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TRANSLATION

AN ION SOURCE FOR PROTON-ACCELERATOR INJECTORS

By

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UNEDITED ROUGH DRAFT TRANSLATION

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AN ION SOURCE FOR PROTON-ACCELERATOR INJECTORS

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This invention deals with an ion source for proton-accelerator injectors.

In the familiar type ion source, two-fold compression of the plasma is attained by means of a heterogeneous magnetic field, created by a magnetic lens made in the form of an axially magnetized annular permanent magnet with pole faces.

The basic disadvantages of such an ion source are the complexity of regulating the magnetic field of the lens, and significant losses of the useful magnetic flux in the cooling system, in the air gap (which maintains a potential difference of the order of 10^2 v between the pole faces) and also in the air gap between the pole faces and the annular magnet, which prevents the magnet from heating to a temperature exceeding the Curie point.

The presence of these air gaps, which weakens the general flux and which correspond, in order of magnitude, to the air gap of the lens, makes doubtful the possibility of creating optimum conditions for propagation of the heterogeneous magnetic field of the lens.

Thus, the defects of the familiar ion source do not make it possible to effectively utilize the magnetic field strength of the lens. As a result, the two-fold compression of the plasma is insufficient and the necessary electron beam intensity is not reached.

The purpose of this invention is the elimination of these deficiencies by using a radially magnetized permanent magnet, with a single air gap having magnetic shunts to regulate the magnetic field of the lens; this increases the operational reliability and facilitates regulation of the source.

Figure 1 shows the proposed source; Figure 2 shows a cross section along line A-B.

Number 1 is the radially magnetized annular magnet made of maniperm. Ring 2 is introduced into the magnet; by means of this, water cooling of the magnet is accomplished. Pole face 3 borders upon this ring.

The second pole face 4, together with pole face 3, forms the lens, and is connected, by the magnetic circuit which is devoid of air gaps to the outer pole of the permanent magnet. The necessary electrical insulation between pole faces 3 and 4, which are at various electrical potentials, is attained by using the permanent magnet itself, the electrical resistivity of which is 10^8 ohm/cm. This electrical shunt, in conjunction with the working resistance of the space between the pole faces, has practically no influence on the operation of the source.

Auxiliary magnetic shunts (5) (or also principal shunts), accessible from without, are located inside the vacuum section of the ion source and are directed in sequence toward the main flux. These shunts are arranged such that the heterogeneous magnetic field formed by the lens has optimum magnitude and the discharge mechanism does

not adversely effect the bubble.

In order to maintain the available potential difference between pole faces 3 and 4 we can, by using an insufficiently insulating material to make the magnet, provide in magnetic shunt 5 an air gap many times smaller than that used in familiar designs.

The proposed design provides us with an annular magnet of maniperm which is flatter, and which guarantees such an emission density which up to now had been achieved only by an electromagnet.

Object of the Invention

The ion source for proton-accelerator injector with controllable compression of the plasma, equipped with a lens in the form of a permanent magnet, has the distinguishing characteristic that a radially magnetized permanent magnet with a single air gap equipped with magnetic shunts which regulate the magnetic field of the lens has been used to increase both the reliability of source operation and the facility of regulation.

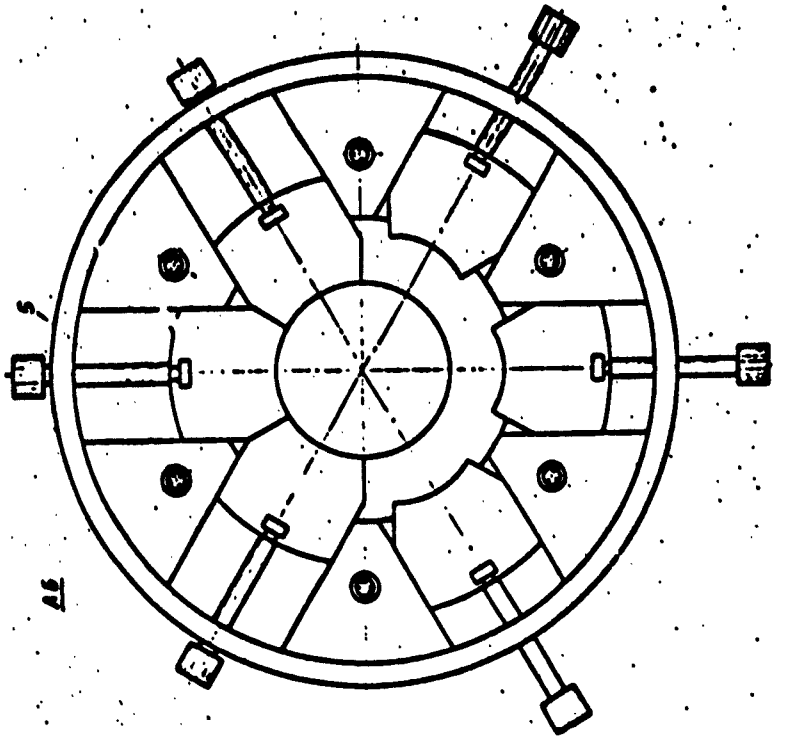

Fig. 2

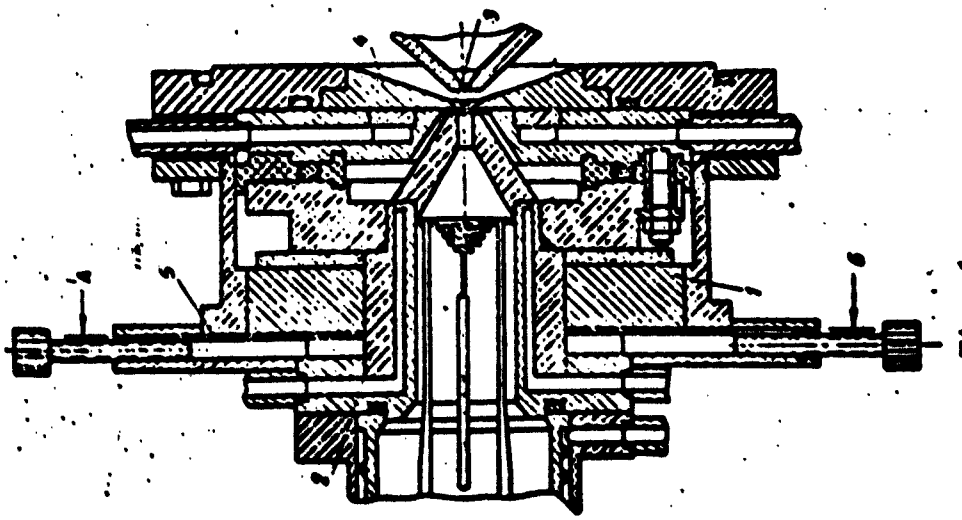

Fig. 1

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