No. 896,683. PATENTED AUG. 18, 1908.

G. H. BENJAMIN.

ART OF EXTRUDING METALS.

APPLICATION FILED JUNE 9, 1906.

2 SHEETS—SHEET 1.

FIG. 1.

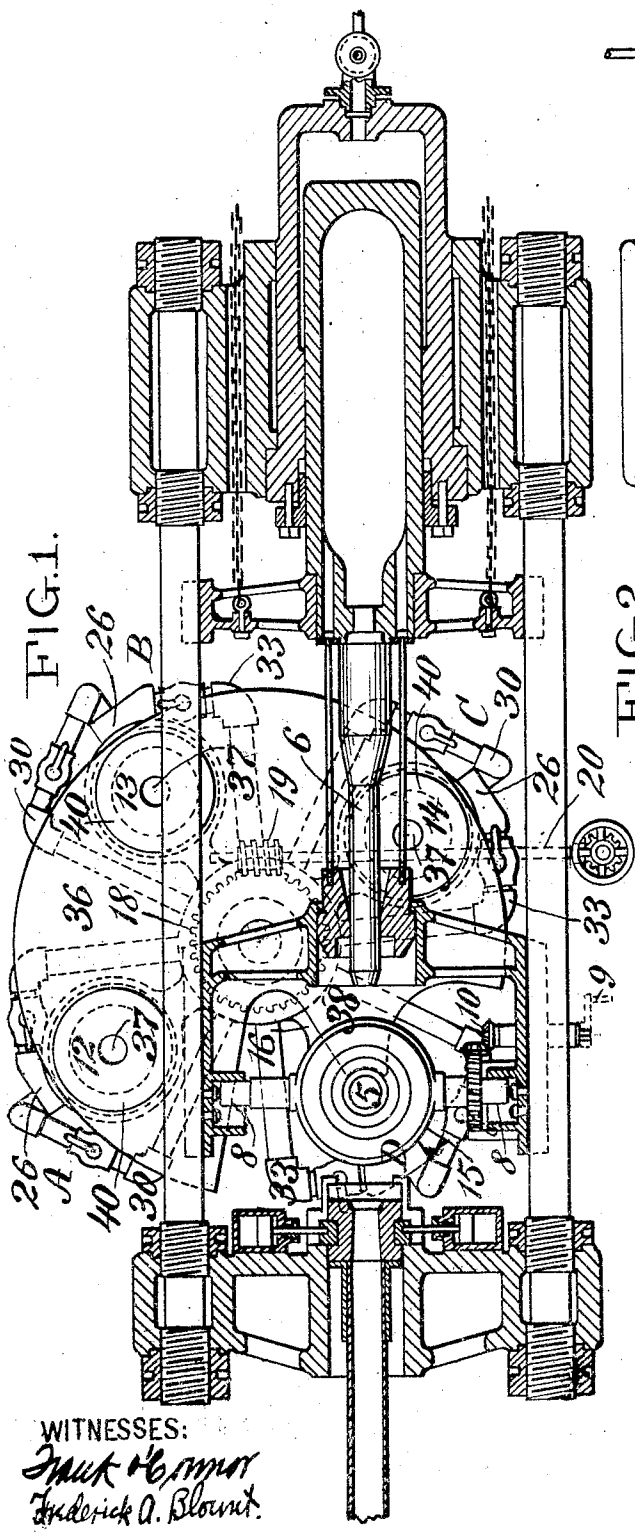
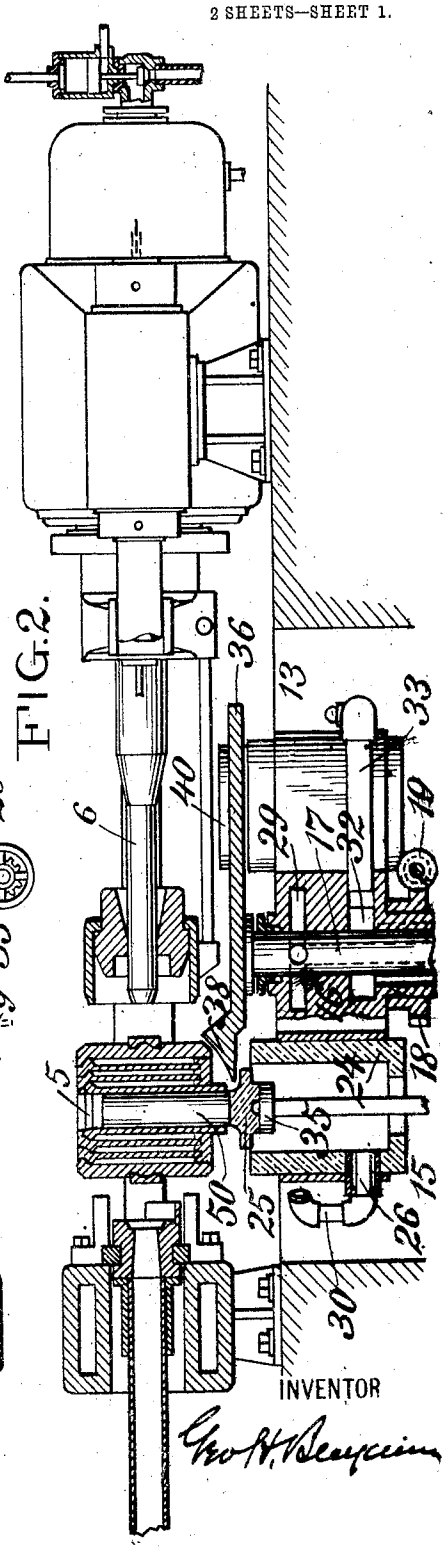


FIG. 2.



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2 SHEETS—SHEET 2.

FIG. 3.

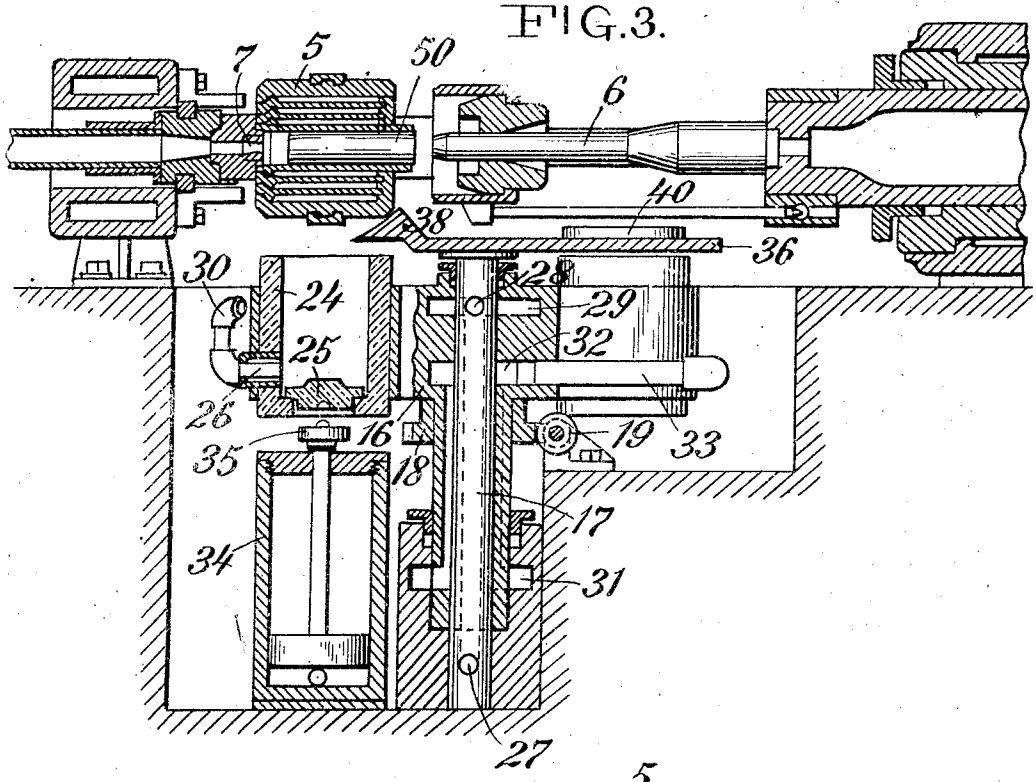
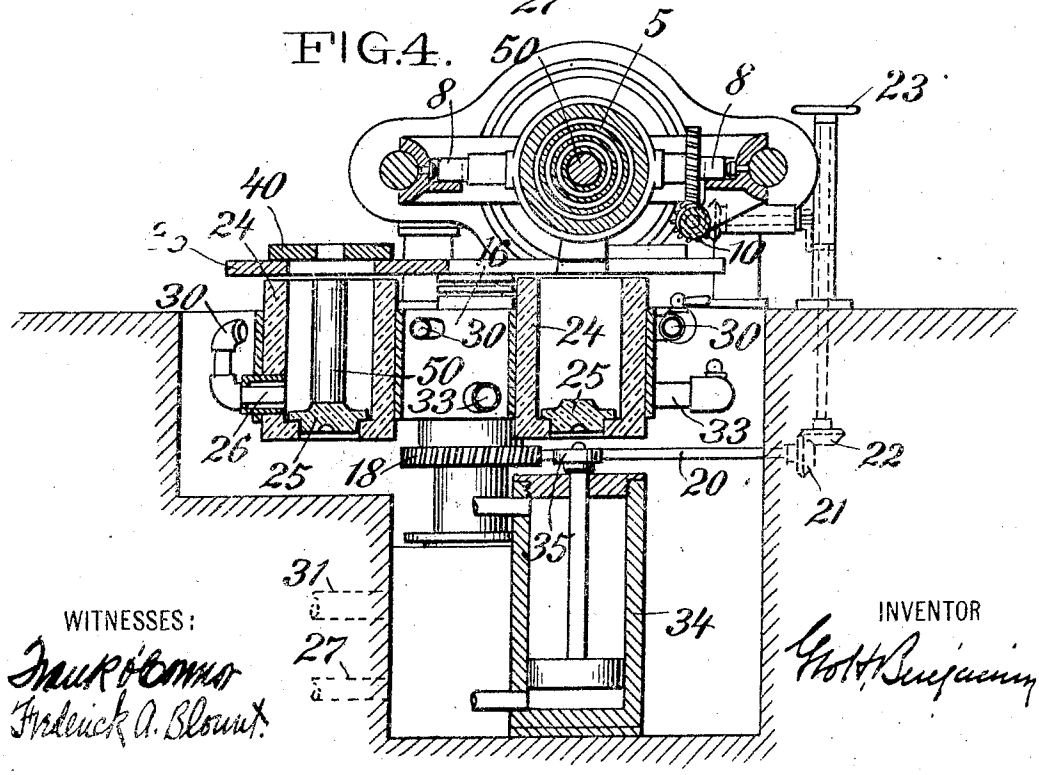


FIG. 4.



WITNESSES:

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UNITED STATES PATENT OFFICE.

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ART OF EXTRUDING METALS.

No. 896,683. Specification of Letters Patent. Patented Aug. 18, 1908.

Application filed June 9, 1906. Serial No. 321,049.

To all whom it may concern:

Be it known that I, GEORGE HILLARD BENJAMIN, a citizen of the United States, residing in the city, county, and State of New York, have invented an Improvement in the Art of Extruding Metals, of which the following is a specification.

My invention relates to an improvement in the art of extruding metals and consists in the mode of operation described herein.

Heretofore it has been found practically impossible to extrude certain metals and metallic alloys, owing to the fact that they can be extruded only when at certain definite temperatures, and that it has been found impossible to raise these bodies to the required temperature and maintain them at such temperature during the length of time necessary to convey them from the heating furnace to the extrusion machine and during the act of extrusion. This difficulty I have overcome by the mode of operation and apparatus which I will now proceed to describe.

Considered broadly, my invention consists in first heating the billet to be extruded, then introducing such billet into the container without exposing it to the cooling action of the atmosphere, and finally pushing the billet through the die of the container.

The accompanying drawings will serve to illustrate such apparatus as I may employ, in which

Figure 1, is a plan view partially in section; Fig. 2, a partial elevation and vertical section, showing the container in the receiving position with the billet to be extruded within the container; Fig. 3, is a similar view, showing the container in the extruding position, with the billet in the position to be acted on by the ram. Fig. 4, is a transverse section of Fig. 1.

The extrusion machine shown in the drawings is that disclosed in U. S. Patent No. 819,261, granted to W. A. Wood, May 1, 1906, and consists essentially of the following parts: A container, 5, a hydraulic ram 6, and a die 7.

The particular form or construction of extrusion machine is immaterial. Different forms exist, and they all may be used. It is only necessary that the container should be mounted upon trunnions 8, and means be provided, such as a crank 9, and gears 10, for changing the position of the container from horizontal, as shown in Fig. 3, to vertical, as shown in Fig. 2, or preferably to provide for complete rotation of the cylinder for the purpose which will be hereinafter described.

The billets to be extruded I prefer to heat progressively, *i. e.*, as they are carried towards the extrusion machine, and to accomplish this result I provide a rotary heating apparatus. This apparatus consists essentially of a series of furnaces 12, 13, 14 and 15, supported upon a spider 16, mounted to rotate around a cylindrical tubular bearing 17. Means is provided for rotating the spider, which consists of a gear 18, worm 19, shaft 20, bevel gears 21, 22, a hand wheel 23. Of course, any other suitable means may be provided for rotating the furnaces.

Each of the furnaces 12, 13, 14 and 15 consists of a tubular casing 24, lined with firebrick, and provided with a movable bottom 25. These furnaces are provided with burners 26, through which gas and air may be admitted and subsequently ignited within the furnace. Preferably a non-oxidizing flame is employed. The bearing 17 is hollow and through it the gas is carried, being introduced through an opening 27, and emitted through an opening 28, into a channel 29, communicating with a pipe 30. The air is introduced through a channel 31, surrounding the shaft of the spider, and is emitted into a channel 32, communicating with a pipe 33. It will be observed that the pipes 30 and 33 combine, as is usual, to form the burners 26.

Situated under the container 5 is a hydraulic cylinder 34, the piston of which has an external member 35, adapted to coöperate with the movable bottom 25 of the furnaces as they are rotated over the cylinder 34.

The furnaces 12, 13, 14 and 15 are shown as open at the top, and covering three of these furnaces is a disk screen 36, provided with openings 37. This screen has a projection 38, which co-acts with the container 5, when the container is rotated from the vertical to the horizontal position, and serves to prevent the heated billet from slipping out of the container during the act of changing from one position to the other. Situated over the screen 36 are covers 40 for the furnaces. Above the disk 36, and between it and the extrusion machine, there might be placed a hood for carrying away the products of com-

bustion from the furnaces, but owing to the fact that the combustion in these furnaces is perfectly controllable, such a hood is not essential.

In the drawings I have shown four furnaces. I do not limit myself to the number of furnaces, nor do I limit myself in anywise to the construction disclosed, as manifestly it may be very considerably varied without departing from the intent of my invention.

The mode of operation which I employ is as follows: The billet 50, to be extruded, is inserted into the furnace 12 at the position marked "A", and the flame turned into the furnace. After a time the furnace 12 is rotated to the position marked "B", then to the position marked "C", then to the position marked "D". When the furnace 12 is in the "D" position, the container is moved from the horizontal to the vertical position, *i. e.*, from the position of Fig. 3 to the position of Fig. 2. The hydraulic cylinder 34 is then operated, with the effect that its member 35 moves under the movable bottom 25 and lifts the billet into the cavity of the container 5. Immediately, the container is rotated to the position shown in Fig. 3, and the container and die 7 adjusted relative to each other. The ram 6 is then driven into the container and against the billet to push the billet through the die 7. Immediately afterwards, the ram is withdrawn and the furnace 15, which has followed the movement of the furnace 12, brought under the container 5 and the action repeated. It sometimes happens that the end of a billet sticks in the forward end of the container, in which case it is necessary to remove it. Its removal can be facilitated by reversely rotating the container 5, so that its forward end shall lie over an empty furnace with the flame in full play in the furnace. The heat from the furnace is sufficient to melt the material in the container, so that it may be readily removed.

In the case of alloys, as for instance, certain zinc alloys, which are friable above and below their extruding temperature, I heat the billet to a temperature above that at which it can be extruded, that is, the billet is progressively heated in the furnaces 12, 13, 14 and 15, or in one of them, as for instance, the furnace 12, into which the billet may be inserted when said furnace is in the location designated by A. As the furnace 12 is stepped around from the position A to position B, to position C and to position D, the billet may be progressively heated or it may be progressively heated throughout any portion of the movement of the furnace 12. I then reduce the temperature of the billet when the furnace occupies the position D, no heat being turned on, to an extrudable condition, after which the billet is introduced directly into the container without exposing it to the atmosphere, and then subjected to pressure to drive it through the die. Of course, the temperature of the billet might be reduced when the furnace was in some other position than that indicated by D, as, for instance, when at C, or when passing from C to D and at D.

The construction of my furnaces 12, 13, 14, and 15 is such that I may regulate the character of the atmosphere therein. When heating billets of certain metals and alloys, it is very desirable to maintain a reducing or a non-oxidizing atmosphere within the furnace, so as to prevent oxidation. As the billet may be inserted directly into the container from the furnace containing a reducing atmosphere, I avoid exposing it to the atmosphere, that is, atmospheric air, which would have a tendency to oxidize the billet. The non-oxidizing atmosphere of the furnace displaces atmospheric air in the immediate vicinity of the mouth of the furnace, as is readily understood, and by my process I avoid exposing the heated billet to the influence of an oxidizing atmosphere.

Having thus described my invention, I claim:

1. An improvement in the art of extruding metals which consists in raising the billet to a definite temperature, introducing it into a container without exposing it to the atmosphere, and finally subjecting it to pressure to force it through a die.

2. An improvement in the art of extruding metals which consists in exposing the billet to heat until it is in an extrudable condition, introducing it into the container without exposing it to the atmosphere, and finally subjecting it to pressure to force it through a die.

3. An improvement in the art of extruding metals which consists in subjecting the billet to the influence of heat and a non-oxidizing atmosphere until it is in an extrudable condition, introducing it into a container without exposing it to the atmosphere, and finally subjecting it to pressure to force it through a die.

4. An improvement in the art of extruding metals which consists in first heating the billet to a temperature above that at which it can be extruded, then reducing the temperature to bring it to an extrudable condition, then introducing the billet into a container without exposing it to the atmosphere, and then subjecting it to pressure to drive the billet through a die.

5. An improvement in the art of extruding metals which consists in heating the billet while advancing it toward the container, then introducing it quickly into the container, and then subjecting it to pressure to drive the billet through a die.

6. An improvement in the art of extruding metals which consists in heating the billet to the extruding temperature, and maintaining it at such temperature until extruded.

7. An improvement in the art of extruding metals which consists in heating the billet in a non-oxidizing atmosphere to an extruding temperature, and practically maintaining such temperature while extruding.

8. An improvement in the art of extruding metals which consists in subjecting the billet to a regulatable temperature to heat it to the extruding temperature, and maintaining said billet at the extruding temperature until extruded.

9. An improvement in the art of extruding metals which consists in subjecting the billet to a high temperature, thereby heating it until it is in a friable condition, then gradually cooling it until it is in an extrudable condition, and maintaining it at approximately such temperature until extruded.

10. An improvement in the art of extruding metals or metallic alloys, volatile at a high temperature, which consists in applying heat until such a body is in an extrudable condition, then introducing such body into a container without exposing it to the atmosphere, and immediately subjecting it to pressure to force the body through a die.

In testimony whereof, I affix my signature, in the presence of two witnesses.

GEORGE HILLARD BENJAMIN.

Witnesses:

FRANK O'CONNOR,

M. G. CRAWFORD.