

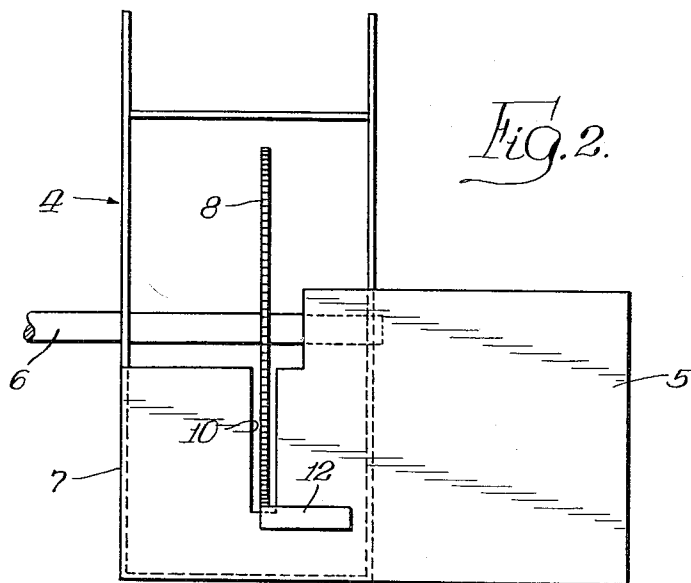
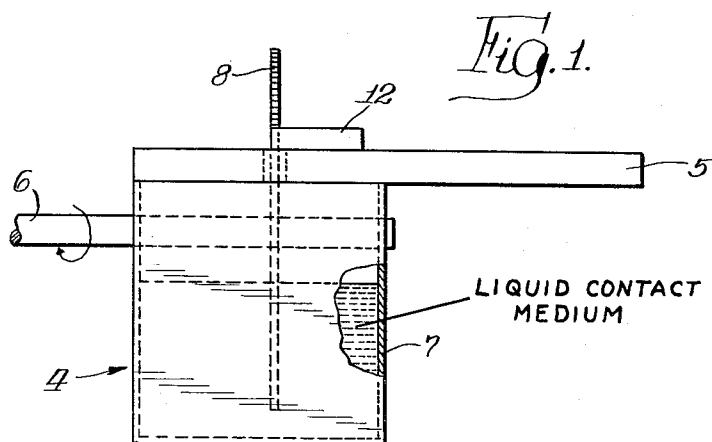
Aug. 22, 1961

W. V. HUCK

2,997,405

APPARATUS FOR AND METHODS OF CONTACTING OXIDIZABLE MATERIALS

Filed June 5, 1958



INVENTOR.
William V. Huck,
BY *Brown, Jackson*
Boettcher & Seeman Attys.

1

2,997,405

APPARATUS FOR AND METHODS OF CONTACT- ING OXIDIZABLE MATERIALS

William V. Huck, St. Paul, Minn., assignor, by mesne assignments, to Minnesota Mining and Manufacturing Company, St. Paul, Minn., a corporation of Delaware
Filed June 5, 1958, Ser. No. 740,064
4 Claims. (Cl. 117-4)

My invention relates to improvements in apparatus for and methods of forming stable contacts on readily oxidizable materials such as metals and semi-metallic compositions.

It is known that exposed surfaces of most metals as well as most semi-metallic compositions, examples of which are hereinafter related, readily oxidize in the open air at room temperatures in a fraction of a second. Such surface oxidation of materials of the class indicated is exceedingly detrimental for the satisfactory operation of devices in which said metals or semi-metallic compositions are to be utilized, and especially so in regard to semi-metallic compositions employed, for example, in thermoelectric generators, thermoelectric heat pumps, thermistors and like components and devices, wherein low resistance ohmic contacts must be provided for connection to electrical circuits.

It is an object of my invention to provide apparatus for and methods of applying a stable contact medium to oxidizable material.

It is a further object of my invention to provide apparatus for and methods of applying contact medium stable in the open air and at room temperatures to material oxidizable in the open air at room temperatures.

It is a further object of my invention to provide apparatus for and methods of removing a portion of a body of oxidizable material of the class above indicated, and simultaneously applying stable contact material to that portion of the oxidizable material.

An important advantage of my invention resides in the fact that it permits the preparation of materials of the class indicated to be carried out in the open and without resort to complex and expensive apparatus and methods requiring non-oxidizing atmospheres or reactive fluxes in order to provide such materials with good contacts.

The above and other objects and advantages of my invention will appear from the following detailed description of preferred embodiments of my invention.

Now in order to acquaint those skilled in the art with the manner of practicing my invention, I shall describe in connection with accompanying drawings certain preferred embodiments of my invention.

In the drawings:

FIGURE 1 is a side elevational view of an apparatus constructed in accordance with my invention; and

FIGURE 2 is a plan view of the apparatus shown in FIGURE 1.

Referring now to FIGURES 1 and 2 of the drawings, I have shown one form of apparatus of my invention which comprises a tank member 4 for supporting a body of liquid contact medium. A cutting or supporting platform 5 extends across a portion of the open upper end of the tank member 4. A shaft 6 extends through and is journaled in side wall 7 of the tank and adjacent its inner end within the tank carries abrading means 8 in the form of a thin abrasive disc or steel saw. The shaft 6 may be motor driven or otherwise as desired to effect rotation of the abrading means 8. The cutting or supporting platform 5 as shown, is provided with suitable cut-out 10 to afford positioning on the supporting platform of a body of oxidizable material 12 on which it is desired to apply the contacting medium in tank 4.

The oxidizable material 12 may, for example, be of

2

metal or of semi-metallic compositions, with such materials being characterized by being readily oxidizable in open air at room temperatures, and on which it is desired to provide a non-oxidizable or stable contact surface to afford use of such metals or semi-metallic compositions as electrical conductors or components in other devices in which they are to be used such as thermoelectric generators, thermistors and thermoelectric heat pumps. In regard to semi-metallic compositions to which this invention has application, typical examples thereof are described and claimed in United States Patents No. 2,811,440, No. 2,811,720 and No. 2,811,721, all issued October 29, 1957, and owned by the assignee of my present application. The materials of the patents mentioned, in addition to being readily oxidizable in the open air at room temperature, are also friable, and the apparatus and methods of my present invention enable the ready application of tinned or soldered facings thereto.

In regard to the liquid contact medium contained within tank 4 of the apparatus of FIGURES 1 and 2, it preferably should be of low to medium melting point. A contact medium having utility, for example, for use with the lead-tellurium compositions of the aforementioned Patent No. 2,811,440 may be Wood's metal which has a melting point of 150° F. As is known, Wood's metal is composed of bismuth, lead, tin and cadmium in proportions of about 50% bismuth, 25% lead, 12.5% tin and 12.5% cadmium, by weight. Another suitable contact medium for the aforementioned lead-tellurium compositions may consist, for example, of compositions of about 32% bismuth, 51% indium and 17% tin, by weight. The latter composition is characterized by a melting point of 140° F.

The liquid contact medium as indicated by the samples above given is preferably of low to medium melting point to facilitate maintaining the same in liquid form in tank 4.

In using the apparatus of FIGURES 1 and 2 a slug or body of oxidizable material, such as shown at 12, is positioned on the supporting or cutting platform 5 and engaged with the abrasive disc or steel saw to cut the member 12 into two pieces, or to remove an oxidized layer or portion of a surface thereof, and simultaneously to apply contact medium carried by the abrading means onto the cut surface or surfaces of member 12.

The abrading means whether it be a steel saw or an abrasive substance should be wet or otherwise impregnated with the liquid contact medium to carry the contacting medium to the surface of contact with the oxidizable material 12 without permitting air to enter between the contacting medium and the surface of contact of the oxidizable material.

The aforementioned liquid contact mediums, of course, rapidly solidify in open air and the cut surface or surfaces are thus provided with a stable normally non-oxidizable surface or layer affording a low resistance electrical contact. Since the saw or disc 8 continuously passes through the body of liquid contact medium, said saw or disc is continuously coated with the contact medium to tin or cover the cut surfaces of the body or member 12 of oxidizable material.

The aforementioned liquid contact mediums are classified as tinning solders and the specific compositions related do not in regard to the specific example of lead-tellurium compositions react with the latter in practicing my invention. It thus should be observed that in the preferred practice of my invention the liquid contact medium should in its liquid state not be deleteriously reactive with the body of material being contacted, and should preferably solidify at normal open air or room temperature so that the apparatus may be of simple construction in that regard.

It is believed the method of my invention is readily

discernible from the description of the above apparatus and the manner of using them. However, it will be clear that the method of my invention concerns the steps of affording a non-oxidized surface on a body of oxidizable material, and substantially simultaneously affording that surface with a stable contact medium. As indicated, the contact medium preferably is applied in liquid form and solidifies to alloy with and cover the non-oxidized surface at open or room air temperatures.

While I have shown and described certain preferred forms of apparatus of my invention and the method employed for performing my invention, it will be understood that various modifications and rearrangements may be made therein without departing from the spirit and scope of my invention.

I claim:

1. Cut-off and contacting apparatus, comprising a tank, a body of molten metallic contact medium in said tank, said medium being solidifiable at room temperatures, a circular saw mounted for rotation with a peripheral portion thereof immersed in said molten medium and the remainder thereof projecting above the medium surface, means for supporting a member of oxidizable material above the medium surface in a position for cutting through said member with said saw, and means for driving said saw independent of said member to effect cut-off of a portion of said member and simultaneous application of the molten metallic medium to a surface thereof created by the cut-off operation.

2. Cut-off and contacting apparatus comprising, a movably mounted cut-off tool, a molten metallic contact medium solidifiable at room temperature and with which a cutting portion of said tool is in contact, means for supporting a member of readily oxidizable material in position for cut-off of a portion thereof by said tool, and means for driving said cut-off tool independent of said

member to effect cut-off of a portion of said member and simultaneous application of said molten medium to a surface of said member created by the cut-off operation.

3. The method of electrically contacting a member of material readily oxidizable in air comprising applying in a molten state to a cut-off tool a molten metal relatively stable in air alloyable with the material of said member and solidifiable at room temperatures, cutting off a portion of said member while continuing the application of said molten metal to said cut-off tool to thereby apply said molten metal to a freshly cut surface on said member created by said cut-off operation simultaneously with the formation of said surface and before oxidation thereof can take place, and then allowing said molten metal to solidify.

4. The method of electrically contacting a member of material readily oxidizable in air comprising immersing a peripheral portion of a rotating circular cut-off saw in a bath of molten metal relatively stable in air alloyable with the material of said member, and solidifiable at room temperatures, and then cutting off a portion of said member with said saw to thereby apply said molten metal to a freshly cut surface on said member created by the cut-off operation simultaneously with the formation of said surface and before oxidation thereof can take place, and then allowing said molten metal to solidify.

References Cited in the file of this patent

UNITED STATES PATENTS

549,610	Ramage	Nov. 12, 1895
1,271,885	Freyberg	July 9, 1918
1,923,790	Moore	Aug. 22, 1933
1,984,624	Bagley	Dec. 18, 1934
2,104,237	Neidich	Jan. 4, 1938
2,413,016	Wilken et al.	Dec. 24, 1946
2,815,562	Wilkie	Dec. 10, 1957