L. JONES.

EXTENSION OF METAL BODIES.

APPLICATION FILED JULY 3, 1916.

1,199,080.

Patented Sept. 26, 1916.

2 SHEETS—SHEET 1.

FIG. 1.

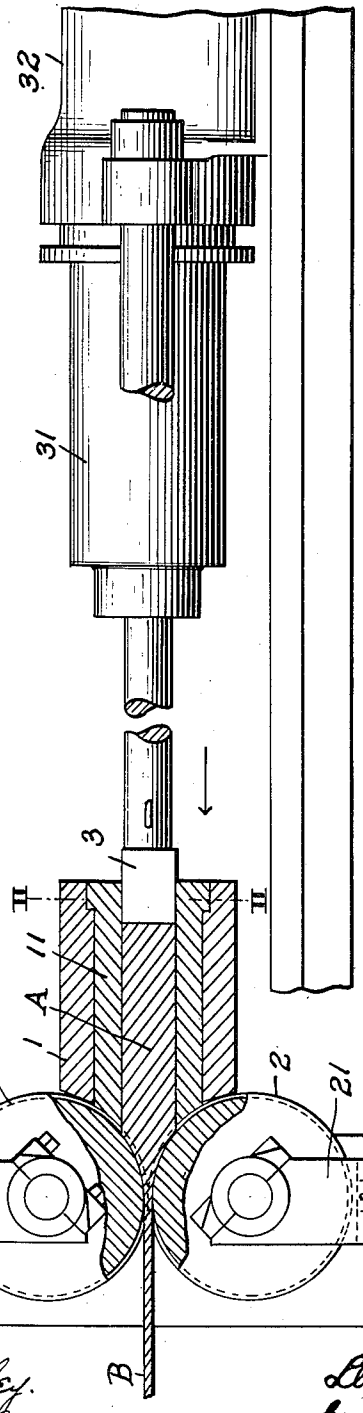
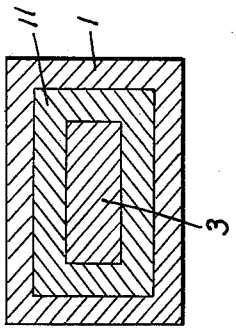


FIG. 2.



WITNESSES

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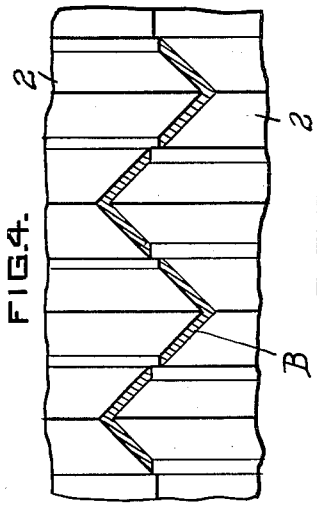


FIG. 4.

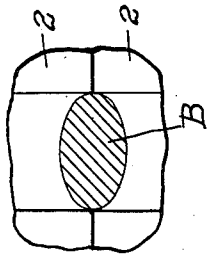


FIG. 5.

FIG. 3.

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UNITED STATES PATENT OFFICE.

LLOYD JONES, OF WILKINSBURG, PENNSYLVANIA.

EXTRUSION OF METAL BODIES.

1,199,080. Specification of Letters Patent. Patented Sept. 26, 1916.

Application filed July 3, 1916. Serial No. 107,377.

To all whom it may concern:

Be it known that I, LLOYD JONES, residing at Wilkinsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Extrusion of Metal Bodies, of which improvements the following is a specification.

My invention relates to the shaping of bodies of metal by extrusion through orifices and concerns both the method and the apparatus employed.

The apparatus is illustrated in the accompanying drawings; the method will be made plain in the description of the apparatus and its mode of operation.

Figure 1 is a view partially in side elevation, partially in vertical section of a machine embodying and operating in accordance with my invention, and containing material in course of fabrication; Fig. 2 is a transverse section on a plane indicated by the line II—II, Fig. 1; Fig. 3 is a view in end elevation, viewed from the left end (Fig. 1) of a machine differing in some respects from that of Figs. 1 and 2, and showing in section the extruded material; Figs. 4 and 5 are fragmentary views and on larger scale, but corresponding to Fig. 3, showing the machine adapted to the production of shapes specifically different from the product of the machine shown in Fig. 3.

The shaping of metals by extrusion through orifices has long been practised, and my invention has to do with improvements which render that operation more widely applicable, to metals of such hardness as steel for example—metals not ordinarily so shaped heretofore, and applicable with economic benefit in the shaping by extrusion of such softer metals as lead, tin, brass, and bronze.

Broadly stated, the invention consists in extruding the metal through an orifice of which the opposite lips are roll surfaces; in this operation the metal is not, as in the ordinary processes of extrusion, shaped by being forced to move across the rigid lips of the orifice, nor even through an orifice of which one lip moves while the other is stationary, but is shaped by passing through an orifice the opposite lips of which are both moving, and moving in the same direction with the advancing body of metal. Herein, it will be observed, lies novelty in method, for the material itself is subjected to different strains, differently related, from what obtains in the operation of extrusion through a rigid-lipped orifice, or through an orifice formed in part by a rigid mandrel.

Referring to Figs. 1 and 2 of the drawings, the machine consists essentially of a container 1 for the metal to be shaped; a pair of rolls 2, 2, forming the constricted orifice of the container, and the orifice through which metal contained in the receptacle 1 is extruded; and means for exerting pressure upon the metal within chamber 1 to effect extrusion, such means being here shown as a plunger 3. The container 1 will be formed of suitable material with walls of sufficient strength and thickness to withstand the pressures incident to use. The container may be provided with a removable lining 11 to be replaced as it becomes worn. Ordinarily the container will be of rectangular shape in cross section, suited to receive in close fit a previously cast or rolled blank of metal to be fabricated. But the particular shape here is of no controlling importance, so far as concerns invention. The rolls 2 together form, as is best shown in Fig. 1, a forwardly narrowing end of the chamber in which the metal to be treated is contained; and, as has been said, they are normally spaced apart to form, by and between them, the extrusion orifice. This orifice is open and unobstructed by mandrel or any other structure. The rolls are preferably so mounted that alternately in the ordinary course of use they may be widely separated and brought again into proximity. This provision is to the end that, when a containerful of material has been substantially all of it extruded, the unextruded remnant which lies in the forward narrowing end of the chamber between the opposite faces of rolls 2 may be carried forward—a butt-end, to be subsequently removed from the otherwise shaped article. Provision for such separating and bringing together of the rolls is found in the sliding journal-boxes 21, the screws 22, and the screw-turning gear 23. Either or both rolls may be mounted and equipped for such relative movement. The provision which allows relative movement of the rolls makes possible also adjustment of the operative width of the roll pass; this possibility may be taken advantage of, par-

ticularly in the case of the rolls grooved hereinafter described. The means for shifting the rolls may, of course, be power-driven. The rolls 2 may, as is best shown in Fig. 3, if desired, be geared to rotate in unison; and they may, if desired, be geared to be driven by a motor 24. These features, however, form no essential part of the invention in its broader aspect, for the machine is entirely operative without them. The motor, when present, may be employed to drive the rolls and assist at the beginning of the operation, or even throughout the entire operation.

Although the invention, in its broader aspect, is not limited to such features, Figs. 3 and 4 show that the rolls may be shaped to afford in the pass between them a plurality of extrusion orifices, and that to the entire series of such a plurality of orifices a single blank may be fed from a single, unobstructed container such as is shown in cross section in Fig. 2. The rolls are grooved, and so grooved for coöperation in pairs that when assembled the groove in one roll stands opposite and coöperates with the band formed by and between adjacent grooves in the companion roll; the walls of the grooves are vertical (extending in transverse planes, perpendicular to the axes of rotation of the rolls). Thus the opposed faces of groove and band coöperate to spread the metal, while the opposed vertical groove-walls coöperate to shear the metal into discrete parts as operation progresses. Herein is a further feature of novelty in method.

Fig. 3 shows that a blank may be shaped and subdivided into bars between rectangularly grooved rolls; Fig. 4, taken in comparison with Fig. 3, shows that the grooving may be varied, to produce such special shapes as may be desired. In each case, however, shearing is effected by coöperating vertical groove walls—that is to say, surfaces disposed in planes perpendicular to the axes of roll rotation.

Fig. 5 shows the rolls shaped to afford a single orifice. Manifestly, variously shaped articles may be produced, such as billets, sheet-bars, plates, strips, angles, etc., of commerce, or other desired shapes.

The plunger 3 will be shaped to fill or substantially fill the chamber of container 1 and drive before it in its advance the body of metal which is in course of extrusion. It has been said that ordinarily this chamber will be rectangular in cross-section, and, correspondingly, the plunger 3 will ordinarily be rectangular. Any suitable means may be employed to exert on the plunger 3 the power necessary to drive it forward and effect extrusion of a body of metal within the container. The drawings are in this respect exemplary merely. They show the plunger 3 mounted on a stem-like extension of a ram 31, which ram forms the piston of a hydraulic cylinder 32.

Fig. 1 shows the apparatus in course of operation upon a body of material. A indicates the blank within the container 1 which is to be understood to be advancing to the left toward the extrusion orifice, and B the extruded and fabricated material advancing from the orifice.

The operation of the machine is as follows: The rolls are spaced at proper distance to afford the desired extrusion orifice. A blank of material, hot or cold, according as its ductility is small or great, and of shape and size corresponding more or less closely to the container 1, is introduced into the container; the plunger 3, previously withdrawn, is then brought forward and enters container 1 to rearward of the blank. The further advance of the plunger drives the blank forward, forcing it between rolls 2 with gradually diminishing thickness, until it passes through the orifice at the desired size and shape. In this operation the rolls will rotate and advance with the metal entrained between them; and, as has been said, power may be applied to drive the rolls and so assist in the operation, either at the beginning or continuously throughout. When the forward thrust of plunger 3 is completed, there will still remain in the tapering forward end of the container and between the oppositely standing roll bodies a small body of material approximately triangular in cross section and of one piece with the material which has already advanced through and beyond the shaping orifice. Of course, in proper case, a new blank of material introduced in the container and forced forward by the plunger may drive this remnant forward and shape it to its very end. An alternate procedure will be, when the plunger has completed its extrusion stroke, to separate the rolls and then carry the article under treatment forward, beyond the roll-pass, either by a further forward movement of plunger 3 or otherwise. In such case there will remain on the rear of the fabricated article a butt-end, to be cut away. Retraction of the plunger and adjustment of the rolls (if necessary) prepares the machine for another operation.

It will be observed of the operation now described that in it the material under treatment is subjected to simultaneously acting processes of extrusion and rolling: that is to say, as extrusion progresses, the contact of material with the walls of the orifice is on both sides a rolling contact.

When the rolls are shaped as is shown in Figs. 3 and 4, coincidently with extrusion an operation of cutting is in progress, in which overlapping complementary edges of the two rolls are progressively shearing the

material under treatment, so that from a single blank a plurality of fabricated articles is produced. And it will be observed that the strains which effect subdivision of the material under treatment are not strains directly opposed to the force applied to effect extrusion, but rather it is the force applied to effect extrusion which, acting to turn the rolls, directly accomplishes the shearing. The metal is not subjected to violent internal strains, tension and tearing.

I claim as my invention:

1. The method herein described of shaping a body of metal in solid state which consists in driving the body of metal by pressure applied to it in the rear between opposite forming surfaces both of which advance as the metal advances.

2. The method herein described of shaping a body of metal while in solid state which consists in driving the body of metal by pressure from behind forward between opposite roll surfaces while such body is restrained from lateral spread.

3. The method herein described of shaping a body of metal which consists in subjecting the metal when in solid state simultaneously to operations of extrusion and of rolling between opposite roll surfaces.

4. The method herein described of shaping a body of metal which consists in subjecting it when in solid state to simultaneous and progressive operations of subdivision and reduction in one direction.

5. The method herein described of shaping a body of metal which consists in subjecting it when in solid state to simultaneous and progressive operations of shearing and reduction in one direction.

6. In a metal-extrusion apparatus the combination of a pair of rolls forming by their spacing an unobstructed extrusion orifice, and means for exerting extrusion pressure upon a body of metal fed to the pass between said rolls.

7. In a metal-extrusion apparatus the combination of a pair of rolls geared to rotate in unison and in opposite directions and forming by their spacing an extrusion orifice, and means for exerting extrusion pressure upon a body of metal fed to the pass between said rolls.

8. In a metal extrusion apparatus the combination of a pair of rolls geared to rotate in unison and forming by their spacing an extrusion orifice, means for rotating the said rolls, and means for exerting extrusion pressure upon a body of metal fed to the pass between said rolls.

9. In a metal-extrusion apparatus the combination of a pair of rolls forming by their normal spacing an extrusion orifice, the said rolls being relatively movable to increase and diminish the space between them, and means for exerting extrusion pressure upon a body of metal fed to the pass between said rolls.

10. In a metal-extrusion apparatus the combination of a pair of oppositely grooved rolls forming by their spacing a plurality of extrusion orifices, and means for exerting extrusion pressure upon a body of metal fed to the pass between said rolls.

11. In a metal extrusion apparatus the combination of a pair of rolls oppositely grooved with vertically walled grooves and intervening vertically walled bands, forming by their arrangement and spacing a plurality of extrusion orifices, the opposite faces of groove and band coöperating as metal-spreading parts and the opposite vertical walls of groove and band coöperating as metal-shearing parts, and means for exerting extrusion pressure upon a body of metal applied to the roll-pass between said rolls.

12. In a metal-extrusion apparatus the combination of a container, a pair of rolls arranged at one end of said container and forming by their spacing one from another an unobstructed extrusion orifice, and means for exerting extrusion pressure upon a body of metal within the said container.

13. In a metal-extrusion apparatus the combination of a container, a pair of oppositely grooved and banded rolls arranged at one end of said container and forming by their spacing one from another a plurality of extrusion orifices for said container, and means for exerting extrusion pressure upon a body of metal within said container.

14. In a metal-extrusion apparatus the combination of a container, a pair of rolls arranged at one end of said container and forming by their spacing one from another an unobstructed extrusion orifice, a plunger movable longitudinally in said chamber, and means for driving said plunger.

15. In a metal-extrusion apparatus the combination of a container, a pair of rolls arranged at one end of said container and forming by their normal spacing an extrusion orifice for said chamber, the said rolls being relatively movable to increase and diminish the space between them, a plunger movable longitudinally throughout said chamber and beyond the pass between said rolls, and means for driving said plunger.

In testimony whereof I have hereunto set my hand.

LLOYD JONES.

Witnesses:

BAYARD H. CHRISTY,

FRANCIS J. TOMASSON.

Correction in Letters Patent No. 1,199,080.

It is hereby certified that in Letters Patent No. 1,199,080, granted September 26, 1916, upon the application of Lloyd Jones, of Wilkinsburg, Pennsylvania, for an improvement in "Extrusion of Metal Bodies," an error appears requiring correction as follows: In the drawings, Sheets 1 and 2, headings, title of invention, for "Extension of Metal Bodies" read *Extrusion of Metal Bodies;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 24th day of October, A. D., 1916.

[SEAL.]

F. W. H. CLAY,

Acting Commissioner of Patents.