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[54] ELECTRICAL CONTACT FOR MOVING FILAMENTS
1 Claim, 2 Drawing Figs.

[52]	U.S. Cl.	219/155, 118/49.5, 118/620, 339/9
[51]	Int. Cl.	C21d 9/62
[50]	Field of Search	118/48- — 49.5, 620; 219/155; 339/9, 9 A, 9 E, 9 R, 241

[56] **References Cited**
UNITED STATES PATENTS

3,203,831	8/1965	Jeannin	118/620 X
3,393,290	7/1968	Hough	118/620 X

ABSTRACT: An electrical contact member is disclosed which comprises a horizontally disposed electrically conductive tube, a pair of apertures in the upper and lower portions of the side in registry with each other, and a pair of cylindrical rodlike electrically conductive members freely supported in said tube in contact with each other and both extending across the lower aperture. In operation, a pair of such members are supported in vertically spaced relationship and electrically isolated from each other, the apertures of each in substantial registry with the other. An electrically conductive filament is threaded through the apertures of each tube and between the rodlike bodies of each member and electric power is applied to each member to resistively heat the filament between the contact members.

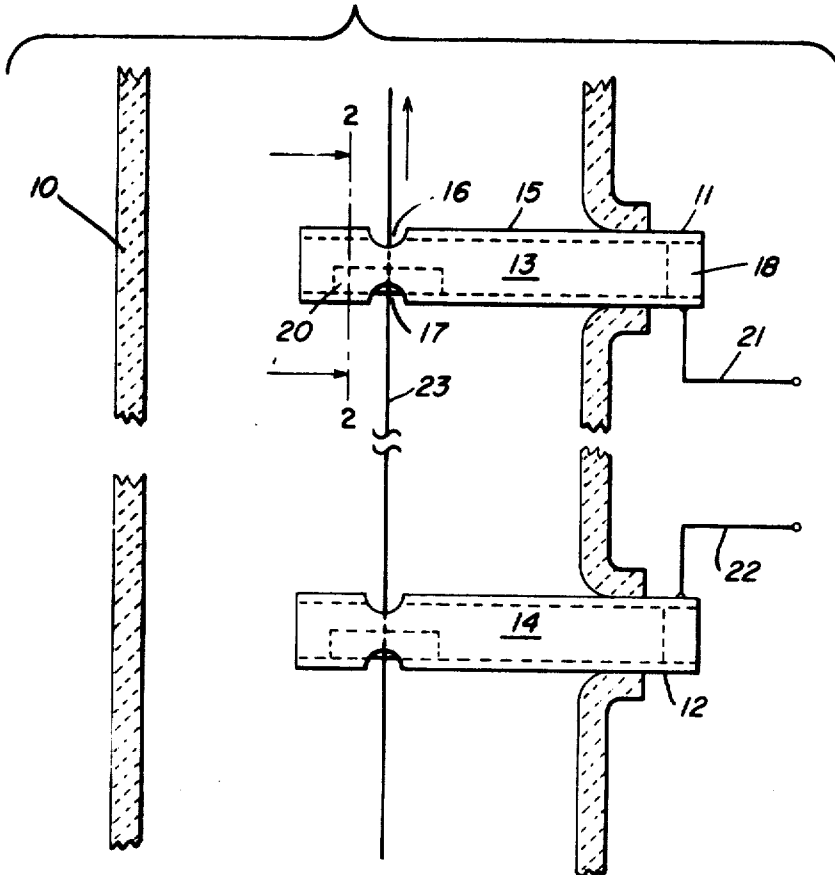


FIG. 1

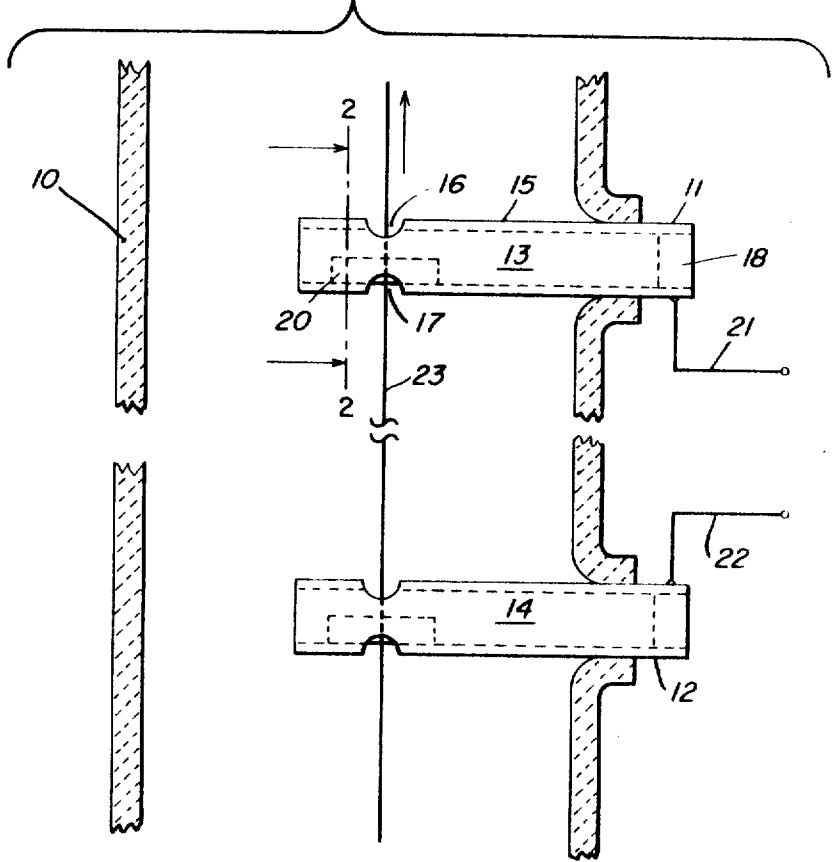
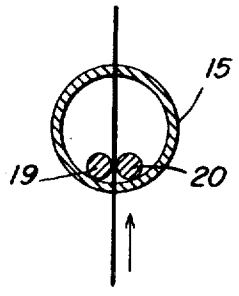


FIG. 2



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ELECTRICAL CONTACT FOR MOVING FILAMENTS

CROSS-REFERENCE

Cross-reference is hereby made to the copending application of the present inventor, Ser. No. 586,809, filed Oct. 14, 1966, now issued as U.S. Pat. No. 3,479,205, patented Nov. 18, 1969, assigned to the assignee of the present invention and entitled "Process for Producing Boron Filament," the disclosure of which is incorporated by reference herein.

BACKGROUND OF THE INVENTION

As described in greater detail in the previously referenced disclosure, continuous filaments having superior mechanical, electrical and/or chemical properties have been manufactured by pyrolytically depositing a material such as boron or graphite on the surface of such a filament which is electrically conductive and hence capable of being resistively heated. In general, this is done by passing the conductive filament through a reaction chamber containing a thermally decomposable gas, such as, for example, diborane or boron trichloride where a boron coating is to be produced, or acetylene where a graphite coating is desired, and resistively heating the filament within the chamber by passing an electric current through the filament. The filament is passed into the chamber through a capillary opening provided with a mercury pool seal and out of the chamber through another capillary and mercury pool seal. The mercury pools serve a second function, namely as the contact electrodes for resistively heating the filament as it passes between them. The temperatures necessary to thermally decompose the reaction gas are quite high, for example, in the deposition of elemental boron from a mixture of boron trichloride and hydrogen, the surface of the filament must be between about 1,000° C. to 1,200° C. Since the heating of the filament starts at the inlet while the filament is passing through the inlet mercury pool and the glowing, heated filament is quenched in the outlet mercury pool, the temperatures of both pools are raised, particularly in the zones immediately adjacent or in contact with the filament. Substantial amounts of mercury vapor are evolved resulting in contamination of the reaction chamber and related system as well as presenting a health hazard problem. Yet further, mercury contamination of the deposited layer has been found under certain conditions of operation. Also, undesirable reactions between the reactant gas and the heated mercury surface exposed to the interior of the reaction chamber whereby a scum may be produced on the surface which may be transferred to the filament surface to the detriment of the resulting coated filament. Furthermore, if a multiple-stage reactor is desired to deposit successive coatings on the filament, the quenching function by each intermediate mercury pool removes heat from the filament which must be replaced for the next deposition stage and hence is undesirable from an efficiency standpoint. Many kinds of sliding or rolling contacts have been tried in order to avoid these difficulties which are inherent with the use of mercury, but all such previous mechanical contacts have not been capable of maintaining a continuous good electrical contact with the filament. If a good electrical contact is not maintained, an arc is generated which causes the filament to burn through.

It is therefore a principal object of this invention to provide an improved electrical contact for use in such reaction chambers which maintains good, constant, electrical contact with a moving electrically conductive filament without the use of mercury. Other and specifically different objects of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing in which

FIG. 1 is a fragmentary elevational view of a pair of the contact members of the invention installed in a reaction chamber, and

FIG. 2 is a sectional view of one of the contact members taken along line 2-2. With reference to the drawings which illustrate a preferred embodiment of the invention, a tubular reaction chamber 10 is provided with a pair of vertically spaced parts 11 and 12. Tubular chamber 10 is constructed of a nonelectrically conductive material such as glass. Mounted within said parts 11 and 12 are a pair of identical contact members 13 and 14. Contact member 13 comprises an electrically conductive tube 15 having a pair of vertically opposed openings 16 and 17 in the sidewall thereof, and a sealing member or plug 18 closing the outer end thereof. Supported within the outer end of tube 15 and extending across opening 17 are a pair of electrically conductive rod members 19 and 20 which are freely rotatable therein. It will be appreciated that since member 14 is identical in all respects to member 12, the previous description of member 13 applies in all respects to member 14. Electrical connections 21 and 22 are provided to a suitable electric power source, not shown.

The filament 23 to be treated is threaded through the openings 16 and 17 of each member and between each pair of rod members 19 and 20 as shown for example in FIG. 2. During operation, the filament 23 is drawn upwardly through the spaced contact members as indicated by the arrow.

In operation, a suitable reactive gas is provided within the chamber 10, electrical power is applied to members 13 and 14 and the electrically conductive filament 23 is moved in a continuous fashion upwardly. Rod members 19 and 20, while freely rotatable, maintain a uniform contacting pressure on each side of the moving filament producing a two-point floating contact with the filament. Since at least one-point contact is always maintained arcing cannot occur.

It will be obvious to those skilled in the art that tube member 15 and rod members 19 and 20 may be constructed of any suitable electrically conductive material. For example, such members have been fabricated from a thin wall steel tube having a 5/16-inch I.D. and a pair of 1/4 inches O.D. steel drill rods. Such contact members have also been constructed from nickel tubes and copper rods of similar dimensions. Obviously, the rod members 19 and 20 may be hollow tubes rather than solid. While the electric contacts of this invention may be employed in the coating of any electrically conductive filament, they have been found to be particularly useful in the coating of fused silica filaments having a pyrolytic graphite coating, with boron or boro-carbon. Yet further, since the electrical contacting rod members provide a "floating" contact with the filament, precise alignment is not required as is the case with the capillary openings when mercury pools are used.

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

1. In a reaction chamber for treating a continuous filament and including means therein to resistively heat such filament comprising:

a pair of spaced electrical contact members extending in vertical alignment, and in a horizontal, parallel relationship, from an electrically insulated portion of the chamber wall and sealed with respect thereto;

each member comprising an electrically conductive tubular element having a pair of vertically aligned slots disposed substantially at the longitudinal axis of said chamber and each slot lying along the plane generated by the vertical diameter of said tube;

a pair of electrically conductive rods disposed in each tube and overlying the lower slot thereof;

said rod elements being substantially small with respect to the inner tube diameter and urged, by gravity, toward a line contact with one another;

means to pass a filament to be treated through each of the vertically aligned pairs of rods whereby each pair of rods comprises a floating contact with respect to such filaments; and

means to pass an electric current through the contact members whereby to continuously heat such filament.