture of gases and solids encased in a sleeve of an appropriate refractory material, there being secured to and spaced around the periphery of the tubular member, a number of secondary tubular members.

By providing a cluster of tubular members all encased in the refractory sleeve, the rigidity of the lance is so greatly increased over known lance constructions, that flexing during use is virtually eliminated, thereby removing a major cause of lance failure. Also, if the secondary tubular members are arranged in pairs and coupled together towards the outlet end of the lance each pair of secondary tubular members can serve for the passage of coolant gas or liquid along substantially the full length of the lance, thereby minimising the effects of shock loading and differential expansion.

The invention will now be described with reference to the accompanying drawings, in which:–

Figure 1 is a sectional side elevation of a lance on the line 1-1 of Figure 2;

Figure 2 is a sectional plan on the line 2-2 of Figure 1; and

Figures 3 to 6 show various methods of connecting in pairs, the reinforcing members of Figure 1.

In Figures 1 and 2, a lance 1 has a tubular metal member 2 encased in a sleeve 3 of refractory material, the tube, at the inlet end, being secured to a connector block 4 whereby the lance can be secured to mechanism (not shown) to introduce it into a furnace, and connect the bore of the tubular member to a source of gas or gas/solids mixture. At the opposite end of the lance, its bore communicates with an outlet orifice 5 from the refractory sleeve.

Along the length of the tubular member 2, there are provided six reinforcing members 6 in the form of metal tubes, the metal tubes 6 being secured to the tubular member 2 and spaced around its periphery. As shown, and as is preferred, the reinforcing tubes 6 are grouped in pairs, with the pairs spaced around the periphery, and with the tubes of each pair connected together at their lower ends. At the inlet end, the reinforcing tubes 6 are secured, e.g., by welding, to the connector block 4.

As is shown by Figures 1 and 2, further reinforcement in the form of a wire mesh sleeve 7 can be provided, encircling the tubular reinforcing members, and also embedded in the refractory of the sleeve 3.

To interconnect the reinforcing tubes 6 at the lower ends, each pair may be formed from a single tube bent into U-configuration as is shown in Figure 3. Alternatively, the tubes 6 of each pair may be connected by a U-shaped connector pipe 8 as is shown in Figure 4. It is further possible to connect the tubes 6 of each pair by a solid U-shaped connector, fitted within the tubes 6 as shown by Figure 5, or secured to the outsides of the tubes 6 as shown by Figure 6.

By providing reinforcing tubes along the length of the tube 2 there is formed a reinforcement that presents no sharp edges within the refractory, eliminating stress raising points that could otherwise promote the formation of cracks within the refractory during use, and provides a degree of rigidity that virtually eliminates flexing during use thereby removing another major cause of lance failure. So greatly increased is the rigidity of the lance, that a tube 2 of reduced gauge can be used, reducing the mass of metal within the lance, and reducing weight with its effect on handling, with a consequent reduction in production costs.

To assist in minimising the effects of differences in thermal expansion between the tubular member/reinforcing structure and the refractory sleeve, the tubular member 2, more particularly the connector block 4, and the reinforcing tubes 6 at the inlet end of the lance are left exposed. The construction also has the advantage that the cooling effect of gas or gas/solids passing down the tube 2 is dissipated by the tubes 6 into the refractory material. To enhance the cooling effect internally of the lance, when the connections between the tubes 6 are as shown either in Figure 3 or Figure 4, the ends of the tubes at the inlet end can be connected to a manifold 9 for the passage of coolant fluid down the reinforcing tubes 6. It is also possible prior to casting the sleeve 3, to coat the reinforcing tubes 6 and tube 2 with a heat destructible material, or a low melting point compound which is removed on drying or firing of the refractory sleeve, to leave a minute gap between the metal and the refractory.

CLAIMS

1. A metallurgical lance comprising a tubular member for the passage of gas or a mixture of gases

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

and solids encased in a sleeve of an appropriate refractory material, there being secured to and spaced around the periphery of the tubular member, a number of secondary tubular members.

2. A metallurgical lance as in Claim 1, wherein adjacent secondary tubular members are secured in pairs towards the outlet end of the lance.

3. A metallurgical lance as in Claim 2, wherein the connection is by bending a secondary tubular member into U-configuration.

4. A metallurgical lance as in Claim 2, wherein the connection is by a U-shaped tubular connecting member.

5. A metallurgical lance as in Claim 2, wherein the connection is by a solid U-shaped connecting member.

6. A metallurgical lance as in any of Claims 1 to 5, wherein the tubular member is secured to a connector block at the inlet end of the lance.

7. A metallurgical lance as in Claim 1, Claim 3 or Claim 4, wherein the secondary tubular members are secured to a manifold block at the inlet end of the lance.

8. A metallurgical lance as in any of Claims 1 to 7, wherein a wire mesh sleeve is provided, encircling the cluster of secondary tubular members, and embedded in the refractory sleeve.

9. A metallurgical lance as in any of Claims 1 to 8, wherein the ends of the tubular and secondary tubular members are left exposed, directly or indirectly, at the inlet end of the lance.

10. A metallurgical lance as in any of Claims 1 to 9, wherein prior to forming the refractory sleeve, the tubular and secondary tubular members are coated with a heat destructible material or low melting point compound, removed on drying or firing of the refractory sleeve, to leave a gap between the tubular and secondary tubular members and the refractory sleeve.

11. A metallurgical lance substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawings.

12. A metallurgical lance substantially as hereinbefore described with reference to any one of Figures 3 to 6 of the accompanying drawings.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1983.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.