Jan. 17, 1956 R. E. MANFREDI 2,731,244

FLUID COOLED ANODE

Filed March 8, 1952

Fig. 1.

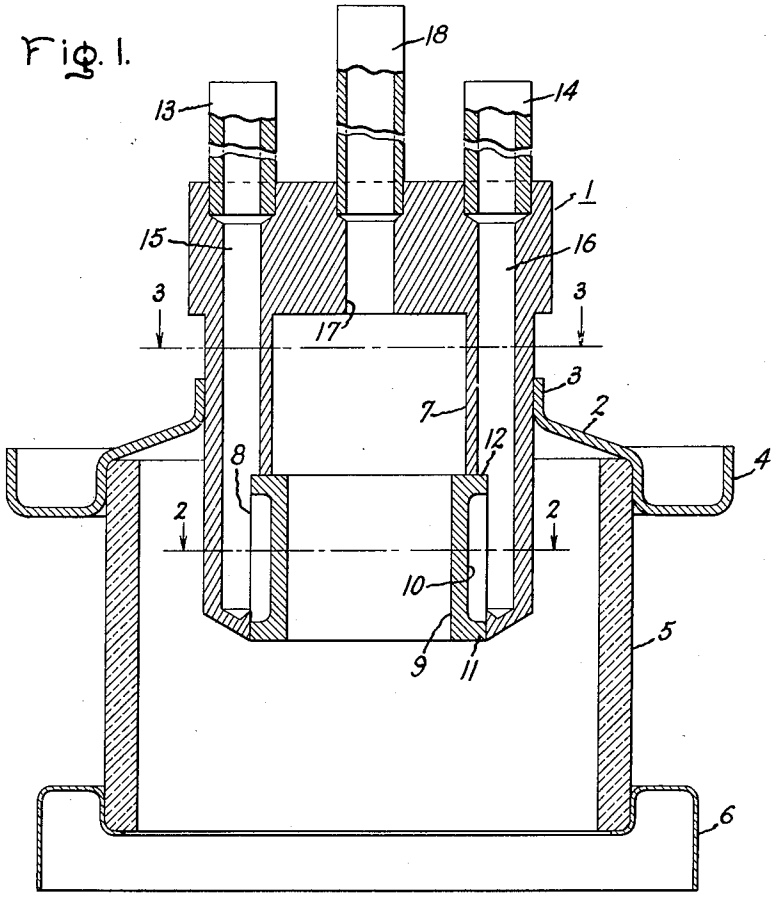


Fig. 2.

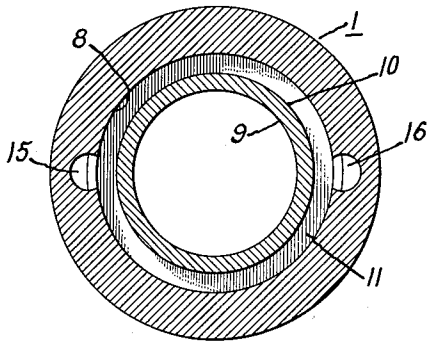
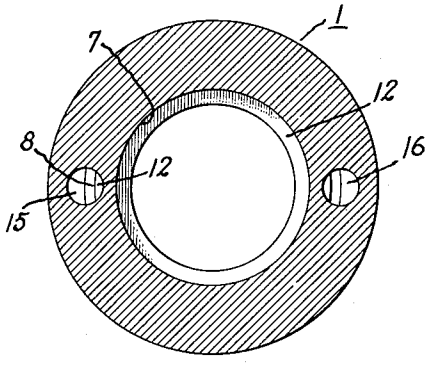


Fig. 3.



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2,731,244

FLUID COOLED ANODE

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Application March 8, 1952, Serial No. 275,523

2 Claims. (Cl. 257—250)

My invention relates to an improved fluid cooled anode, particularly suited for high frequency high power electric discharge devices. In my application Serial No. 275,522 filed concurrently herewith and assigned to the assignee of the present invention, is described and claimed an improved high frequency electric discharge device including the fluid anode structure forming the subject matter of this application.

The design requirements of high frequency, high power electric discharge devices are difficult to meet since high frequency considerations tend to require small compact structures and high power considerations tend to require large structures both from the standpoint of adequate emission and heat dissipating capacity.

The present invention has for important objects the provision of a compact, fluid cooled anode which is readily produced by production methods. Further objects and advantages of the present invention will become apparent as the following description proceeds, reference being had to the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing, Fig. 1 is an elevational view in section of an anode assembly embodying my invention. Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1. Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1.

Referring now to Fig. 1 of the drawing, there is shown my invention embodied in an anode assembly including an anode body 1 or outer anode member of generally cylindrical shape and of a material having good heat transfer properties such as copper, for example. The anode body is adapted to be mounted by means of an anode terminal member 2 in the form of an annular washer having a flange 3 bonded to the external surface of the anode at about its mid-point in an axial direction. The terminal 2 is provided at its outer end with a longitudinally extending flange 4 which provides the terminal area proper. The terminal ring is bonded to the upper end of a cylindrical ceramic insulator 5 having its lower end bonded to an annular terminal 6 which, as described in my copending application, may form a part of the screen grid terminal assembly.

The anode body is provided with an axially extending bore 7 opening on the lower face of the anode body 1 and extending upwardly for a major portion of the axial length thereof and terminating short of the opposite end. The dimension of the bore 7 is such as to provide the anode body 1 with substantially thick side walls. A counter-bore 8 opening on the inner face of the anode body and terminating short of the bottom of the bore 7 is also provided. In the particular embodiment illustrated this extends upwardly about half of the axial length of the bore 7.

The counter-bore 8 is for the purpose of receiving an inner anode or discharge receiving member 9 which is annular in shape and provided on its outer surface with an annular recess 10. The circumferential recess 10 is

defined by the flange portions 11 and 12 of the member 9 and these flanges just fit the counter-bore 8, so that the mating surfaces of the member 9 and the counter-bore 8 define the annular cooling passage. This passage is connected to inlet and outlet conduits 13 and 14 at the upper end of the anode body by means of longitudinally extending passages 15 and 16 which are drilled or bored into the anode body from the outer end and terminate short of the inner end. The passages 15 and 16 overlap or intersect the junction between the anode body and the annular member 9. The anode is also provided with exhaust passage 17 formed on the axis of the body communicating with the bore 7 at one end and with exhaust tubulation 18 at the other end.

The bond between the terminal members 4 and 6 and the ceramic cylinder 5 may be made in accordance with any of the known processes. It has been found particularly advantageous to metallize the cylinder on the areas to be bonded with a molybdenum-manganese powder mixture which is applied as a thin coating and heated at an elevated temperature in a hydrogen atmosphere, as described in detail and claimed in copending Nolte application Serial No. 238,871, filed July 27, 1951, and assigned to the assignee of this invention. After the cylinder 5 is metallized, it is possible to braze it to the terminal members 4 and 6 in an ordinary hydrogen furnace in brazing operation. This permits the entire assembly, as shown in Fig. 1, to be brazed together as a single operation.

As will be well understood by those skilled in the art, all of the parts shown in Fig. 1 may be assembled in an upright position or shown and supported to the extent necessary from a suitable fixture which retains the parts in centered relationship, it being undersood that many of the parts are self-supporting with respect to the other parts. It will also be understood that the brazing material or solder is suitably located adjacent each joint to be made so that during the brazing operation the solder flows over the area to be bonded.

It will be apparent from the foregoing description that my invention provides an anode structure which is very easily assembled, which may be made of compact size to provide for adequate fluid cooling, and in this way meets the requirements of an anode structure for high frequency, high power discharge devices.

While I have described and claimed a particular embodiment of my invention, it will be apparent to those skilled in the art that changes and modifications may be made without departing from my invention in its broader aspects, and I aim, therefore, in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A fluid cooled anode structure comprising a generally cylindrical solid body of conductive material, said body having a bore extending thereinto from one end and terminating short of the opposite end and a counterbore extending thereinto from said one end and terminating short of the bottom of said bore, said body having substantially thick side walls, an annular member having an inner diameter less than said bore and a circumferential recess in the outer surface thereof, said member being bonded to said body in said counterbore to provide an annular fluid passage between said member and said body, and a pair of spaced longitudinal passages extending into said side walls of said body through said opposite end and terminating short of said one end, said longitudinal passages communicating with said annular passage.

2. A fluid cooled anode structure comprising a generally cylindrical solid metallic outer anode member, said outer anode member having a bore extending thereinto

from one end and bottoming short of the opposite end and a counterbore extending thereinto from said one end and bottoming short of the bottom of said bore, said outer anode member having substantially thick side walls, an inner anode member positioned in said counterbore and thereby spaced from said bottom of said bore, said inner anode member having an inner diameter less than said bore and defining an active anode surface inwardly displaced from the sides and bottom of said bore, said inner anode member having a circumferential recess in the outer surface thereof and being bonded to said anode in said counterbore to provide an annular fluid passage between said inner and outer members, and fluid inlet and outlet passages comprising spaced longitudinal bores extending into said side walls of said outer anode member through said opposite end and terminating short of said one end thereof, said spaced longitudinal bores intersecting said counterbore and communicating with said annular fluid passage.

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