Sept. 16, 1930. H. VOIGTLÄNDER ET AL 1,776,053

APPARATUS FOR THE MANUFACTURE OF CASTINGS OF DIFFICULTLY MELTABLE METALS AND METALOIDS

Original Filed Aug. 25, 1925

Fig. 1.

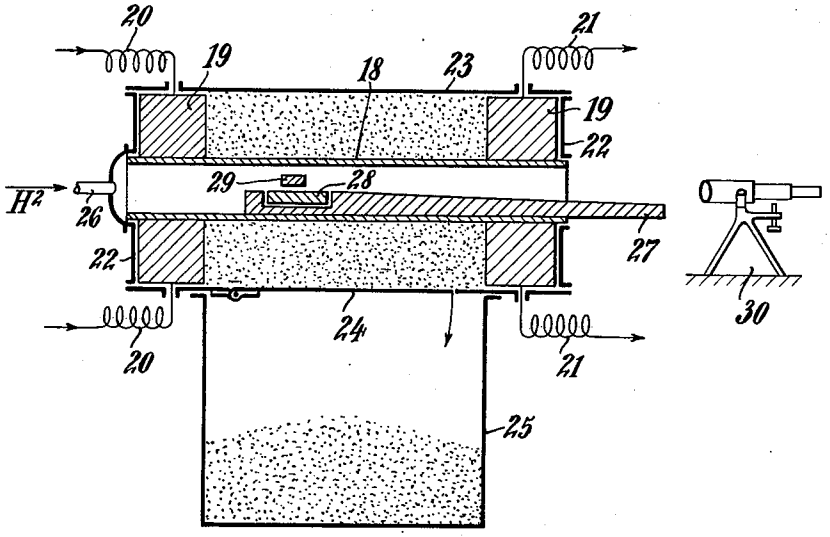
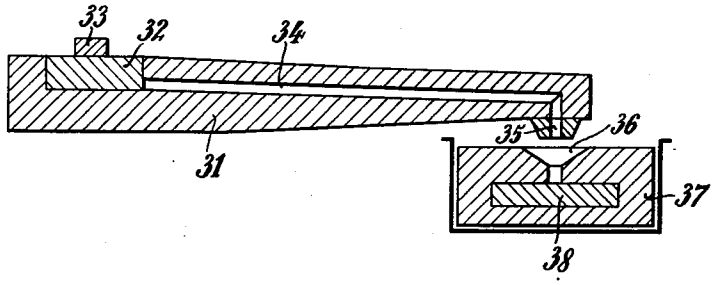


Fig. 2.



Inventor:

Hermann Voigtländer, Otto Kaufels

by Luise Pannelsche

attorney

Patented Sept. 16, 1930 1,776,053

UNITED STATES PATENT OFFICE

HERMANN VOIGTLÄNDER AND OTTO KAUFELS, OF ESSEN, GERMANY, ASSIGNORS TO GEWERKSCHAFT WALLRAM ABTEILUNG METALLWERKE, OF ESSEN, GERMANY, A CORPORATION OF PRUSSIA

APPARATUS FOR THE MANUFACTURE OF CASTINGS OF DIFFICULTLY-MELTABLE METALS AND METALLOIDS

Original application filed August 25, 1925, Serial No. 52,378, and in Germany September 8, 1924. Divided and this application filed June 20, 1929. Serial No. 372,343.

The present application is a divisional one from our application for U. S. Letters Patent, Ser. No. 52,378, filed August 25th, 1925, and relates to a device for carrying out the process claimed and specified in the said original application.

The device according to the present invention allows to manufacture castings of carbides of difficultly meltable metals or metalloids, e. g. tungsten, uranium, molybdenum, titanium, borium, zirconium, etc., thereby using moulds arranged outside the furnace.

The drawing shows two modifications of a device according to the invention.

Fig. 1 is a section through a horizontal furnace according to the invention,

Fig. 2 shows a modified melting mould such as can be used in connection with the furnace of Fig. 1.

The furnace illustrated in Fig. 1 is a carbon tube resistance furnace the horizontally arranged furnace chamber of which is constituted by a resistance tube 18 open at both ends and made of carbon or preferably graphite. Strong current supply terminals 19 made of carbon, or preferably graphite, are mounted on the two ends of the said tube. 20 are the current supply cables of which there may be only one, or several. 21 are the current return cables or cable. The whole is mounted in a sheet iron chamber 22 with a detachable cover 23 and a discharge valve 24 at the bottom which opens into a container 25 placed underneath. The inner space of the chamber 22 is filled with a suitable incombustible non-conducting loose mass, such as for instance carbon grains to such an extent that the resistance tube 18 is well covered with it. To one open end of the resistance tube 18 is connected a gas pipe 26 through which hydrogen or other neutral gas or gas suitable as the atmosphere for the melting process (for instance ammonia) is introduced during the melting process.

The melting crucible is constituted simply by a graphite rod 27 of a somewhat smaller diameter than the inside diameter of the resistance tube 18.

The upper face of this graphite rod is somewhat flattened and tapers downwards like a wedge towards the end projecting out of the furnace in order to facilitate the observation of the end situated in the furnace and containing the melting mould 28.

In such a furnace it is possible not only to cast the molten material outside the furnace, but also to effect any desired number of meltings in a single furnace heat, which hitherto could not be done with any process or any apparatus. Moreover, the new process and the new apparatus enable the melting process to be accurately controlled optically, and the moment of casting or of the interruption of the melting to be correctly chosen. A chief advantage of the new apparatus is its unequalled simplicity, great accessibility and the possibility of watching it.

The casting process is carried out as follows: A charge of the material to be melted is rammed in or pressed into the melting mould 28 of one or any desired number of graphite rods 27. The material to be melted is constituted either by pure tungsten powder or by tungsten powder mixed with a given quantity of carbon as described in our said original applicaton. Charges of tungsten carbides or tungstic acid anhydrides with the admixtures already mentioned in said application, can be also treated in the furnace. Finally a small check block 29 formed from the same mass as the material to be melted (for instance under a press) is placed loosely on top of the filled melting mould.

In the meantime the resistance tube 18 is heated to a bright white heat in a few minutes by switching on the current, and a current of hydrogen is admitted through the pipe 26.

The first graphite rod 27 is then introduced into the tube 18 up to the position shown, and the required melting temperature (according to the composition of the material, as a rule 2700° to 3500° C.) is determined by means of the optical pyrometer 30. Preferably, the interference photometer or pyrometer of Lummer, or the optical pyrometer of Holburn Kurlbaum is used.

By observing the check block 29 by means of the optical pyrometer 30, it is possible to

ascertain when the melting of the mass begins, which generally will be the case after 2–3 minutes. The mass is then left in the furnace for another period empirically determined beforehand, for instance 30 seconds, whereupon the graphite rod 27 (which can be conveniently gripped at its free end with asbestos gloves) is quickly pulled out and emptied into a casting mould prepared outside the furnace.

The next graphite rod with the charge is thereupon introduced into the furnace and so on.

According to the size and shape of the resistance tube 18, several graphite rods 27 could be introduced into the furnace simultaneously. It is, however, preferable to work with only one melting mould at a time, as it facilitates the watching of the melting mass.

For the manufacture of large castings, the melting mould 31 can be made as shown in Fig. 2. The mould 31 comprises a casting channel 34 and 35 leading out of the furnace and provided with a slight gradient downwards to convey the molten material 32 to the funnel 36 of a casting mould 37 arranged outside the furnace and preferably made of graphite or carbon and containing the mould 38 for the desired casting. When a melting mould according to Fig. 2 is used, a tapping process could also be used. To that end the casting channel 35 is held closed for a time empirically determined beforehand, after the melting of the check block 33 and then opened by any desired tapping process. The mould situated outside the furnace moreover can be first heated and then cooled as required either temporarily or continuously, for instance in order to ensure the formation of a given crystalline shape or general texture.

We claim:—

1. An apparatus for manufacturing castings of carbides of difficultly meltable metals and metalloids, such as tungsten, uranium, molybdenum, titanium, borium, zirconium etc. consisting of a horizontal tubular electric carbon furnace adapted to receive the mass to be molten, a graphite bar adapted to be so introduced in said furnace as to project with one end beyond it, and a melting mould formed in the inner end of said bar.

2. An apparatus for manufacturing castings of carbides of difficultly meltable metals and metalloids, such as tungsten, uranium, molybdenum, titanium, borium, zirconium etc. consisting of a horizontal tubular electric carbon furnace adapted to receive the mass to be molten, a graphite bar adapted to be so introduced in said furnace as to project with one end beyond it, a melting mould formed on the inner end of said bar, and a melting channel arranged in said bar and extending from said melting mould toward the outer end of said bar.

In testimony whereof we affix our signatures.

HERMANN VOIGTLÄNDER.
OTTO KAUFELS.