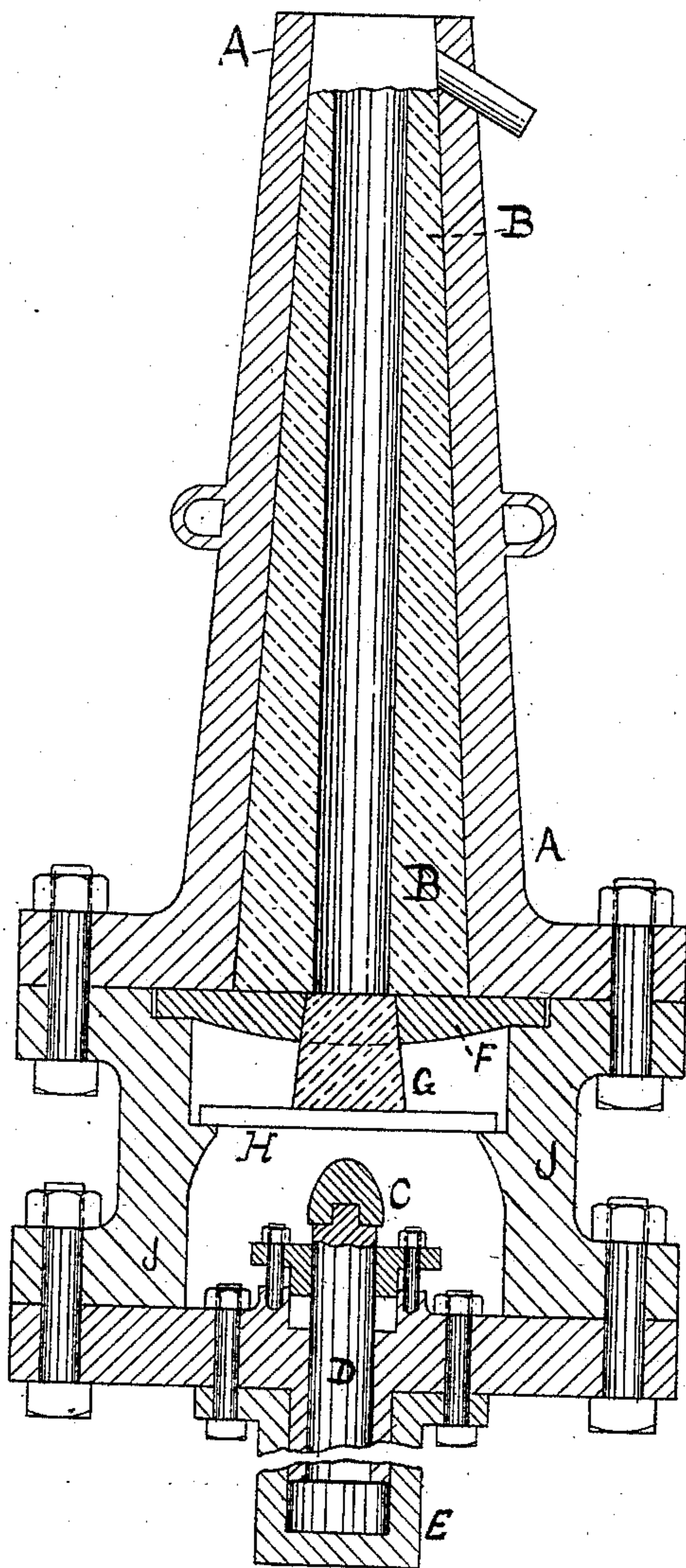


(No Model.)

T. JAMES.  
APPARATUS FOR MAKING HOLLOW METAL ARTICLES.  
No. 442,895. Patented Dec. 16, 1890.



WITNESSES.

*Wm. C. Davis*  
*John M. Reese*

INVENTOR.

*Thomas James*

# UNITED STATES PATENT OFFICE.

THOMAS JAMES, OF BRADDOCK, PENNSYLVANIA.

## APPARATUS FOR MAKING HOLLOW METAL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 442,895, dated December 16, 1890.

Application filed February 24, 1890. Serial No. 341,396. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS JAMES, of Braddock, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Making Hollow Metal Articles, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, which is a vertical sectional view of apparatus embodying my invention.

A is the mold in which the steel ingot is cast.

B is the ingot, which is shown in the drawing, not as it is when first cast in the mold, but after it has been punched.

C is a punch made of any suitable material and operated by the plunger D, working in cylinder E.

F is a round metal plate or stool with a tapered hole in the center for receiving a refractory plug G, which is held in position by the bar H, so as to close the hole in the stool. The plug G is made of fire-clay or other refractory material, which being a poor conductor of heat retards the cooling of the bottom of the ingot at the middle.

The entire machine, ingot, and mold are carried and supported by a suitable frame J, to which the cylinder E is attached.

The operation of the machine is as follows: The ingot is cast in the mold A, and when the outside shell of the ingot has solidified, and when the center has become partially solid, the cross-bar H is taken away and the plug G removed. As before described, the function of the plug is to prevent the too rapid chilling of the middle of the bottom of the ingot, so as to retain it in a condition sufficiently soft to permit easy entrance of the punch; but as the contact of the metal with the refractory plug does chill it to a moderate extent there is formed at the middle portion of the end of

the ingot a thin shell of solidified metal sufficiently strong to prevent the molten interior of the ingot from running out or bleeding on removal of the plug. The punch C is then forced through the center of the ingot, carrying the metal it displaces over the top and through the spout K into a suitable vessel, forming in the ingot a hole and by the resulting lateral compression densifying the metal. The punch C is then removed and the plunger D allowed to fall back to its original position. The punch is now replaced by a larger one, and the operation is repeated, the effect of which is to compress the metal and to give it greater tensile strength. When the ingot becomes too cold to work further, it may be reheated in a furnace, replaced in the mold, and the operation repeated as often as necessary. The ingot is then taken out of the mold and finished, in the usual manner, by forging, turning, or otherwise to the shape desired. The machine may be used either in a horizontal or vertical position.

The punch C may be operated either with a powerful screw or by hydraulic pressure.

I claim—

In apparatus for making hollow steel articles, the combination of the mold, a non-heating conducting plug set removably at the end of the mold to prevent rapid solidifying of the portion of the metal in contact therewith, and a plunger directed toward the plug and adapted to be forced through the central part of the metal on removal of the plug, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 22d day of February, A.D. 1890.

THOMAS JAMES.

Witnesses:

THOMAS W. BAKEWELL,  
H. M. CORWIN.