May 3, 1960 B. A. PETERS 2,935,633

RADIATION EMITTING TARGET COOLER

Filed Sept. 25, 1957

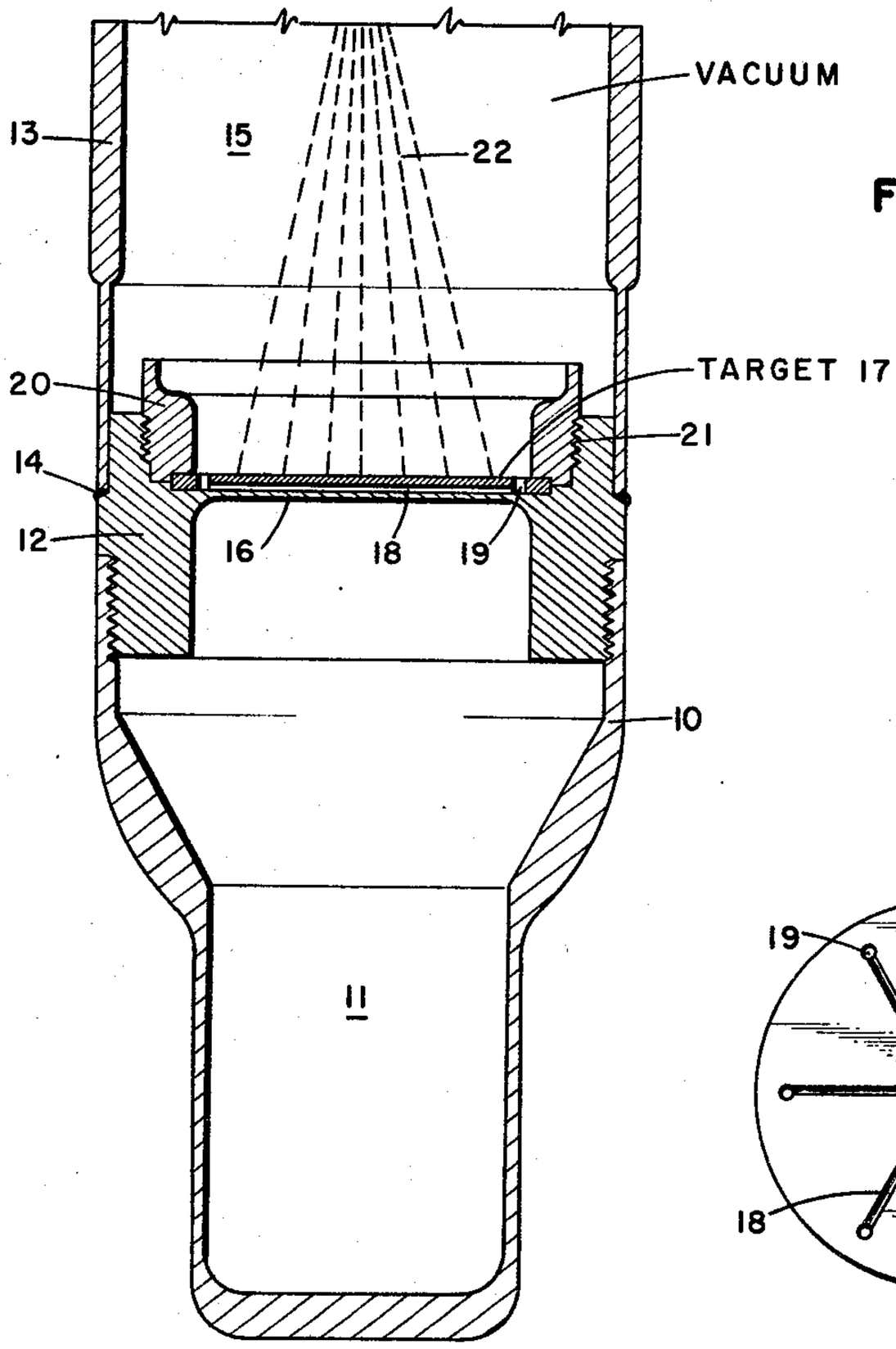

FIG. 1.

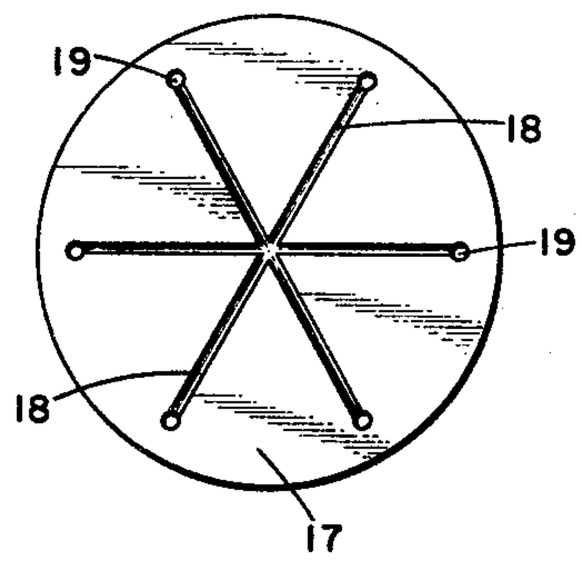

FIG. 2.

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RADIATION EMITTING TARGET COOLER

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1 Claim. (Cl. 313—32)

This invention concerns apparatus for cooling a radiation emitting target and, in particular, a neutron emitting target.

As is known, particle accelerators have been used to produce neutrons and other radiation. In one method for producing neutrons, a tritium target is bombarded with deuterium ions. The ion bombardment generates considerable heat at the target, which heat, if not dissipated, destroys the target material. Various cooling means such as circulating water or air have been used in laboratory or other conventional installation to remove the heat generated by the bombarding ions. However, these conventional cooling systems are not available in locations which are not readily accessible or where space requirements are a major consideration such as in well boreholes. Therefore, logging tools used to make spectral analysis of subsurface formations surrounding a well bore cannot employ conventional cooling systems.

In logging tools of this type the target is contained in a housing and the housing is contained in a logging tool case. Since, when the tool is operating, the target has a potential of 100,000 volts on it and the tool case is maintained at ground, heat conduction through metal supports is not possible. Further, the housing must be supported in the tool case by high dielectric materials, which materials are poor heat conductors. Additionally, for proper operation, the pressure adjacent the target must be below atmospheric pressure; heat transfers poorly in gases at these pressures.

Briefly, the invention comprises particle accelerator apparatus including a housing, a thin metallic base member arranged in said housing separating said housing into two chambers and a tritium coated platinum target mounted on the base in contact therewith. The base is formed sufficiently thin so that when a pressure differential exists across the base, metal to metal contact between the target and the base is assured. The target is provided with at least one groove on the surface thereof facing the base and at least one opening therethrough in fluid communication with the groove.

An object of this invention, therefore, is to provide improved apparatus for cooling the tritium target of a neutron source. Another object of the invention is to provide improved apparatus for cooling the tritium target of a neutron source employed in a particle accelerator, which accelerator is adapted for use in making spectral analyses of subsurface formations surrounding a well bore. These and other objects of this invention will be apparent from the following description of the invention taken in conjunction with the drawing wherein:

Fig. 1 is a vertical view, partly in section, of the invention; and

Fig. 2 is a plan view of the target element.

In Fig. 1 is shown a housing 10 enclosing a chamber 11, a base member 12 screw threadedly connected to housing 10 and an upper housing 13 hermetically sealed to base 12 as at 14 and enclosing a chamber 15. Base 12 is configured so as to provide a very thin center portion 16. A target 17 is arranged on top of the center portion 16 of base member 12 and in metal to metal contact therewith. The surface of target 17 facing the center portion 16 of base member 12 is formed to provide a plurality of grooves 18 extending radially thereacross as seen more clearly in Fig. 2. Target 17 is also provided with a plurality of openings 19 which openings fluidly communicate with the ends of the grooves. A clamp ring 20 is screw threadedly connected to the upper portion of base member 12 as at 21 and engages target 17 to maintain target 17 in position on base member 12. Deuterium ions are indicated by dotted lines 22. These ions emanate from a source not shown.

In a neutron source of the deuterium-tritium type, the target is enclosed in a hermetically sealed enclosure, as shown. The pressure in chamber 11 may range from atmospheric pressure up to 80 pounds per square inch. However, the pressure in chamber 15 is below atmospheric pressure.

When ion beam 22 strikes the tritium coated target 17, neutrons are emitted and heat is generated. The center portion 16 of base member 12 is made sufficiently thin so that the lower pressure in chamber 15 and the higher pressure in chamber 11 cause the center portion 16 to deflect upwardly until metal to metal contact is made over the entire target base surface. The grooves 18 and openings 19 in target 17 provide fluid communication between chamber 15 and the lower surface of target 17. The metal to metal contact provides good heat conduction from target 17 to the medium surrounding the target housing. Convection currents then provide sufficient heat transfer to maintain target 17 at safe operating temperatures.

Having fully described the nature, objects, elements and operation of my invention, I claim:

Particle accelerator apparatus comprising a housing, a thin metallic base member arranged in said housing separating said housing into first and second chambers, said first chamber being hermetically sealed and under a vacuum, said second chamber being at least at atmospheric pressure and a tritium coated platinum target mounted on said base member, said target being provided with at least one groove on the surface thereof facing said base member and at least an opening therethrough in fluid communication with said groove, said base member being formed sufficiently thin such that when a pressure differential exists across said base member metal to metal contact between said target and said base member is assured.

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