June 17, 1947. G. F. TAYLOR 2,422,636

METHOD OF MAKING CEMENTED CARBIDE ARTICLE

Filed Nov. 24, 1943

Fig. 1.

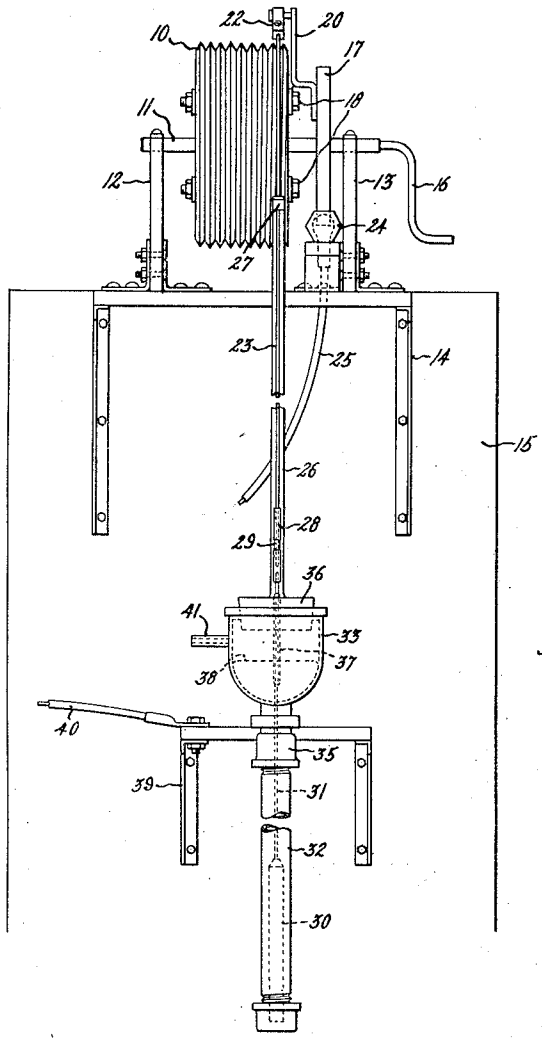
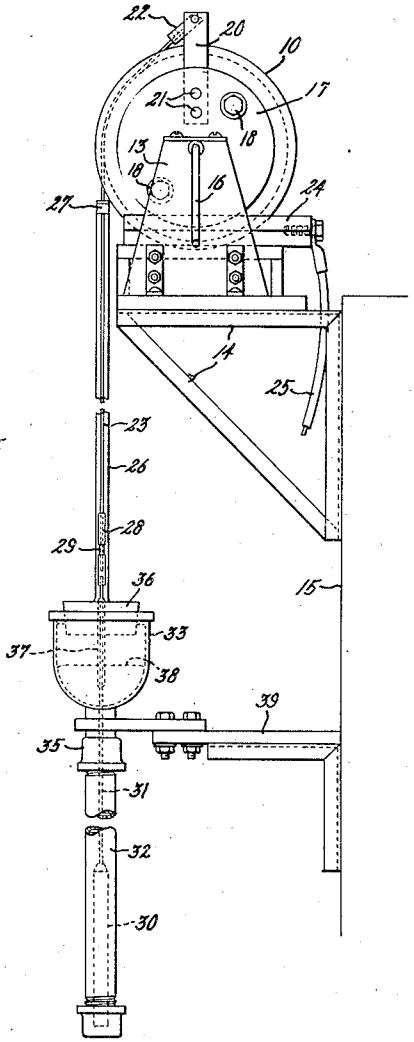


Fig. 2.



Inventor:
George F. Taylor,
by Harry E. Dunham
His Attorney.

Patented June 17, 1947

2,422,636

UNITED STATES PATENT OFFICE

2,422,636

METHOD OF MAKING CEMENTED CARBIDE ARTICLE

George F. Taylor, Grosse Pointe Woods, Mich., assignor to Carboloy Company, Inc., a corporation of New York

Application November 24, 1943, Serial No. 511,634

2 Claims. (Cl. 219—3)

1

The present invention relates to refractory hard metal compositions and more particularly to a a cemented carbide article of manufacture and a method and apparatus for making it. Heretofore cemented carbides have been employed principally in the form of metal cutting tools, swaging and drawing dies and the like. Such material is brittle in comparison with certain other materials such as steel and in general requires to be supported on a softer and tougher base. I have found, however, that if a cemented carbide in the form of wire or strip is heated under the proper conditions to an elevated temperature it may be bent into a desired shape, for example a ring, and the resultant product is resilient.

It is one of the objects of the present invention to provide resilient cemented carbide rings or springs which are flexible and strong to a practical degree. It is a further object of the invention to provide an improved method and apparatus for producing such products. Other objects will appear hereinafter.

The novel features which are characteristic of my invention are set forth with particularity in the appended claims. My invention itself however will best be understood from reference to the following specification when considered in connection with the accompanying drawing in which Fig. 1 is a front elevation of an apparatus for carrying my invention into effect, while Fig. 2 is a side elevation of the same apparatus.

Referring more particularly to the drawing, I have indicated at 10 a grooved drum or windlass which may be made of quartz, Alundum, sandstone or any suitable electrically, non-conducting material. The drum 10 which may comprise a plurality of circular sections is supported on a shaft 11 for rotation therewith. The shaft 11 is mounted in bearing supports 12 and 13 carried by a steel or other framework 14 which in turn may be secured to a wall 15. The drum 10 may be rotated by a crank 16. A metal ring 17 which may be copper is mounted on shaft 11 to rotate therewith. Bolts 18 extend through the drum 10 and hold the sections thereof rigidly together. A metal arm 20, which is secured by bolts 21 to ring 17 to rotate therewith and with drum 10, is provided with pivoted means 22 to which the upper end of a wire 23 may be secured. A mercury well 24 makes electrical contact with ring 17 and is connected by means of an insulated wire 25 to one terminal of a source of power, not shown. Wire 23 may consist of any cemented carbide composition, for example a sintered com-

2

position consisting of one or more hard metal carbides with a softer binder metal therefor, for example cobalt. Wire of this composition may be extruded and sintered as set forth in my prior Patent No. 2,271,960, February 3, 1942, entitled "Extrusion process."

The wire 23 is passed through a long relatively small diameter glass or quartz tube 26, for example about $\frac{5}{16}$ of an inch in diameter, the upper end of which is closed by a carbon plug 27 having a central opening to accommodate wire 23. The lower end of wire 23 is silver soldered or otherwise secured in a temporary manner in one end of a copper rod 28 which for example may be about $\frac{5}{32}$ of an inch in diameter. The rod 28 is undercut slightly at a point 29 intermediate the end portions thereof to restrict the transfer of heat from wire 23 below that point. Tension is applied to the wire 23 by a weight 30 which is suspended from the lower end of rod 28 by a wire 31 which is of such size and material that its electrical resistance is well below that of the wire 23. Wire 31 is soldered or otherwise secured in an opening in the lower end of the copper rod 28.

Weight 30 is enclosed in a steel tube or pipe 32 which is filled with mercury 38 and closed at its lower end. A metal bowl or cup 33 is secured to the upper end of the pipe 32 by a screw threaded extension 35 on the lower end of the bowl. The bowl 33 has a rubber stopper or closure member 36 provided with a centrally disposed hollow metal cylinder or bushing 37 through which wire 31 extends. The mercury in the receptacle comprising pipe 32 and bowl 33 extends to a point slightly above the lower end of the bushing 37. The mercury filled receptacle is mounted on a steel framework 39 which is connected by a wire 40 with one terminal of a source of electric energy.

The tube 26, which may be glass, quartz or other suitable material rests on the rubber stopper 36 and encloses the upper end of the metal bushing 37 which also serves as a guide for the wire or rod 31. If desired, hydrogen gas may be supplied to the bowl 33 through the intake pipe 41. The hydrogen flows through channels in the bushing 37 so that the wire 23 may be continually surrounded by a protective gaseous atmosphere.

In operation the wire 23 is attached between the pivoted fastening means 22 on the arm 20 and the copper rod 28 and preliminary heat is applied only to the end portions of the wire 23 and glass tube 26 by an oxyhydrogen flame, an external resistance coil, or other suitable means. If heat is not applied to the ends of the carbide

wire previous to closing the heating circuit through it, the carbide wire will become heated at an intermediate point before the end portions are heated. This preliminary heating lasts for a few seconds only. After the preliminary heating is completed current is immediately supplied from a source of power to a circuit including the mercury, wire 31 and wire 23. The latter wire, which is a high resistance wire, is thereby immediately heated throughout its entire length to a temperature of about 1300° C. at which temperature it may be bent easily. While the wire is at about this temperature the drum 10 is rotated and the hot wire wound to the desired extent thereon after which the heating circuit is opened. The wire 23 cools quickly and hardens to form a ring or wound spring on the drum 10. The wire is now disconnected from the winding apparatus and rod 28.

The ring formed on the drum is resilient and may be expanded or restricted to a certain extent without breaking. Rings formed by the present process may be employed for various purposes and are suitable for use as piston rings in internal combustion engines or the like or as wear resistant inserts on such rings whereby the wear on the piston ring may be greatly reduced and its life increased.

While I have illustrated my invention in connection with a wire it will be clear that the wire may be round, flat or other shape, or, if desired, it may be in the form of a tube. Where I employ the term "wire" it is understood not only to include various forms of wire and tubing but also strip material. Also, although the wire 23, prior

to forming on the drum 10, may be heated in a hydrogen or other protective atmosphere, such atmosphere and the tube 26 may be omitted if a small amount of oxidation on the wire 23 is not objectionable.

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

1. A method for bending a cemented carbide wire which comprises attaching one end of the wire to a drum, applying tension to the wire, supplying external heat to said wire at a point adjacent said drum, thereafter heating other portions of said wire and finally bending the heated wire on said drum.

2. A method for bending a cemented carbide wire which comprises applying tension to the wire, applying external heat to the end portions of said wire, thereafter supplying an electric current to the wire to heat it to a red heat and then bending it on a rotary drum.

GEORGE F. TAYLOR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
458,115	Thomson	Aug. 18, 1891
1,684,204	Ruttenberg	Sept. 11, 1928
1,505,478	Macha	Aug. 19, 1924
1,804,705	Paulus et al.	May 12, 1931
2,121,448	Ritzau	June 21, 1938
2,167,516	Kelley	July 25, 1939
2,220,018	McKenna	Oct. 29, 1940