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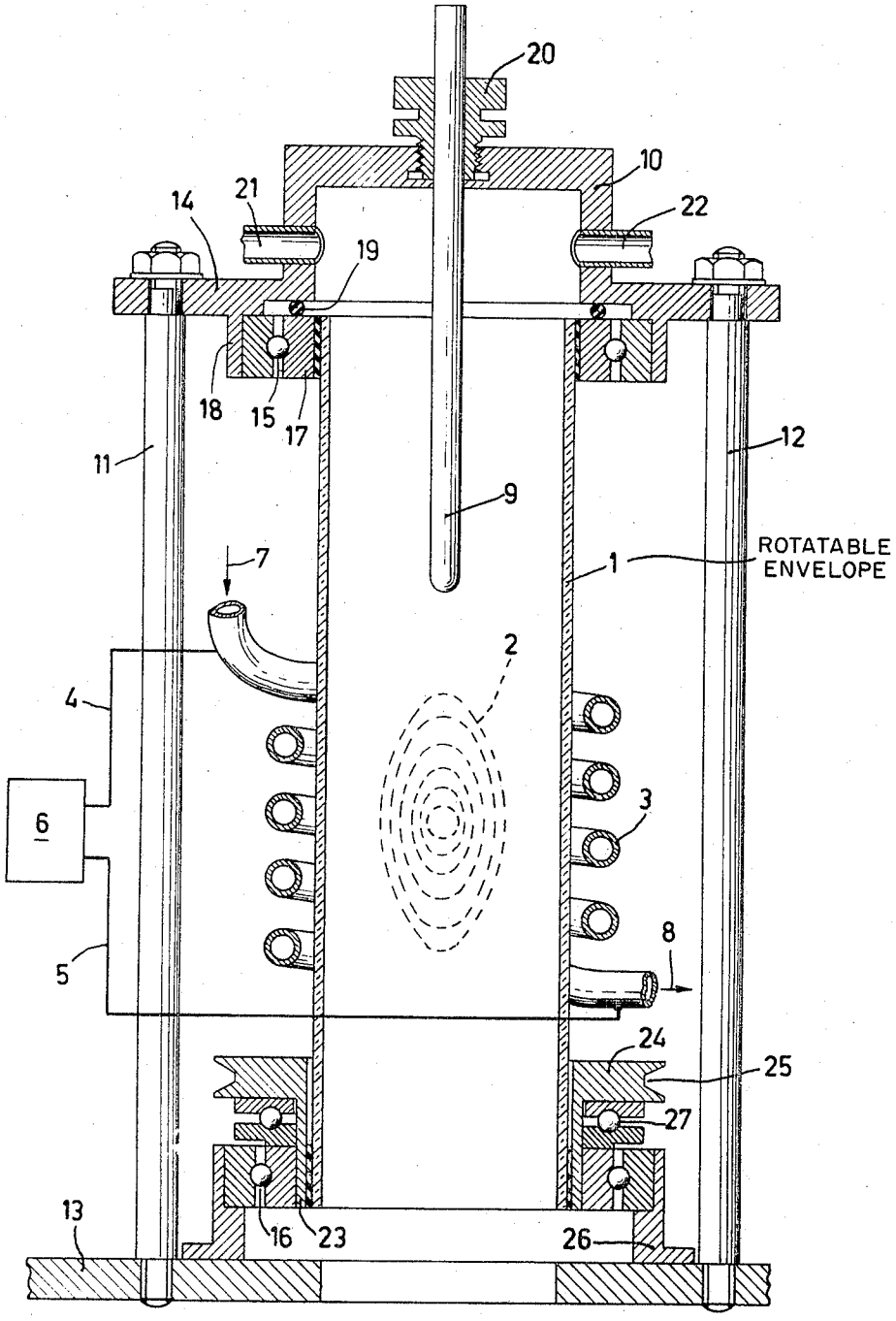

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INDUCTION GAS IONIZER HAVING A ROTATABLE ENVELOPE

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ABSTRACT OF THE DISCLOSURE

An induction gas ionizer for a working flame of high temperature having a rotatable refractory envelope. The rotating envelope has the desirable result of causing a centrifugal action of the rotating envelope on the gas volume thereby increasing the density of the gas along the wall of the envelope and decreasing the density of the gas at the center thereof.

This invention relates to electric gas-discharge burners for obtaining a flame of very high temperature intended for melting, welding, cutting or for performing any other thermal treatment of materials.

Supplying gas to an electric arc-discharge between two electrodes results in a flame of gas particles of high temperature which extends in the direction of movement of the gas and which impinges on the material to be treated. It is known to maintain such a gas discharge by means of a high-frequency induction field in which event no use is made of the conductivity of the gas due to conduct the electric current between two electrodes, but instead the gas is brought into a state of conductivity and strong electric currents are produced in short-circuited guide paths through the induction field.

The working space of such a gas-discharge burner is enclosed by an insulating envelope of refractory material which is surrounded by a plurality of turns of a high-frequency coil. Similarly as is the case with an arc discharge between electrodes, means are used for producing a discharge which may initially be of small volume but which increases afterwards due to the conversion of electric energy into heat.

The size of the flame is regulated by the supply of gas, producing at the same time a heat-insulating layer which protects the wall of the envelope. The flow of the gas through the discharge region imposes the condition that this flow must not be so strong as to give rise to extinction of the discharge which may imply that the gas flow which is limited for this reason provides inadequate protection for the envelope. This disadvantage is mitigated by leading the gas through the envelope in a whirling motion and for this purpose the gas is supplied to the envelope in a tangential direction, resulting in a circulation of gas along the wall having a density which is greater along the wall than at the center. It will be evident that in this case also the extent of the gas supply influences the behaviour of the discharge and the heat-insulating gas layer which keeps the discharge volume separated from the envelope, so that the aforementioned disadvantage remains, although to a lesser extent. In fact, if a smaller amount of gas is admitted in order to increase the specific heat content of the gas-discharge volume, the density of the gas circulating along the wall also decreases whereas the opposite would have to take place in view of the increased temperature in the discharge region.

An object of the invention is to obviate this disadvantage. The electric gas-discharge burner to which the invention relates comprises an envelope of non-conducting

refractory material which is placed in the working aperture of a cylindrical high-frequency coil and which has at least one inlet for the supply of gas into the space enclosed by the envelope which gas is of a kind suitable for producing an electric discharge. According to the invention the envelope is rotatable within the working aperture of the coil about an axis of rotation which coincides with the axis of the cylindrical envelope, the outer wall of the envelope moving relative to the coil. The advantage envisaged by the invention is based on the centrifugal action of the rotating envelope on the gas volume which is kept in motion due to flow, thus increasing the density of the gas along the wall of the envelope independently of the velocity of the gas and decreasing the density at the center. The difference in density may be chosen independently of the rate of flow by control of the rotational speed.

In order that the invention may be readily carried into effect, one embodiment thereof will now be described in detail, by way of example, with reference to the accompanying diagrammatic drawing.

The electric gas-discharge whereby high-frequency energy is converted into heat takes place in a space enclosed by an envelope **1**. The discharge region will be bounded approximately by the broken line **2** and the lines present in this region indicate equal differences in temperature. It has been found that, when using certain gases, the temperature at the center may be 20,000° C. or higher.

The envelope **1** is cylindrical and made of a refractory, electrically non-conducting material, for example, quartz. The envelope is externally surrounded by a plurality of turns of a high-frequency-coil **3** within which the envelope can move freely. Current conductors **4** and **5** connect the ends of the coil **3** to a generator **6** for the supply of high-frequency current which flows through the turns of the coil when the generator **6** is switched in. The turns are manufactured from hollow copper tube. A cooling liquid may be supplied and removed in the directions indicated by arrows **7** and **8**, respectively. If artificial cooling is not required, the coil may be made of solid wire.

The gas-discharge proper may be initiated with the aid of a carbon rod **9** and, for this purpose, the carbon rod extends into the vicinity of the discharge region **2** within the envelope **1**. The tip of the rod **9** is located in the peripheral region of the alternating magnetic field produced upon switching in the high-frequency-generator and is thus heated, resulting in heat being given off to the surrounding gas until the temperature is high enough for an independent discharge to arise under the influence of the alternating field.

On the upper end of the envelope **1** there is arranged a cap **10** which is secured by means of supporting rods **11** and **12** to a base plate **13** through a flat flange **14** which forms part of the cap **10**. The envelope **1** is rotatably arranged between the cap **10** and the base plate **13** by using ball-bearings **15** and **16**. An inner ring **17** of the upper ball-bearing **15** is secured to the wall of the envelope **1**, whereas an outer ring **18** is an upright edge on the flange **14**. A sealing ring **19** is provided between the cap **10** and the ring **17**.

The carbon rod **9** is arranged to be slidable in the cap **10** by means of a clamping screw **20** so that the rod may readily be displaced upwards and moved outside the reach of the gas-discharge.

The gas flow through the envelope is maintained through inlet apertures **21** and **22** provided in the cap **10**. The gas supplied may leave the envelope **1** at its lower end and lead out a gas flame which may be used, for example, for the treatment of materials.

At the lower end of the envelope **1**, an inner ring **23** of the ball-bearing **16**, which forms part of the envelope, is provided with a disc **24** which has a peripheral V-shaped groove **25** to receive a driving belt. The upper surface of

an outer ring **26**, which is supported by the base plate **13**, serves to support balls **27** which constitute a thrust bearing together with the disc **24**.

The result is a reliable gas-discharge burner which can be regulated in temperature and length of flame in a simple manner and which has a high energy output due to the control of the heat-insulating capacity of the wall-protecting layer of gas by variation of the rotational speed independently of the gas supply.

What is claimed is:

1. An electric gas discharge burner comprising a substantially cylindrical envelope constituted of a non-conducting refractory material, an helical high frequency coil located around a portion of said envelope, an inlet for the gas supplied into said envelope, said gas being of the type for producing an electric discharge, and means for rotating said envelope within said coil about a rotational axis which substantially coincides with the axis of said cylindrical envelope, the outer wall of said envelope being movable relative to said coil.

2. An electric gas discharge burner as claimed in claim **1** wherein the rotational speed of said envelope is adjustable.

3. An electric gas discharge burner as claimed in claim **1** further comprising a cap closing one end of said cylindrical envelope, and a base plate adjacent to the other end of said cylindrical envelope, and supporting rods connecting said baseplate and closing cap, the latter being provided with said inlet for the supply of gas into said envelope.

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