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Kervizic et al.

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[54] **TURRET DEVICE FOR POSITIONING CRUCIBLES IN ION SOURCES**

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[73] Assignee: **Thomson-CSF,** Paris, France

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[52] **U.S. Cl.** ..... **13/31,** 250/41.9 S

[51] **Int. Cl.** **H01j 39/26**

[58] **Field of Search** ..... 13/31; 250/41.9 R, 250/41.9 SE, 41.9 SB, 41.9 S

[56] **References Cited**

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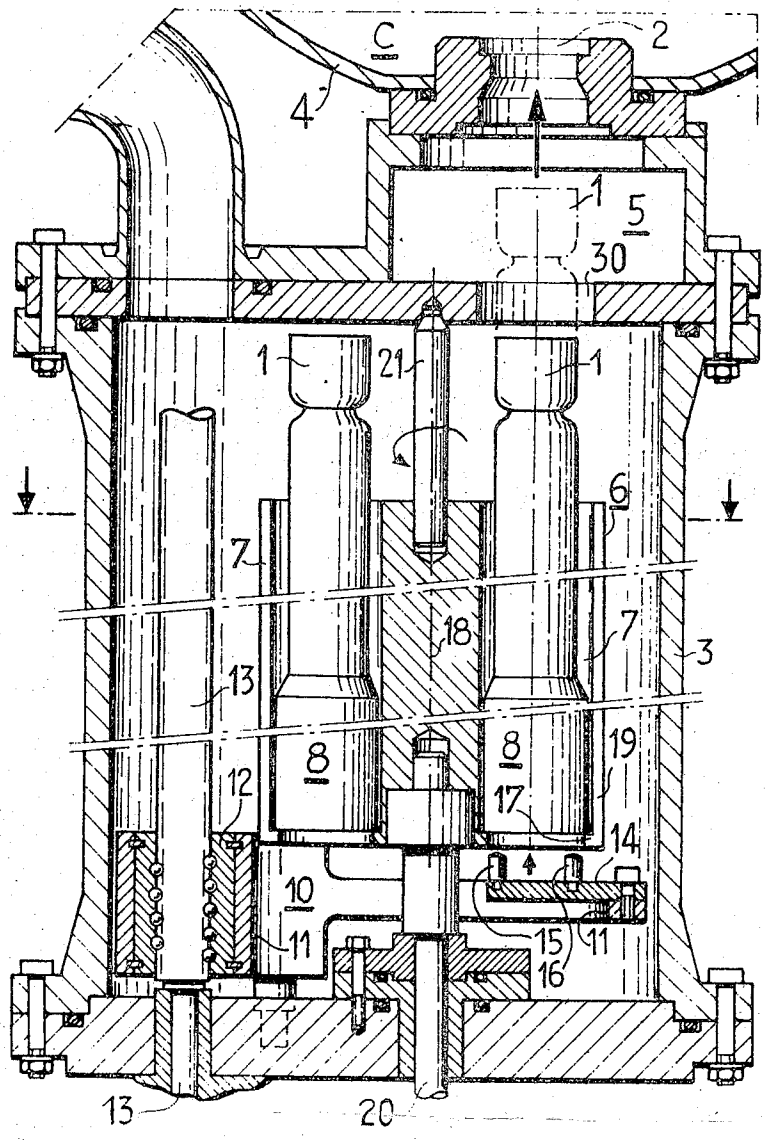
[57] **ABSTRACT**

Turret device making it possible to successively introduce, in the ionization chamber of an ion source, crucibles containing different kinds of elements, without any need to interrupt the operation of the source. This device comprises a detachable rotatable barrel associated with cylindrical support-members 8 carrying the crucibles 1, means being provided for rotating the barrel and for translating any one of the crucibles toward the ionization chamber C. This turret device is suitable for an ion source successively producion ions of arsenic, phosphorus, aluminium, silicium, for example.

7 Claims, 3 Drawing Figures



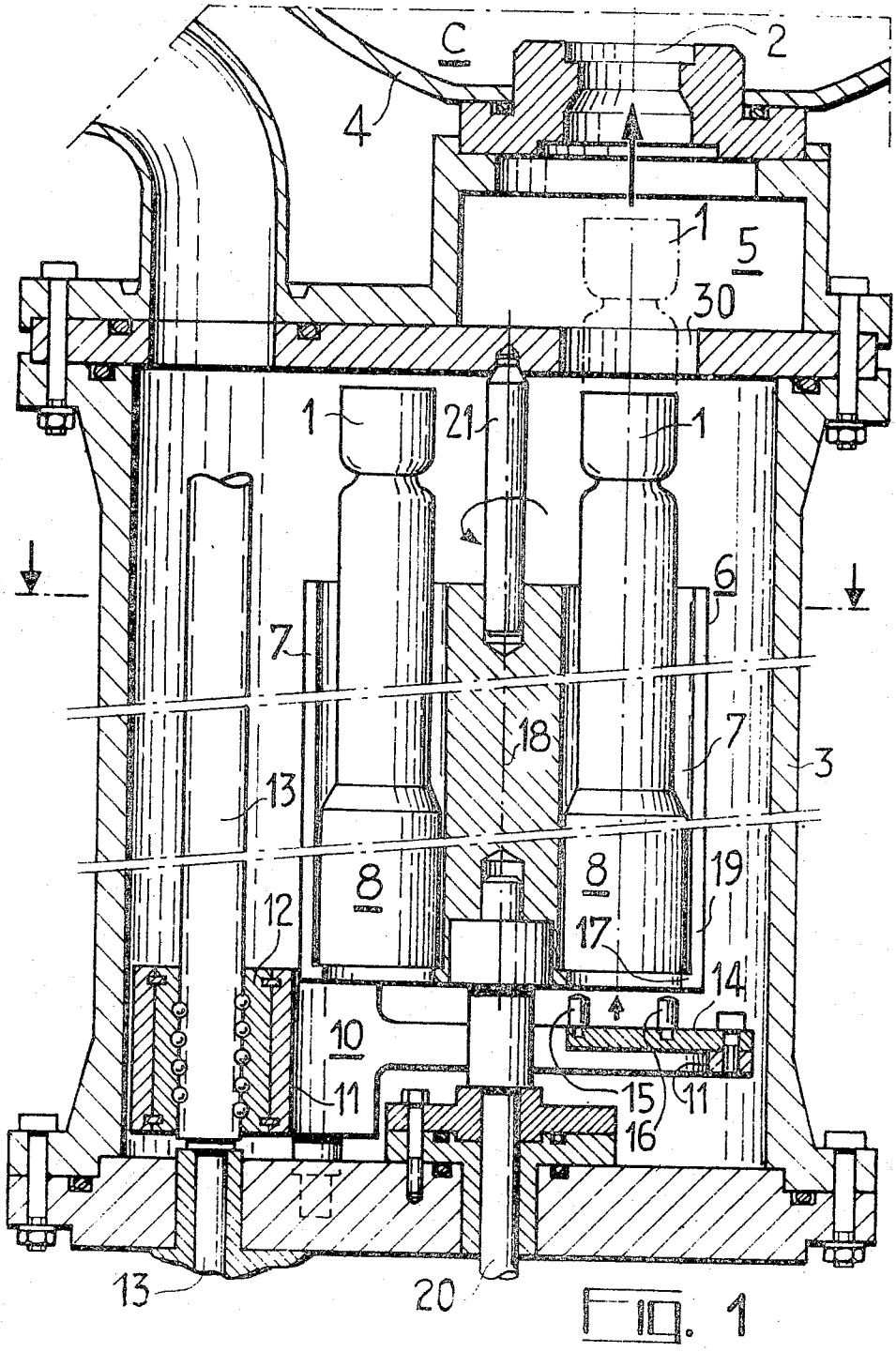


FIG. 1

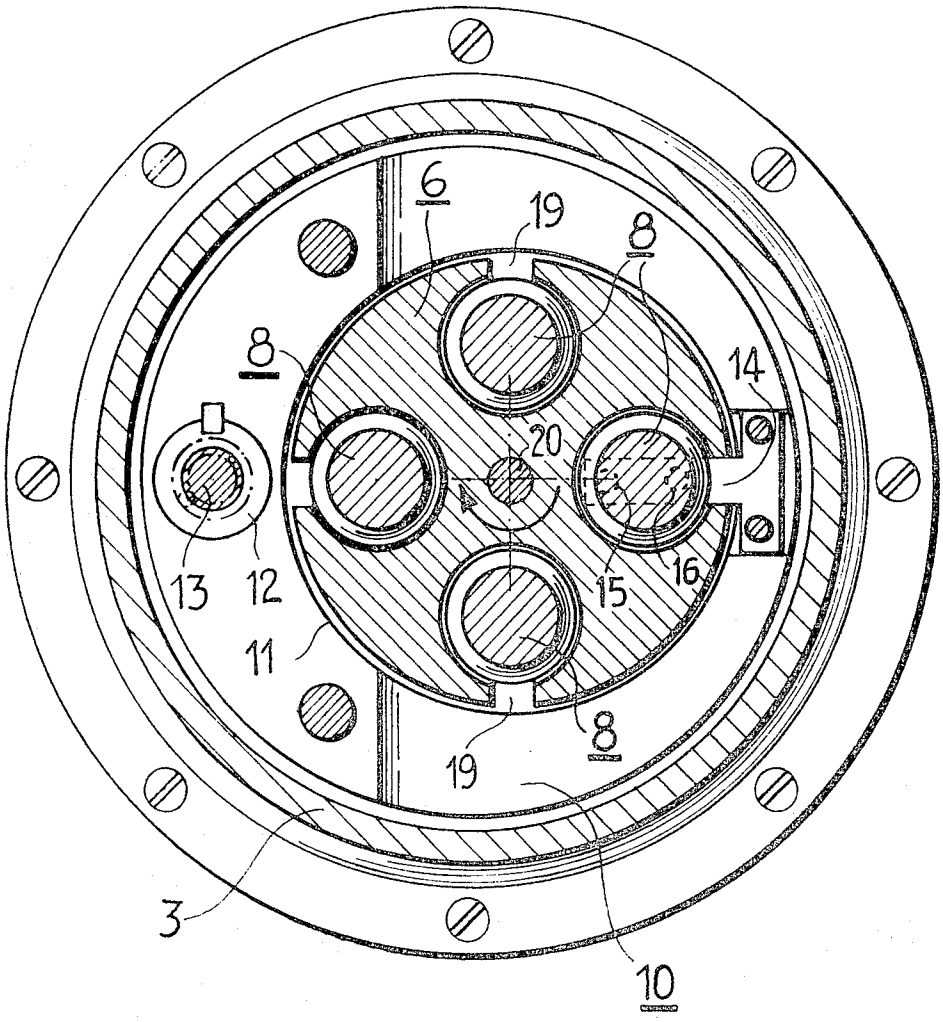


FIG. 2

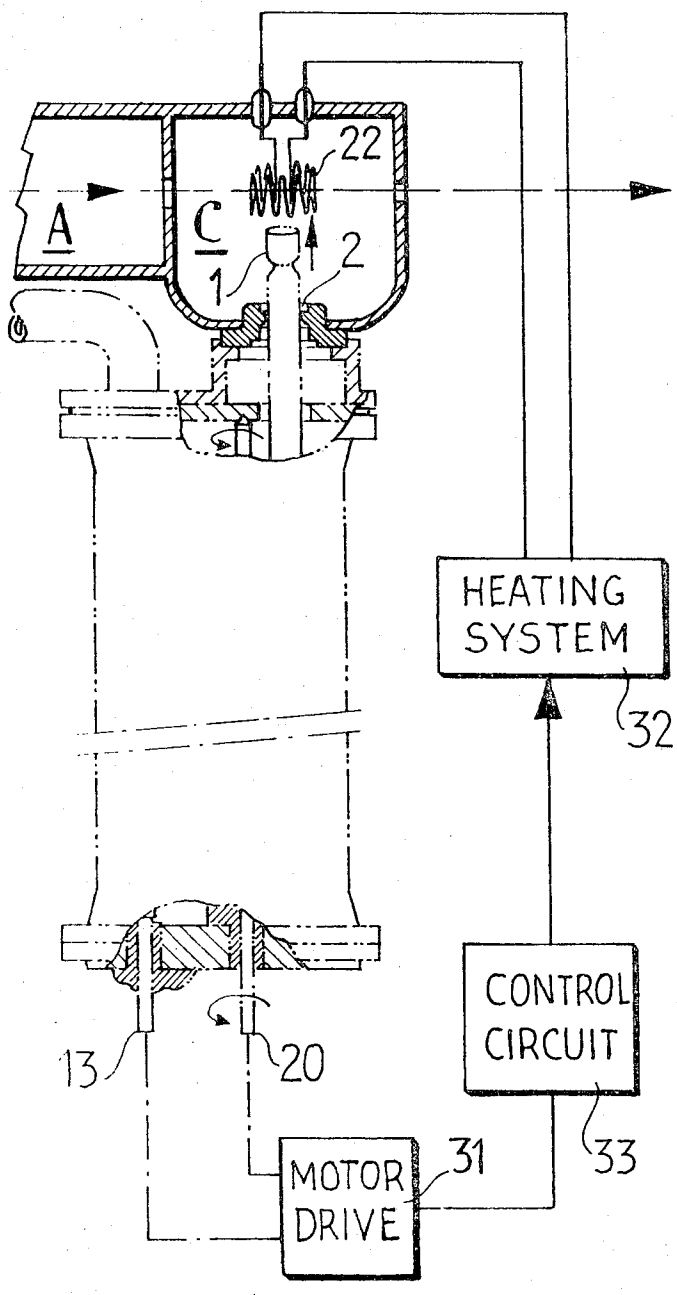

22
A
C
1
2
HEATING SYSTEM
32
CONTROL CIRCUIT
33
13
20
MOTOR DRIVE
31

FIG. 3

TURRET DEVICE FOR POSITIONING CRUCIBLES IN ION SOURCES

The invention relates to ion sources being able to produce beams of ions of different kinds (phosphorus, arsenic, boron) without having to interrupt the opertion of the source and more particularly to a turret device for positioning crucibles in these ion sources.

The ion sources used hitherto require, for producing ion beams of different kinds halting of operation of these sources as well as a lengthy period of manipulation to change the type of ions (introduction of air, extraction of the crucible, replacement with another crucible containing the new element to be vaporised, pumping the sealed envelope of the ion source).

The object of the present invention is a turret device for successively positioning crucibles on the path of an ion beam crossing an ionization chamber of an ion source, said turret device comprising: a vacuum tight enclosure coupled to said ionization chamber, a rotatable barrel located within said vacuum tight enclosure and having a plurality of compartments for respectively received support-members, said support-members supporting said crucibles and being located at a constant distance of the rotation axis of said rotatable barrel, said support members being slidably mounted within said compartments; means being provided for translating anyone of said support-members along a direction parallel to said rotation axis; means being provided for bringing anyone of said support-members in register with an aperture of said ionization chamber; means being provided for heating one of said crucibles upon introduction thereof within said ionization chamber.

For a better understanding of the invention and to show how the same may be carried into effect, reference will be made to the drawings given solely by way of example, which accompany the following description.

In the drawings:

FIG. 1 illustrates, in longitudinal section, the turret device in accordance with the invention;

FIG. 2 illustrates, in transverse section, the turret device in accordance with the invention;

FIG. 3 shows an arrangement for heating the crucibles.

The turret device in accordance with the invention, shown in longitudinal section in FIG. 1, makes it possible to rapidly introduce, through an aperture 2, one of the crucibles 1 containing the selected element, into the second ionization chamber C of a source having two ionization chambers. The turret device comprises a vacuum tight enclosure 3 fixed to the wall 4 of the ionization chamber C through a sliding valve 5 having two apertures 2 and 30 facing one another. The vacuum tight enclosure 3 contains a barrel 6, for example of stainless steel, provided with four compartments 7 (only two of which are visible in the figure), arranged at 90° intervals from one another. In the compartments 7, there are arranged four support-members 8, respectively supporting crucibles 1. These supports 8, cylindrical in form, are made of tantalum in the example chosen here; they can slide, without any backlash, along the wall of the cylindrical compartment 7 in which they are respectively located.

Below the barrel 6, a translating element is arranged which is constituted, as the transverse section of FIG. 2 shows, by a circular plate 10 provided internally with an eccentric circular opening 11, in which the barrel 6 locates. This plate 10 is fixed to a ball nut 12 displacing along a threaded shaft 13, and comprises an arm 14 disposed diametrally opposite the nut 12, this arm 14 having two pins 15 and 16, which come into contact with the base 17 of the support-member 8 upon which the selected crucible 1 is fixed, as shown in FIG. 1. The arm 14 translates the crucible 1 parallel to the axis 18 of the turret device, this axis 18 corresponding to the axis of the shafts 20 and 21, a slot 19, formed in each of the cylindrical compartments 7, enabling said arm 14 (FIG. 1) to freely pass.

The rotation of the barrel 6, makes it possible to bring the selected crucible 1 in register with the apertures 30 and 2 of the sliding valve 5, and the rotation of the threaded rod 13 allows to translate the crucible 1 toward the second ionization chamber C adjacent a first ionization chamber A of the ion source.

These movements are produced by a motor drive 31, as sketched in FIG. 3.

Vacuum tight joints are used to seal off the control shafts 13 and 20 of the device.

When the selected crucible 1 has been introduced into the ionization chamber C, it is raised to the suitable temperature by means of a furnace constituted for example by the heating resistor 22.

A heating system 32 is coupled to this heating resistor 22 and is controlled by a control circuit 33 for regulating and controlling the temperature of this selected crucible 1. These parts are associated with the motor drive 31, for enabling the selected crucible 1 to be raised to the temperature corresponding to its content. Thus, the element contained in the crucible 1 and introduced into the second ionization chamber C, is automatically raised to its vaporization temperature.

The vacuum tight enclosure 3 can be detached from the ionization chamber C for allowing the loading of elements in the crucibles 1. A pumping system 34 is coupled to this vacuum tight enclosure 3 to permit a rapid restarting of the ion source, the ionization chamber C being isolated from the vacuum tight enclosure 3 by means of the sliding valve 5 during this loading operation.

This system considerably reduces the regulation time, so that the proper operation of the ion source is ensured. A device of this kind has been used for successively producing oxygen, phosphorus, aluminum, silicium gold or arsenic ions (this by no means being a limitative list), under highly satisfactory conditions.

What we claim is:

1. A turret device for successively positioning crucibles on the path of an ion beam crossing an ionization chamber of an ion source, said turret device comprising a vacuum tight enclosure coupled to said ionization chamber, a rotatable barrel located within said vacuum tight enclosure and having a plurality of compartments for respectively received support-members, said support-members supporting said crucibles and being located at a constant distance of the rotation axis of said rotatable barrel, said support-members being slidably mounted, within said compartments; means being provided for translating anyone of said support-members along a direction parallel to said rotation axis; means being provided for bringing anyone of said support-members in register with an aperture of said ionization chamber; means being provided for heating one of said

crucibles upon introduction thereof within said ionization chamber.

2. A turret device as claimed in claim 1, further comprising a sliding valve located between said ionization chamber and said vacuum tight enclosure for isolating said enclosure from said ionization chamber, thereby allowing the opening of said enclosure.

3. A turret device as claimed in claim 1, wherein said means for heating comprise: an electric furnace located within said ionization chamber and electrically coupled to a heating system including a voltage supply; said heating system being associated to a control circuit for regulating and controlling the temperature of said selected crucible.

4. A turret device as claimed in claim 3, wherein means for rotating and translating said support-members comprise a motor drive associated to said control circuit, for obtaining the suitable temperature of said selected crucible, this temperature depending from the element contained within said selected crucible.

5. A turret device as claimed in claim 1, wherein said translating means comprise a circular plate provided internally with an eccentric circular opening having its inner edge surrounding said barrel, said plate being fixed to a ball nut movable along a screwed rod disposed parallel to the rotating axis of said barrel, said plate being equipped with an arm carrying pins for driving said support-members toward said ionization chamber.

6. A turret device as claimed in claim 1, wherein said means for rotating and translating said support-members within said vacuum tight enclosure include control shafts equipped with vacuum tight joints.

7. A turret device as claimed in claim 1, wherein means for rotating and translating said support-members comprise a motor drive associated to said control circuit, for obtaining the suitable temperature of said selected crucible, this temperature depending from the element contained within said selected crucible.

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