Patented Sept. 15, 1953

2,651,952

UNITED STATES PATENT OFFICE

2,651,952

DIE FOR EXTRUDING COMPRESSED POWDER RODS

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Application November 24, 1947, Serial No. 787,797

12 Claims. (Cl. 78—0.5)

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The present invention relates to a die mechanism for compressing powdered metal to form a continuous rod which may be sintered into a relatively rigid structure; and this application is a continuation-in-part of applicant's copending application, Serial No. 776,091, filed September 25, 1947.

The invention may be employed in conjunction with any desired powdered metals, but is peculiarly suited for use in forming a self-sustaining rod from the powders of refractory metals such as molybdenum and tungsten and their alloys without the use of any binder. Such rods require high compacting pressures and are relatively fragile. They have a relatively low elastic limit; and, when that limit is exceeded, they break down into small fragments.

The object of the invention is to provide an improved die for the purpose mentioned above.

Other objects and advantages of the invention will become apparent from the following specification, the accompanying drawings, and the appended claims.

In the drawings:

Figure 1 is a cross-sectional view of a complete apparatus suitable for forming a continuous rod of compressed and sintered powdered metal;

Figure 2 is a section taken on the line 2—2 of Figure 1;

Figure 3 is a section taken on the line 3—3 of Figure 1;

Figure 4 is an elevational view partly in section and Figures 5 and 6 are upper and lower end views of the inner die nozzle;

Figure 7 is an elevation and Figure 8 is a lower end view of the conical die-supporting member;

Figure 9 is an elevation and Figure 10 is an upper end view of the die-supporting shoes;

Figure 11 is an elevation and Figures 12 and 13 show upper and lower end views of the plunger; and

Figure 14 is a fragmentary section taken on the line 14—14 of Figure 3.

Referring to Figure 1, the invention is illustrated in connection with a vacuum arc melting furnace in which the continuously formed sintered powdered metal rod produced by the mechanism of the present invention acts as a consumable electrode and the collecting pot or mold which receives the molten metal acts as the other electrode. The mechanism of the present invention compresses powdered metal and extrudes it in a continuous rod, and thus continuously supplies the consumable electrode material. The

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compressed rod is sintered by the passage of an electric current or otherwise in order to impart sufficient strength to enable the rod to sustain its own weight.

The complete apparatus includes a housing 1 having a bottom plate 2 provided with a central opening 3 to receive the upper end of a water-cooled copper mold 4, of any desired length. The mold 4 is provided with an integral channel-shaped flange 5, the upper edge of which is adapted to seat against a sealing ring 6 in order to seal the interior of the housing 1 against the admission of atmospheric air. The mold is secured to the bottom plate 2 by means of a plurality of clamps 7, one of which is illustrated in Figure 1. Each clamp 7 consists of an arm which is pivotally mounted upon an insulating bushing 8 surrounding a bolt 9 which is threaded into the lower plate 2 and holds the clamp against a block of electric insulation 10. The inner end of the clamp arm carries a screw 11 which is adapted to engage the flange 5 and hold the flange against the sealing strip 6. When the screw clamps 11 are released and the clamps rotated about their pivotal mountings, the mold 4 may be removed from the housing 1.

A plurality of circumferentially spaced locating lugs 12 is likewise secured to the underside of the plate 2 by screws 13 and engages the outer periphery of the flange 5 in order to rotate the mold in proper axial alignment with the consumable electrode, hereinafter described. The lugs 12 are insulated from the plate 2 by means of a layer of insulation 14 and insulating bushings 15 surrounding the screws 13.

The upper end of the housing is closed by means of a flat plate 16 which seats upon a sealing ring 17 and which is provided with a central opening communicating with a powder feed housing 18 which is secured to the upper surface of the plate 16 by means of screws 19. A magazine 20, of any desired size, is secured to the housing 18 with its discharge opening 21 overlying the feed tray 22 of a conventional vibratory feeder, indicated generally at 23.

In accordance with the present invention, the metal powder which is fed from right to left along the tray 22 of the vibratory feeder is discharged into a funnel 24 and thus to the upper end of an extrusion die 25, within which it is compressed by a reciprocating plunger 26, the plunger also acting to feed the compressed powder downwardly through the die.

As best shown in Figures 4, 5 and 6, the die 25 is generally cylindrical in form, except that