

A. H. EMERY.
ART OF PRODUCING HOLLOW CASTINGS.
APPLICATION FILED MAY 12, 1920.

1,391,675.

Patented Sept. 27, 1921.

Fig. 1

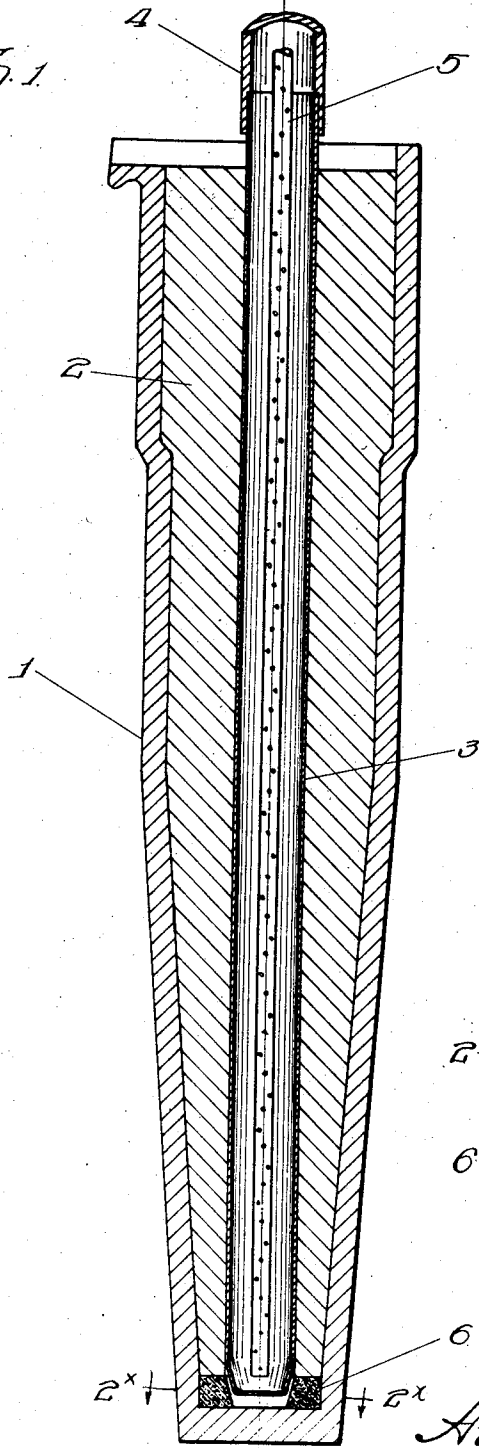
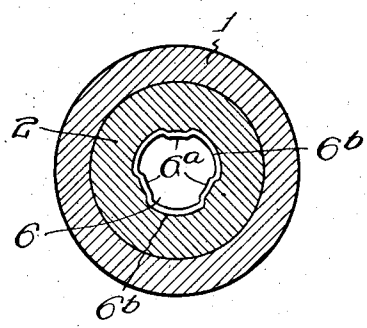


Fig. 2



By

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UNITED STATES PATENT OFFICE.

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Specification of Letters Patent. Patented Sept. 27, 1921.

Application filed May 12, 1920. Serial No. 380,743.

To all whom it may concern:

Be it known that I, ALBERT H. EMERY, a citizen of the United States, residing at Stamford, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in the Art of Producing Hollow Castings, of which the following is a specification.

My invention relates to a method of forming a hollow casting and cooling it very quickly in a manner to avoid segregation to cause large initial cooling strains of compression at the bore and tension at the exterior of the casting, and is especially applicable in the manufacture of castings which subsequently form guns or parts of guns. The present invention may be applied with especial advantage in the production of hollow bodies that are to be used in constructing guns in accordance with one or another of my methods of radial hydraulic straining.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 shows a vertical longitudinal section of a mold, a casting therein, and a means of applying a cooling medium to the interior of the casting; and

Fig. 2 is a transverse section on the line 2*-2* of Fig. 1 through the centering block or step for the cooling core.

Referring to the drawings in detail, 1 is an ingot mold of circular cross section with its interior made closely to the form the finished product is to have. 2 represents a casting poured into said mold as a step in the process to which the present invention relates. 3 is a thin walled hollow cylinder or core forming the bore of the casting. 4 is a head for carrying the core 3. 5 is a perforated pipe for introducing a cooling medium into the hollow core. 6 is a block of refractory material located at the bottom of the casting and having a conical opening for centering the core 3 therein. It is provided with longitudinal ribs 6*, preferably three in number, on its conical face, as shown in Fig. 2, leaving intervening grooves 6* through which molten metal may escape when the core 3 is forced downward to its seat.

With the apparatus as above described, the process may be carried out as follows: The quantity of metal necessary to make a casting is determined, and then a quan-

tity of molten metal slightly in excess of this is introduced into the mold. The mass of metal being large and of considerable diameter relative to its length, the impurities will rapidly rise to the top but the metal will chill very slowly. The core 3 is then forced down into this molten metal causing the metal to rise up in the mold and fill it, and the excess metal to overflow. As the core is smooth and the metal still liquid, its insertion will not churn up the metal and the impurities at the top will rise with the liquid and flow off with the excess metal. The form of the molten mass is greatly changed by the introduction of this core, and now its thickness is small relative to its length and this thin wall chills very quickly reducing segregation, and as it is largely cooled from the interior it will have large initial strains of compression in the interior and tension on the exterior as is desired. This core 3 is made of a thin wall of steel or iron, and remains in the casting and is bored out in machining.

Water or some other cooling agent is introduced into the core 3 as the core is forced down into the mold, to keep the core from being overheated and losing its strength, and this supply of cooling medium is continued in sufficient quantity to cause the interior of the casting to cool rapidly. To carry down the core 3 and pipe 5, the mold will be associated with suitable means, such as by locating it beneath the ram of a hydraulic, pneumatic, or dead weight press. There will also be provided an exit for the cooling medium.

The pipe 5 is best made with a series of radial holes along the portion that enters, within the core, so that the cooling medium can be sprayed against the walls of the core.

The lower end of core 3 is made conical so as to be held central by entering the conical recess in the lower part of the mold.

The effects of this method of casting are three fold. First, it makes it possible to eject some of the impurities from the mold and to cool the remaining metal very rapidly and so reduce the amount of segregation and the amount of sink head required; second, this rapid cooling greatly increases the strength of the metal; and, third, by cooling from the interior, the metal near the center will solidify and cool first, and then as the metal outside of this solidifies and cools it

will contract onto the metal already solidified and put the latter under large initial strains of compression, which is desirable in castings for guns or parts thereof.

It will be advantageous to preheat the mold so that the exterior will not chill prematurely.

After cooling, the casting should be rough turned and bored, and then cold forged or expanded by the use of internal hydraulic pressure as described and claimed in my Patents Nos. 726,520 of April 28, 1903, and 727,766 of May 12, 1903, according to which guns are constructed with permanent strains of tension on the exterior and compression on the interior by slowly and permanently expanding, from the interior outward, the interior and exterior parts of the gun, or of two or more concentric pieces which are to be assembled in building up a gun; this expanding being accomplished by applying liquid to the interior of the gun or gun part under pressure sufficient to give the piece a permanent set and greatly increase its limit of elasticity and ultimate strength, as, for instance, by forcing liquid within the piece to be treated between it and a straining bar, with suitable packings between it and the bar, and, where necessary to subject different longitudinal portions of the piece to different degrees of working, using three or more packings around the straining bar to form two or more chambers, and introducing different degrees of hydraulic pressure into the respective chambers.

This cold forging will increase the elastic limit of the metal and also its ultimate strength, and increase the initial strains in the castings and bring the casting more ex-

actly and uniformly into the condition of strain desired.

I claim:

1. The manufacture of hollow castings having initial strains of compression at and near the bore by filling a mold partly full of molten metal and after pouring the metal introducing a hollow core provided with means for cooling the core and thereby cooling the casting principally from its interior.

2. The manufacture of hollow castings having initial strains of compression at and near the bore by filling a mold partly full of molten metal and after pouring the metal introducing a thinned walled hollow metal core provided with means for keeping the core cool and thereby cooling the casting principally from its interior.

3. The improvement in the art of manufacturing guns, which consists in pouring the metal of the body or of a body member of the gun into a mold, introducing into the metal a hollow core provided with means for cooling the core, and cooling the casting from the interior to the exterior, to develop in the casting strains of compression on the interior and of tension on the exterior.

4. The art of casting gun bodies or members of gun bodies, which consists in molding the casting in hollow cylindrical form and applying a cooling medium to the interior of the casting until the casting is set with strains of compression on its interior and of tension on its exterior.

Signed at Glenbrook, Conn., this 8th day of May, 1920.

ALBERT H. EMERY.