C. PFANSTIEHL.

METHOD OF COMPRESSING TUNGSTEN POWDER.

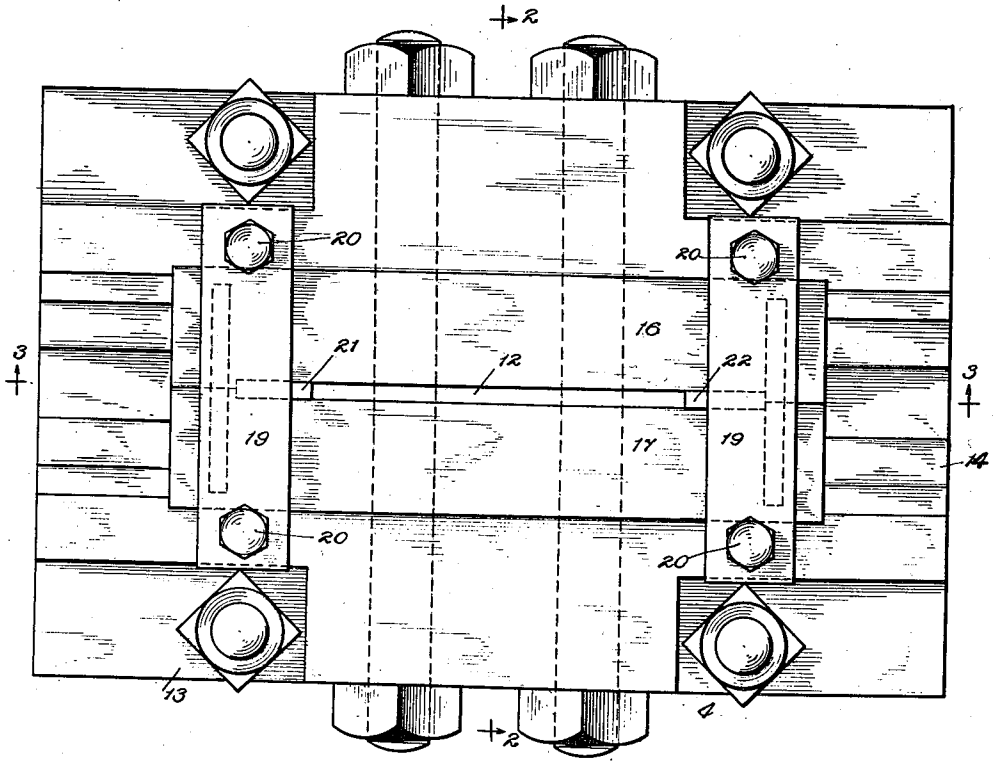
APPLICATION FILED JAN. 26, 1918.

1,305,975.

Patented June 3, 1919.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2

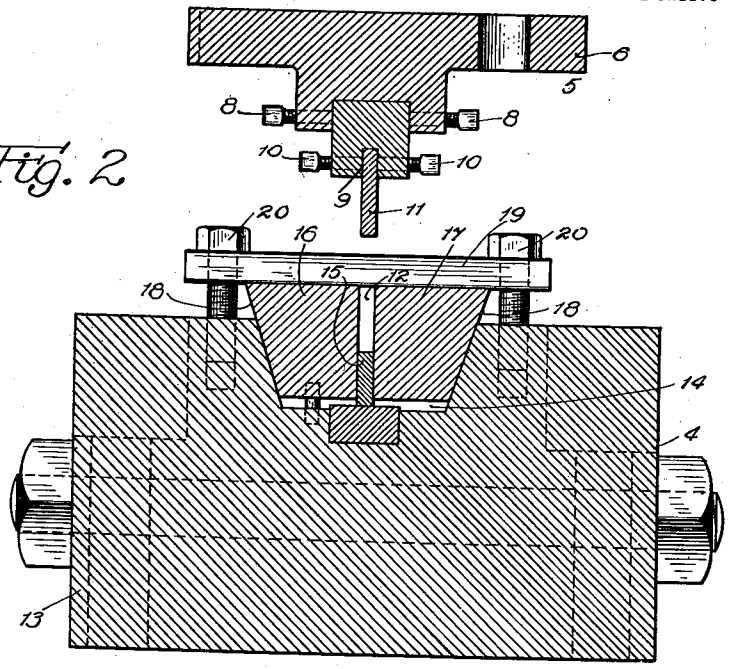
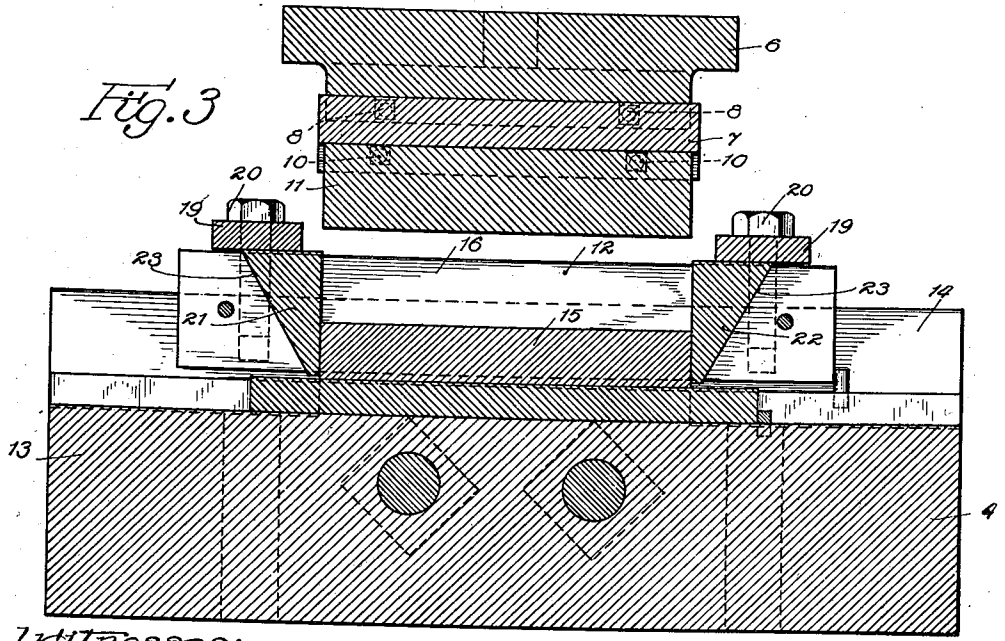


Fig. 3



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UNITED STATES PATENT OFFICE.

CARL PFANSTIEHL, OF HIGHLAND PARK, ILLINOIS, ASSIGNOR TO PFANSTIEHL COMPANY, INC., OF NORTH CHICAGO, ILLINOIS, A CORPORATION OF NEW YORK.

METHOD OF COMPRESSING TUNGSTEN POWDER

1,305,975. Specification of Letters Patent. Patented June 3, 1919.

Original application filed October 9, 1916, Serial No. 124,504. Divided and this application filed January 26, 1918. Serial No. 213,906.

To all whom it may concern:

Be it known that I, CARL PFANSTIEHL, a citizen of the United States, residing at Highland Park, in the county of Lake and State of Illinois, have invented a certain new and useful Improvement in Methods of Compressing Tungsten Powder, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to the art of compressing tungsten powder to form bodies or ingots of tungsten that may be readily handled, machined, sintered, etc., in various processes of converting tungsten into manufactured products. This application is a division of my application Serial No. 124,504, filed October 9, 1916, for means and method for compressing tungsten powder. The improvements which characterize my present invention are particularly useful in producing the articles of tungsten having a high density as described and claimed in my co-pending application Serial No. 113,323, filed August 5, 1916.

In producing compressed tungsten powder ingots of the class described and claimed in my co-pending application Serial No. 113,323, fine tungsten or tantalum powder is subjected to a pressure of substantially 135 tons or more per square inch. The greater the pressure employed in compressing the tungsten powder the greater is the density of the finished product. However, when tungsten powder is subjected to such enormous pressure as 130 to 160 tons to the square inch, as my present invention contemplates, serious difficulties are encountered when the pressure is relieved due to the fact that the compressed powder tends to fly apart or crumble away. My present invention enables me to subject tungsten powder to enormous pressures and at the same time to secure perfect ingots, principally for the reason that when I relieve the ingot from the enormous pressure utilized in its formation I permit the compressed tungsten powder to expand substantially equally in all directions. By so doing I find that the compressed tungsten powder does not crumble or fall apart when the pressure is relieved therefrom.

These and other objects of my invention will be more clearly brought out in connection with the accompanying drawings wherein—

Figure 1 is a plan view of the lower die member of the apparatus for compressing the powdered tungsten into ingot form;

Fig. 2 is a vertical cross sectional view taken along the line 2—2 of Fig. 1 looking in the direction indicated by the arrows; and

Fig. 3 is a vertical cross sectional view taken along the lines 3—3 of Fig. 1 looking in the direction indicated by the arrow.

Similar characters of reference refer to similar parts throughout the several views.

Referring first to Fig. 2, 4 illustrates the lower die member and 5 the upper die member of the apparatus for compressing the powdered tungsten into ingot form. The upper die member consists of a supporting plate 6 attached to suitable mechanism for lowering and raising it into and away from the base die 4. The plate 6 carries a block 7 secured to the former by means of the screws illustrated at 8—8. A slot is provided at 9 in the block 7 in which is held by means of the screws 10—10 the upper die member 11. This die member 11 is arranged to be inserted into the slot 12 provided in the base die 4, which slot contains the powdered tungsten to be compressed.

The die 4 is composed of the base 13 provided with the downwardly tapered opening 14 located on its upper side. A strip 15 is centrally located in the opening 14 and serves as the bottom or base for the slot or opening 12 in which the powdered tungsten is compressed. The side walls of the opening 12 are formed by the movable blocks or dies 16 and 17 each provided with an oblique side face 18 arranged to ride vertically on the side wall of the opening 14.

The blocks 16 and 17 are normally retained in the position illustrated in Fig. 2 by means of the strips 19 secured to the base member 13 by means of the screws illustrated at 20—20. The end walls of the slot or opening 12 are formed by the pieces 21 and 22, which, as most clearly illustrated in Fig. 3, are provided with the oblique faces 23 riding on corresponding faces of the blocks 16 and 17. The end pieces 21 and

22, like the blocks or dies 16 and 17, are arranged to have vertical movement on their oblique faces when the strips 19 are raised.

The operation of the device is as follows: The powdered tungsten or tantalum is placed in the opening 12 and the upper die member 11 lowered into the opening to compress the powdered tungsten. As before mentioned, the pressure required to press the tungsten powder into ingot form is between 135 and 160 tons per square inch. When this enormous pressure is relieved from the ingot it is necessary to relieve the pressure in such manner as to permit the ingot to expand equally in all directions otherwise the ingot will crumble away or fly apart. To provide for this uniform expansion of the ingot when the pressure is removed the expansible die member 4 is utilized.

After the tungsten powder has been subjected to sufficient pressure to convert it into a solid ingot the upper die member 11 is slightly raised. At the same time however that the upper die member 11 is raised the strips 19—19 are released by turning the screws 20 to permit the blocks 16 and 17 and the end pieces 21 and 22 to move upwardly. The upward movement of the members 16, 17, 21, and 22, due to their oblique riding faces, causes them to spread outwardly with the result that the ingot is not only permitted to expand upwardly as the die member 11 is removed, but is permitted also to expand laterally in all directions, the pressure of the ingot, of course, serving to cause movement of the members 16, 17, 21 and 22 in the aforesaid upward direction.

Having thus described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. The method of compressing tungsten powder which consists in applying pressure to the powder and then relieving pressure therefrom so as to permit the compressed powder to expand substantially equally in all directions.

2. The process of forming ingots of metal powder which comprises subjecting the metal powder while inclosed on all sides to a pressure sufficient to substantially permanently deform the particles of metal powder and then allowing the ingot to expand substantially uniformly in all directions.

3. The process of forming ingots of metal powder which comprises subjecting the metal powder to a pressure sufficient to substantially permanently deform the particles of metal powder.

4. The process of forming ingots of tungsten which comprises subjecting the tungsten powder to a pressure of substantially 135 tons per square inch and then allowing the ingot to expand uniformly in all directions.

In witness whereof, I hereunto subscribe my name this 17th day of January, 1918.

CARL PFANSTIEHL.

Witnesses:
W. O. BELL,
MARGARET GROBBEN.