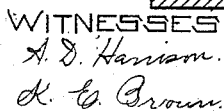


J. ROBERTSON.

No. 493,897.

Patented Mar. 21, 1893.



INVENTOR

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# UNITED STATES PATENT OFFICE.

JAMES ROBERTSON, OF MANCHESTER, ENGLAND.

METHOD OF AND APPARATUS FOR COMPRESSING AND SHAPING METAL ARTICLES.

SPECIFICATION forming part of Letters Patent No. 493,897, dated March 21, 1893.

Application filed July 15, 1892. Serial No. 440,149. (No model.) Patented in England July 6, 1891, No. 11,436.

*To all whom it may concern:*

Be it known that I, JAMES ROBERTSON, of Manchester, England, have invented certain new and useful Improvements in Methods of and Apparatus for Compressing and Shaping Metal Articles, (for which British Letters Patent No. 11,436, dated July 6, 1891, have been granted to me,) of which the following is a specification.

This invention has for its object to provide efficient and simple means for imparting various external shapes to billets of metal, rendered soft and plastic by heat.

The invention consists in the method and the apparatus as hereinafter described and claimed.

Of the accompanying drawings, forming part of this specification: Figure 1 represents a longitudinal section, showing a sliding die and its container, a fixed billet-supporting head, and a movable ram, the parts being shown ready for action, and a single billet being shown in the die. Fig. 2 represents a similar view, showing a series of independent billets, and formers interposed between the same, the parts being shown in the position they occupy before the compressing action. Fig. 3 represents a view similar to Fig. 2, showing the position of the parts and the shape imparted to the billets after the pressing operation.

The same letters of reference indicate the same parts in all the figures.

In the drawings: A' A' represent the two halves of a long die, which is formed internally to impart the desired external form to a billet or blank of metal placed in said die and subjected therein to compressing pressure, the blank or billet being rendered soft and viscid by heat. The die is secured to a container A<sup>2</sup>, which is adapted to slide lengthwise in a fixed guide or holder A<sup>3</sup>, substantially as set forth in British Letters Patent No. 1,627, of 1890, granted to me.

C represents a fixed billet-supporting head, adapted to enter the rear end of the die A', and formed to fit the die so as to permit the independent endwise movement of the latter, the head C at the same time affording a sufficient support for the rear end of the billet B.

J represents a ram, adapted to enter the opposite or forward end of the die, and formed to fit the same closely and move independently in the die. The ram may be forced into the die, as indicated by the arrow *a*, by hydraulic means, such as are shown in my British patent above mentioned, or by any other suitable means.

The billet B, which may be of any desired metal, is heated until it becomes soft and viscid, and in this condition is placed in the die, its rear end being supported by the head C. The ram J is then caused to enter the die and exert compressive pressure upon the forward end of the billet, causing an outward pressure of the billet against the walls of the die. The freedom of the die to move endwise enables the die and its container to move with the metal at a slower rate than the ram J, and as indicated by the arrows *b b*. This motion of the die continues until the metal of the die becomes compressed as much at the rear end supported by the fixed head as at the forward end next to the ram; and, when the billet has been thus compressed, the forming operation is completed. The longitudinal movement of the die during the compression of the billet makes the compression uniform throughout the entire length of the billet or formed article, so that said article is of uniform density throughout, instead of being compressed more at its end portions than at its intermediate portions as would be the case if the die had no endwise movement.

The interior of the die may be of any desired form in cross section, such as circular, polygonal, or irregular, and the cross sections of the head C and ram J should correspond with that of the interior of the die. I have shown the head C as provided with a central passage or conduit C<sup>3</sup>, through which a fluid such as water under high pressure may be admitted to the interior of the die, the water being thus admitted after the compression of the billet, and serving, by contact with the heated metal, to generate steam, the pressure of which, added to the pressure of the fluid, acts to quickly expel the formed article and the ram. I have shown a perforated plate E<sup>20</sup>, interposed between the head C and the billet

B, for the purpose of distributing the fluid uniformly over the end of the billet, said plate being provided with numerous orifices, all communicating with the passage C<sup>3</sup> in the head C.

The fluid under pressure made be admitted to the passage C<sup>3</sup> at the proper time by means of a valve or cock, which is opened to admit the fluid, and is closed after the ejection of the formed article and the ram.

The head C is preferably caused to fit the interior of the die closely, so as to prevent the escape of water from the rear end of the die, by means of a packing ring C<sup>5</sup>.

After the ejection of the formed article and the ram, the die may be moved back to its starting position, by hand or otherwise.

Any desired number of billets may be treated in the die A'. In Fig. 1, I have shown but one billet; but in Figs. 2 and 3, I have shown a series of billets, which are interposed between formers L L, which closely fit the interior of the die A', and are adapted to slide therein, and are shaped at their sides to impart any desired form to the sides or ends of the billets. The formers here shown are shaped to convert the billets into pulleys, each having a central hub B' and a rim B<sup>2</sup>, as shown in Fig. 3, said hub and rim being formed by means of the recesses L' L<sup>2</sup> in the formers (shown in Fig. 2.) The operation is the same as that already described, the billets being placed in the die in a hot soft condition, and the formers being alternated with the billets, as shown. The ram J is then caused to enter the die and exert pressure upon the series of billets and formers, thus compressing the billets and causing the die to move endwise to secure uniformity of com-

pression throughout the series of billets, the movement of the die continuing until the sides of the billets conform closely to the sides of the formers, as shown in Fig. 3. After this, the billets, formers and ram may be ejected by the action of the fluid through the passage C<sup>3</sup>, in the manner already described.

It is obvious that the die and formers may be shaped to impart various forms to soft metal billets, in the manner described, my invention not being limited to the forms here shown.

I claim—

1. The method of compressing and shaping a billet of heated metal in a plastic state, the same consisting in longitudinally compressing the billet, and at the same time expanding it laterally against a forming surface and moving said surface in the direction of the compressing pressure, during the entire compressing operation, as set forth.

2. The improved apparatus for compressing and shaping billets of heated metal, the same comprising a longitudinally movable die, a series of formers adapted to fit the interior of the die and to move therein, a fixed supporting head adapted to enter one end of the die, and a movable ram adapted to enter the opposite end of the die, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 2d day of June, A. D. 1892.

JAMES ROBERTSON.

Witnesses:

ARTHUR C. HALL,  
ARTHUR H. POPE.