No. 695,716. Patented Mar. 18, 1902.

J. FRITZ.

APPARATUS FOR PERFORATING BLOOMS.

(Application filed May 28, 1900.)

(No Model.)

Fig. 1.

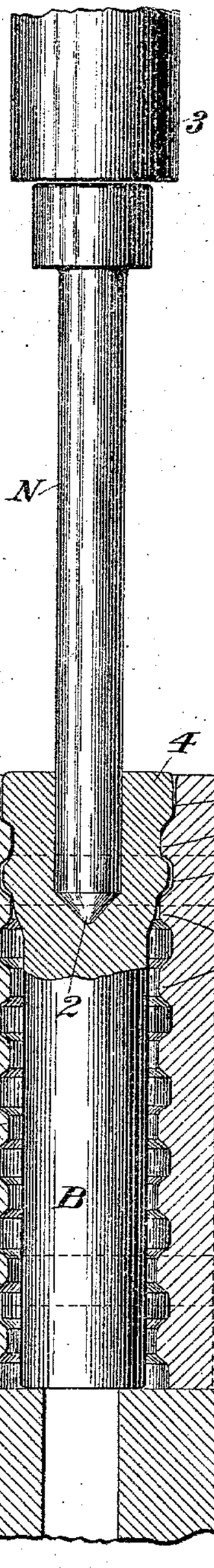


Fig. 4.

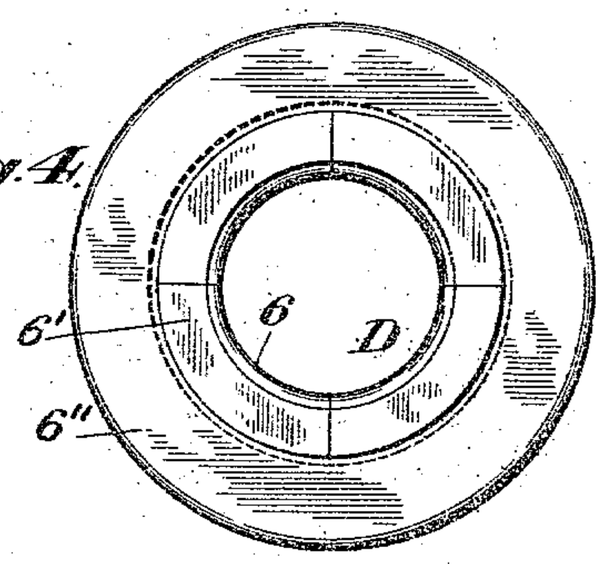


Fig. 2.

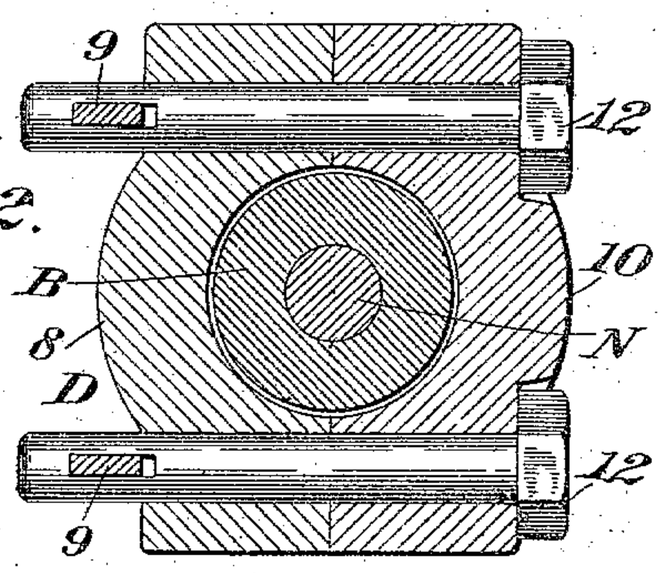
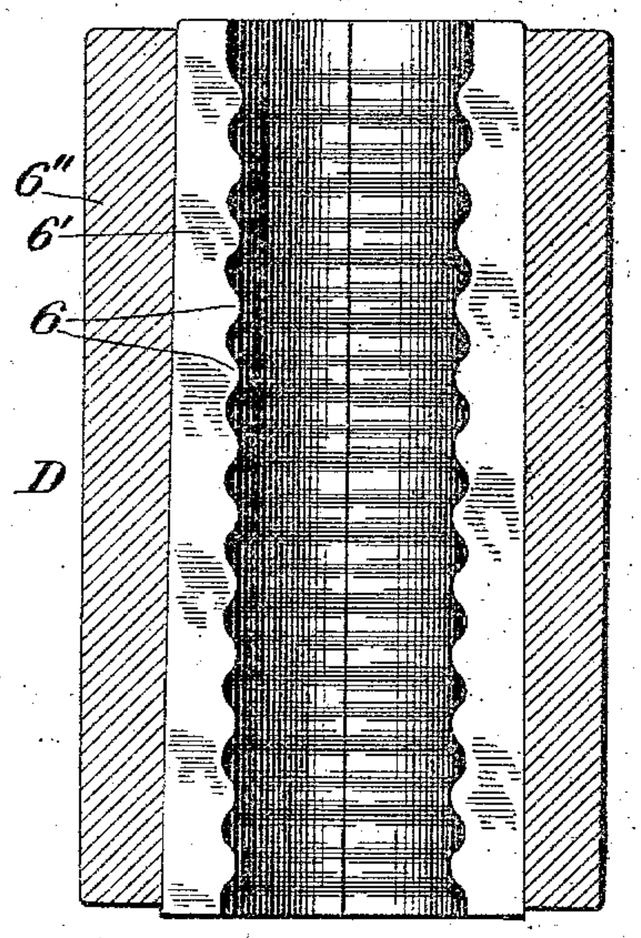


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN FRITZ, OF BETHLEHEM, PENNSYLVANIA.

APPARATUS FOR PERFORATING BLOOMS.

SPECIFICATION forming part of Letters Patent No. 695,716, dated March 18, 1902.

Application filed May 23, 1900. Serial No. 17,626. (No model.)

To all whom it may concern:

Be it known that I, JOHN FRITZ, a citizen of the United States, residing in Bethlehem, in the county of Northampton and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for and Methods of Perforating Blooms and Ingots, of which the following is a specification.

This invention relates to molds or guides for use in the manufacture of perforated blooms and ingots, and has for its object to provide an improved apparatus for perforating and expanding the blooms or ingots and whereby the ingots and blooms may be perforated or punched longitudinally and expand and the work accomplished in a reliable and efficient manner.

In the manufacture of certain qualities of steel it has been practically impossible to produce comparatively long perforated ingots by the apparatus in use and have the ingot proper in all respects for future operation upon it, my present invention providing a suitable apparatus therefor.

In perforating ingots by the general method disclosed in this application it is necessary in order to guard against the crushing down of the ingot, which would destroy the success of the operation, to maintain the temperature of the ingot at a point sufficiently low to thereby secure a sufficient stability of the mass to sustain the pressure of the punch and not crush *en masse*. It is well understood, however, that if the ingot be at a relatively high temperature, so that in the case of long ingots, such as illustrated in the drawings, the operation of the punch upon the metal will leave the same in the most homogeneous and perfect condition. Without some suitable support for the ingot the punch will only enter it a short distance and operate in a correct manner, and if the punch be then forced down a greater distance the ingot will begin to crush in the middle and lower portions of the same, thereby defeating the attempt to produce a perfectly-formed tube in which the metal shall be of the required high quality. It is necessary that the operation shall be performed with rapidity, so as to maintain the ingot in proper condition throughout its length during the entire operation. For this purpose the beginning of the punching operation should be inaugurated when the ingot is at the correct temperature, so the metal at the upper end will flow outwardly without destroying the texture or uniformity of that part of the ingot. For this purpose, as above noted, it is very desirable, and in the case of some kinds of metal it is practically necessary, to have the temperature of the entire ingot at a point above what is practicable when the operation is to be carried out in the old way. In the present process and with the means herein illustrated the ingot is placed within a specially-constructed mold, the inner diameter of which mold is normally less than would otherwise be required, and the ingot being heated to the relatively high temperature already referred to and placed within the mold the punch is forced against the ingot and operates (by reason of the high degree of mobility in the metal due to the relatively high temperature, as aforesaid) to immediately spread the upper part of the ingot (which has not previously been worked for rendering it efficient to engage the mold) and expand the same, not only into engagement against the inner surfaces of the mold, but also to exteriorly forge the expanded portion, and so form extended shoulders on the ingot, which shoulders engage the inwardly-extending shoulders of the mold, and so operate to support the upper end of the ingot in a manner to sustain the middle portions of the same from downward movement, so that the middle portions of the ingot during the following stages of the punching operation will be sustained by the conjoint action of the support afforded by the lower part of the ingot and the additional support afforded by the said shoulders formed at the upper part of the ingot during the first stage of the continuous punching operation, whereby the ingot is perforated. Inasmuch as the punching operation gradually requires increasing force, the inwardly-projecting shoulders of the mold are located at successive points in the length of the same corresponding with the increasing resistance required at the successive stages of the operation, and thus as the punch descends continues the external forging of the ingot to the form of the successive seats or shoulders for sustaining the portions which are immediately beyond, thus permitting the produc-

tion of a perforated ingot of substantially like consistency at any region in its entire length.

By means of the present improvement the ingots may be perforated while the metal is at a temperature too high to permit of the perforation without a substantial support additional to that afforded by the lower end of the ingot or what could be afforded by any mere frictional engagement of the outside of the expanded portion with the interior surface, whether smooth or roughened, of the mold; but, furthermore, the present improvements obviate the necessity heretofore existing in apparatus for this general purpose of expanding the ingot into positive and complete engagement with the interior surface of the mold, and by this means the excessive binding of the perforated ingot upon the punch is reduced to a minimum, whereas, except for the supporting-shoulders exteriorly forged on the ingot to engage with the corresponding shoulders of the mold, it would be necessary, in order to obtain exterior frictional support, to permit the crushing of the ingot to some extent sufficient to secure the enlargement of the same to firmly fill the space between the mold and the punch, and thus cause the mold to bind the metal inwardly onto the punch and so create a maximum of resistance to the forward movement of the punch, all of which is highly detrimental to the success of the operation as a whole, and especially detrimental to the successful punching of ingots at such a high temperature as will prevent them from being self-sustaining under the punch.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side elevation, partly in section, illustrating my present invention. Fig. 2 is a horizontal section in line *a a*, Fig. 1, illustrating one mode of constructing the mold or guide for the ingot or bloom. Fig. 3 is a sectional view of another form of mold or guide, and Fig. 4 a plan of a further improvement in the mold or guide.

Similar characters designate like parts in the different figures of the drawings.

For carrying into practice my present improvements I use any sufficiently large and powerful press or machine—preferably a hydraulic punching-machine—suitable for the work to be done. In the drawings the bed-plate of such a machine or press is designated by P, and the plunger or piston by 3. The ingot or bloom B being brought to a suitable heat is set upon the bed-plate P of the press or machine in which the punching is to be done, and the punch N, whose point or apex 2 may be of any usual form employed in this class of work, is put in place in line with the ingot or bloom and forward of the plunger or piston 3 of the machine. In practice this piston or plunger will usually be operated by hydraulic means, since the operation is one usually requiring considerable power. The effect of the entrance of the plunger into the bloom or ingot is to expand the latter to a larger diameter—as indicated, for instance, at 4—and also the pressure of the punch tends to crush down the ingot, especially after the punch has entered some distance into the ingot. For the purpose of facilitating the operation, and especially for preventing so great a reduction of the length of the piece B, I provide a mold or guide D, constructed for engaging the expanded part of the bloom and to hold the same against the force of the punch. As a means for accomplishing this result I construct the guide or mold with engaging surfaces or projections formed and disposed in a manner adapted to engage or interlock with the expanded portion of the piece B and so by its engagement with said piece resist the longitudinal movement of the piece from the force of the punch.

A suitable construction of the mold for the purposes set forth is to provide its inner wall with inwardly-projecting portions which are preferably in the form of ridges or rings, as 6, extending around the mold, and into the space between each ridge the metal may be forced by the punch, thereby firmly engaging the expanded part of the bloom or ingot with the projecting portions of the mold—as indicated, for instance, at 7. This interlocking of the ingot or bloom with the mold prevents the sliding of the ingot within the mold during the further progress of the punch through the same, and thus resists the tendency to crush down the lower portion of the ingot or mass during the later stages of the punching operation.

For convenience in putting the mold in place and also for removing the same from the expanded ingot the mold may be made in sections, these sections being secured together by clamping with hoops, hooks, or other suitable clamping devices. In the drawings the two parts 8 and 10 of the mold D are shown connected together by bolts 12, held in place by keys, as 9, by which means the bolts may be readily removed by first knocking out the keys with a hammer. Of course the fastenings should, whatever the form thereof, be fitted and arranged for quick operation.

My present invention is especially designed for use in punching relatively large ingots and blooms of steel; but it will be understood that the method is applicable for punching masses of various materials and that my improved apparatus is applicable not only to the punching of different materials, but also to the perforation of ingots or like masses of various sizes, including steel ingots of large or small dimensions, as may be required in any particular case.

In carrying out the process by the aid of the guide or mold constructed as indicated in Figs. 3 and 4 the walls or staves 6′ may be slid into the hoop or cylinder 6″, after which, the mold being set in place in the machine, the ingot may be set therein and the opera-

tion of punching the same proceeded with, as hereinbefore described. In practice the said staves or wall portions 6' may be made of any suitable number, and the projections 6 may in some cases be formed on alternate staves or sections.

For the purpose of engaging the metal of the expanded portion of the ingot in such manner that the projections on the ingot resulting from the forcible expansion of the same into the spaces of the mold or guide may afterward be worked without leaving any crevices in the forging the surfaces may be made, as shown, of an oval or curved form, thus avoiding sharp angles; but in some cases, if preferred, the projections of the guide or mold may be sharp-cornered, so as to more positively engage the outflowing metal, and thus hold the ingot against descending movement.

Having thus described my invention, I claim—

1. An apparatus for perforating ingots or blooms comprising a punch and a mold provided interiorly with projections adapted to engage an expanding ingot or bloom as it is expanded by the punch and to forge projections thereon and to hold it against the longitudinal force of the punch and maintain it from crushing without the side walls of the mold intimately engaging it.

2. A guide or mold for use in perforated ingots or blooms provided on its interior walls with projections adapted to engage an expanding ingot and maintain the same without the wall proper of the mold engaging it.

3. In an apparatus for perforating ingots, the combination with a guide or mold provided on its interior walls with projections adapted to engage an expanding ingot and maintain the same without the wall proper of the mold engaging it; and means for perforating said ingot, the organization being such that its end will, simultaneously with the perforation of such end, be forced into position to engage the uppermost projection, thereby to hold the ingot throughout the further continued punching thereof against longitudinal displacement.

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