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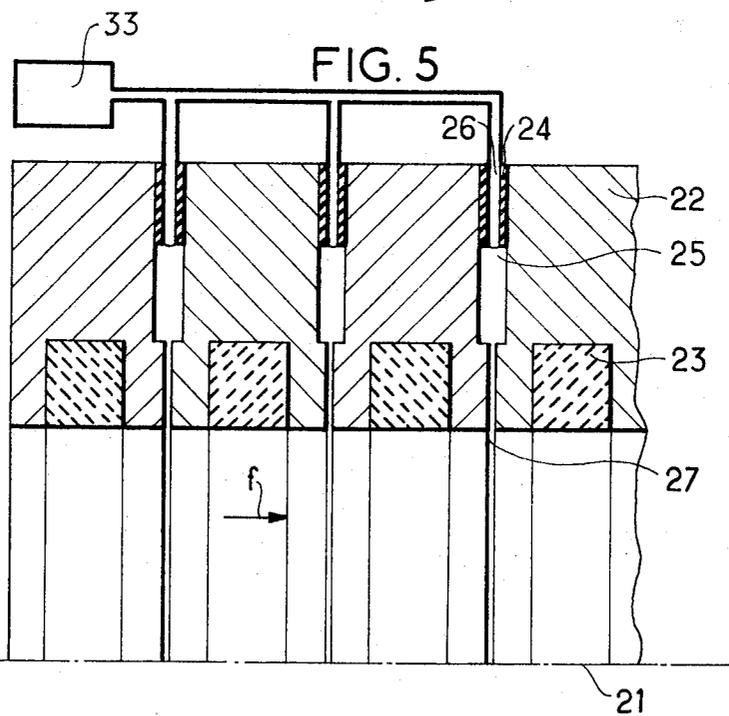
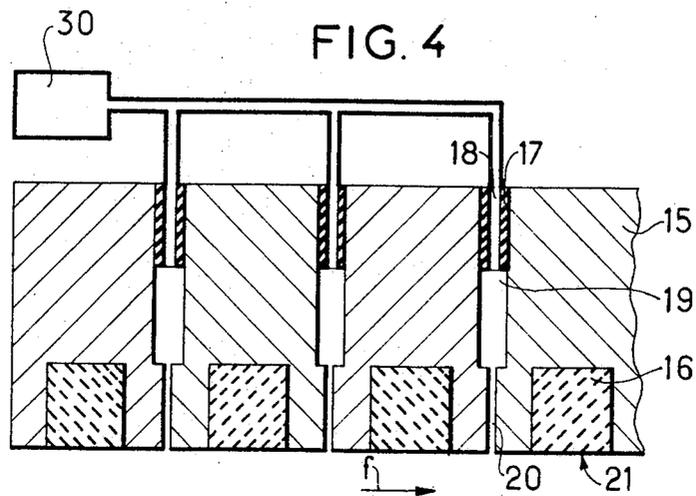
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NOZZLE PRINCIPALLY FOR MAGNETO-HYDRODYNAMIC GENERATORS

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NOZZLE PRINCIPALLY FOR MAGNETO-HYDRODYNAMIC GENERATORS

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7 Claims

ABSTRACT OF THE DISCLOSURE

Nozzle principally for magnetohydrodynamic generators comprising a plurality of metal elements placed alongside one another and separated from one another by a space communicating with the duct of said nozzle, and means to cause a preferably inert gas to circulate from said space to said duct in such manner as to ensure electric insulation between said elements by preventing heating of the insulating gas.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a nozzle for a conversion apparatus of the magnetohydrodynamic type and notably for a generator of the magnetohydrodynamic type, containing a duct through which there circulate the hot gases and means for exerting a magnetic field in the said duct, and wherein the electrical insulation of the current lead-out electrodes and of the metal parts from one another is improved as compared with the known insulating means employed in the various types of nozzles.

Description of the prior art

A nozzle which is intended more particularly for a generator of the magnetohydrodynamic type may be formed either of four walls, comprising two opposed insulating walls and two other walls provided with electrodes, or by the juxtaposition of frames which are alternately conductors (electrodes) and insulators.

It is known that an insulating wall may be formed by the assembly of vigorously cooled metal elements, at least one face of which is in contact with the inoculated hot gases circulating through the nozzle, the various metal elements being electrically insulated from one another by elements consisting of refractory oxides. Likewise, a wall provided with electrodes is formed by the assembly of metallic or non-metallic conductive elements which are insulated from one another by elements of refractory material. The metal elements may either be assembled by screwing to an insulating plate, connected together by cement and traversed by channels for the circulation of a cooling fluid, or connected by a thick layer of insulating material having in its thickness channels through which there flows the cooling liquid which washes the metal elements.

It is also known that a nozzle may be formed of a succession of frames or rings which are alternately conductors and insulators, the conductor frames constituting the electrodes and the insulator frames, which are made of refractory material, having to be capable of carrying the Hall voltage developed along the generator between two conductor frames.

SUMMARY OF THE INVENTION

The present invention concerns, in a nozzle, notably for a magnetohydrodynamic generator, a new and par-

ticularly advantageous means of electrical insulation between the various component elements of the nozzle.

The present invention relates to nozzle, notably for a magnetohydrodynamic generator, which comprises a plurality of metal elements disposed side by side and separated by a space communicating with the duct of the said nozzle, and means for passing a preferably inert gas from the said space to the said duct, so as to insulate the said elements electrically from one another.

The present invention concerns a nozzle in which the said metal elements arranged to form an insulating wall are in the form of nails, each nail comprising a first central channel communicating with the aforesaid space between the said metal elements, advantageously by way of a plurality of second radial channels, the said first and second channels constituting the aforesaid conduit.

The present invention also concerns a nozzle in which a wall provided with electrodes for leading out the electric current comprises the aforesaid metal elements, which are assembled by means of a layer of insulating material formed with at least one conduit which communicates on the one hand with the aforesaid space between the said metal elements and on the other hand with a source of gas. In a modified embodiment, the metal elements comprise a conduit which places in communication the aforesaid space and the aforesaid source of gas, the assembly material then not comprising a gas admission conduit.

In another form of construction of a Hall-effect nozzle, in which the aforesaid metal elements are in the form of frames or rings assembled by means of frames or rings of insulating material, a plurality of conduits, which are preferably radial, are formed either in the metal frames or in the insulating frames for placing the aforesaid space between the said metal elements in communication with a source of gas.

Further features will become apparent from the following description with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWING

FIGURE 1 is a sectional view of an insulating wall of a magnetohydrodynamic generator nozzle.

FIGURE 2 is a view in perspective of one of the component elements of the insulating wall according to FIGURE 1.

FIGURE 3 is a cross-sectional view of the element according to FIGURE 2.

FIGURE 4 is a sectional view of a wall, provided with lead-out electrodes, of a nozzle.

FIGURE 5 illustrates a half-section through another type of nozzle comprising metal rings and metal frames.

BRIEF DESCRIPTION OF THE INVENTION

In FIGURE 1, which is a sectional view of an insulating nozzle wall, the reference 1 denotes one of the metal elements in the form of a nail, such as the element illustrated in FIGURE 2. A plurality of metal elements are disposed side by side in regular spaced relationship. They each comprise a central portion 6 and a head 2, the upper face 3 of which bounds a plane face which is in contact with the hot gases which may flow in the direction of the arrow *f* through the duct of the nozzle. These elements are engaged in orifices in a plate 4 which consists either of electrically insulating material as illustrated in the figure or of metal having good thermal conductivity, preferably copper or aluminum, to enable the plate to contribute to the evacuation of the heat, the said plate being covered with an insulating coating so as to prevent any electrical contact between it and the said nails. Packings, such as the packing 7, ensure a fluid-tight seal between the elements 1 and the plate 4. The plate 4 is also formed

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with channels 5 through which there may flow for washing the central part 6 of the elements 1.

At the level of the channels 5, the elements 1 may have an appropriate relief; for example, they may comprise fins for affording a large surface of contact between them and the cooling fluid.

The electrical insulation between two successive metal elements is effected preferably by an inert gas capable of flowing between the elements. For this purpose, clearances 8, opening into the duct of the nozzle and communicating with a space 9, are provided between the elements 1 at the level of the head 3 of the elements.

A plurality of conduits 10, formed in the head 2 of each element 1, extend radially from a central conduit 11, extending along the axis of each metal element 1, as shown in FIGURES 2 and 3. The other ends of the conduits 10 are connected to the space 9. The central conduit 11, which serves as the gas supply, is connected by means of a pipe 12, having a number of branches 14, to a gas source 13, with means (not shown) being provided to ensure that the supply of gas to each central conduit 11 and the pressure losses at the branches are equal.

The supply of gas, which may be nitrogen, air or another preferably inert gas, is distributed over the lateral faces of the metal elements by flowing through: the conduits 10, the space 9, the clearance 8, where it performs its electrical insulating function and then into the duct.

The gas is injected in the conduits under a pressure higher than that existing in the duct, this excess of pressure being so adjusted as to prevent depositing of alkaline compounds in the clearances and conduits.

In FIGURE 4, which is a sectional view of a wall provided with current lead-out electrodes, the reference 15 denotes each metal element and the reference 16 denotes each electrode element. The face 21 of each electrode is in contact with the hot gas flowing through the duct of the nozzle in the direction of the arrow *f*. The metal elements are assembled together by means of elements 17 of insulating material. Each insulating element 17 is formed with a central conduit 18 leading into a space 19 situated between the insulating material 17 and two consecutive metal elements. The space 19 communicates with the duct of the nozzle through a clearance 20 between the metal elements 15 at the duct end thereof.

The conduit 18 is supplied with gas from a source 30, similar to the source 13 of FIGURE 1, with the gas flowing into the space 19 and through the clearance 20, where it performs its electrical insulating function to the nozzle duct.

In a model of the nozzle, where the insulating walls and electrodes were similar to those illustrated in FIGURES 1 and 4, the injection of gas, for example nitrogen, at a pressure of 4 kg./cm.² in the clearances of 25/100 mm., permitted maintaining a voltage on the order of 80 volts between two consecutive metal elements without electrical arcing.

In a variant, the insulating elements are not apertured and the conduits for the admission of gas into the duct of the nozzle extend through each element 15.

FIGURE 5 illustrates a half-section of another type of nozzle formed by a juxtaposition of frames or rings, the metal elements being denoted by the reference 22 and the elements which constitute the electrodes by the reference 23.

The nozzle may be of circular or rectangular cross-section, and the frames or rings may be perpendicular or inclined in relation to the axis of the nozzle duct.

The metal rings or frames 22 are assembled with two

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rings or frames 24 of insulating material so as to leave a space 25 therebetween. The space 25 communicates with the nozzle duct through a clearance 27 situated between two consecutive metal elements. Gas is supplied from a source 33 through a plurality of radial conduits 26 extending through the insulating elements 24 as shown, or, as a modification, through the metal rings or frames 22.

In the course of the operation, the gas flowing through the clearances 27 performs, as before, the insulating function between the consecutive metal elements and between the consecutive electrodes.

The invention is in no way limited to the embodiments described in the foregoing, but relates to any nozzle in which the insulation of the successive electrodes from one another and of the successive metal members from one another is effected by injection of gas.

Likewise, the invention also concerns open-cycle generator nozzles in which the gases employed are combustion gases, as also to closed-cycle generators in which the gases employed may be, for example, argon, neon or helium.

What is claimed is:

1. A nozzle for conversion apparatus of the magnetohydrodynamic type, comprising: a duct through which hot gases flow, formed by a plurality of regularly spaced metal elements each connected together by an electrically insulating element whose side faces are in contact with one portion of the metal elements, means for applying a magnetic field in said duct, a space separating said metal elements at another portion thereof and communicating at one end with said duct and on the other end with a source of insulating gas under pressure, with the flow of the insulating gas passing through said space to thereby insulate the metal elements from one another.

2. A nozzle according to claim 1, wherein the space is bounded by adjacent metal elements and the corresponding insulating elements, and a projection formed on said other portion of each metal element giving said space a clearance of narrowed cross-section which leads into the duct of the nozzle.

3. A nozzle according to claim 2, wherein the metal elements are in the form of nails, each of which has a first conduit, whose one end is substantially level with the space and whose other end is connected to the source of insulating gas under pressure, and a plurality of second conduits, each communicating at one end to said one end of said first conduit and at the other end to said space.

4. A nozzle according to claim 2 wherein electrodes form a part of the metal elements.

5. A nozzle according to claim 4, further including means to pass through the metal element to said space.

6. A nozzle according to claim 4, further including means to pass the gas through the insulating element to the space.

7. A nozzle according to claim 6, wherein said metal elements and said insulating elements are in the form of frames or rings.

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