NOZZLE PROVIDED WITH COOLING JACKET

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The present invention relates to nozzles and, more particularly, to nozzles for the introduction of gases, vapors, liquids, or fine grained solids, or mixtures thereof of beneath the surface of molten metals. Known nozzles of this type are provided with a cooling jacket to protect them against destruction by the metal bath. Since the mouth of the nozzle is the part most endangered, the cooling agent must be supplied to the nozzle mouth at such a temperature and in such quantity that it will be able to exert a satisfactory cooling effect. However, inasmuch as the cooling agent becomes progressively hotter on its way to the nozzle mouth as the depth of immersion of the nozzle increases, there is a limit as to how deep the nozzle may be immersed in the metal bath.

A further disadvantage of these known nozzles consists in that, when the nozzle is in an inclined position with regard to the surface of the metal bath, the immersed part of the nozzle due to the low specific weight of the latter, experiences a strong buoyancy in the metal bath. This buoyancy subjects the nozzle to a bending stress which is of particular magnitude in that part of the nozzle which extends out of the metal bath. In this part, however, the bending strength of the nozzle is considerably reduced due to the high temperature to which the nozzle is subjected by radiation from the surface of the bath as a result of which the nozzle is liable to bend.

It is, therefore, an object of this invention to provide a nozzle which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a nozzle for the above mentioned purpose, which will allow a more intensive cooling of that portion of the nozzle which is not immersed in the metal bath.

Still another object of this invention consists to provide a nozzle for the above mentioned purpose, the non-immersed part of which will be effectively protected against heat radiation from the surface of the metal bath.

It is also an object of the present invention to provide a nozzle for the introduction of gases, vapors, liquids, fine grained solids, or mixtures thereof beneath the surface of molten metals, which will make it possible that the cooling means for cooling that portion of the nozzle which is immersed in the metal bath will enter into said portion at a lower temperature than heretofore possible.

Still another object of this invention consists in the provision of a nozzle of the type set forth in the preceding paragraphs, which will make it possible to increase the depth of immersion of the nozzle over heretofore known nozzles serving a similar purpose.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawing, which illustrates a longitudinal section through a nozzle according to the invention.

General arrangement

According to the invention a nozzle having a cooling jacket and adapted to introduce gases, vapors, liquids, fine grained solids, or mixtures thereof below the surface of molten metals has its jacketed exposed portion, i.e. that portion which extends out of the metal bath, surrounded by a second cooling jacket. Aside from the mechanical strengthening effect brought about by the second cooling jacket, the latter makes possible a more intensive cooling of the exposed part of the nozzle. This is due to the fact that the cooling agent passing through the second cooling jacket has to cool the exposed portion only of the nozzle. Furthermore, the heat radiation of the metal surface cannot reduce the strength of the first cooling jacket any longer since the latter is now protected against said radiation by the second cooling jacket. Consequently, the first cooling jacket will now be more resistant to bending. Moreover, the nozzle according to the invention has the further advantage that the cooling agent for cooling the immersed part of the nozzle reaches the immersed part of the nozzle at a lower temperature and can leave the immersed part of the nozzle at a considerably higher temperature since it does not have to impart any further cooling effect after it leaves the immersed part of the nozzle. It will be appreciated that the cooling of the exposed part of the nozzle is not done any longer by the cooling means cooling the immersed part of the nozzle but is effected by the cooling agent flowing through the second cooling jacket.

It is, therefore, possible to immerse the nozzle according to the invention to greater depths than is possible with heretofore known nozzles.

It is of particular advantage to mount the second cooling jacket on the nozzle that the length of the nozzle protruding from the second cooling jacket will be adjustable.

Structural arrangement

Referring now to the drawing in detail the nozzle shown therein comprises a nozzle tube 1 serving to blow in the material to be introduced into the metal bath. The tube 1 is surrounded by a cooling jacket 2 which extends up to the nozzle mouth 3. The nozzle furthermore comprises a cooling agent supply conduit 4 adapted to convey the cooling agent to the nozzle mouth from where the cooling agent passes into the annular chamber between nozzle tube 1 and cooling jacket 2 in order to flow back or to be discharged through the discharge conduit 5 for the cooling agent. The exposed portion of the nozzle above the surface 11 of the metal bath is surrounded by a second cooling jacket 6 forming with the jacket 2 of the nozzle an annular chamber 7. Through the delivery pipe 9 a cooling agent is conveyed into the annular or cylindrical chamber 7 and is discharged therefrom through a discharge pipe 10. It will be noted that the mouth of the delivery pipe 9 is located at the lower portion of the cylindrical chamber 7, while the entrance to the discharge pipe 10 is located at the top of the cylindrical chamber 7.

The nozzle is connected to and held by a holder 8 at such a distance from the surface 11 of the metal bath that the lower edge 12 of the cooling jacket 6 is close to the surface 11 of the metal bath.

It is to be understood that the present invention is, by no means, limited to the particular arrangement shown in the drawing but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. A nozzle unit for introducing gases, vapors, liquids, fine grained solids, or mixtures thereof beneath the surface of molten metals, which comprises in combination: a tubular nozzle member having its lower end
portion arranged for immersion into a metal bath, a first cooling jacket surrounding said tubular nozzle member along said lower end portion to be immersed into the metal bath and also along a portion not to be immersed into said metal bath, a second cooling jacket surrounding said first cooling jacket over a portion thereof which is not to be immersed into said metal bath, said second cooling jacket being connected to said first cooling jacket so as to form an entity with said first cooling jacket and said nozzle member and means for conveying cooling means to and discharging the same from said first and second cooling jackets respectively.

2. A nozzle unit for introducing gases, vapors, liquids, fine grained solids, and mixtures thereof beneath the surface of molten metals, which comprises in combination: a tubular nozzle member having one end portion arranged for immersion into a metal bath, a first cooling jacket surrounding said tubular nozzle member along said one end portion to be immersed into the metal bath up to the mouth of said nozzle member and also surrounding another portion not to be immersed of said nozzle member, said first cooling jacket having a first bottom at the mouth of said tubular nozzle member and having a second bottom spaced from said first bottom in axial direction of said nozzle member, first cooling agent conveying conduit means extending into said first cooling jacket and having its mouth close to said first bottom thereof, first cooling agent discharging conduit means arranged near said second bottom of said first cooling jacket, a casing surrounding the major part of the upper portion of said first cooling jacket and being connected to said first cooling jacket so as to form an entity therewith, said casing forming with the outer wall thereof a second cooling jacket, said second cooling jacket having a first bottom adjacent to the first bottom of said first cooling jacket but spaced therefrom by a distance greater than the respective intended depth of immersion of said first cooling jacket into said metal bath, said second cooling jacket also having a second bottom spaced from its first bottom in axial direction of said nozzle member, second cooling agent conveying conduit means having its mouth near the first bottom of said second cooling jacket, and second cooling agent discharging means arranged at the second bottom of said second cooling jacket.

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