G. MELLEN.

PROCESS FOR MAKING EXTRUDED ARTICLES OF METAL OR OTHER MATERIAL.

APPLICATION FILED APR. 20, 1912.

1,092,934. Patented Apr. 14, 1914.

Fig. 2.

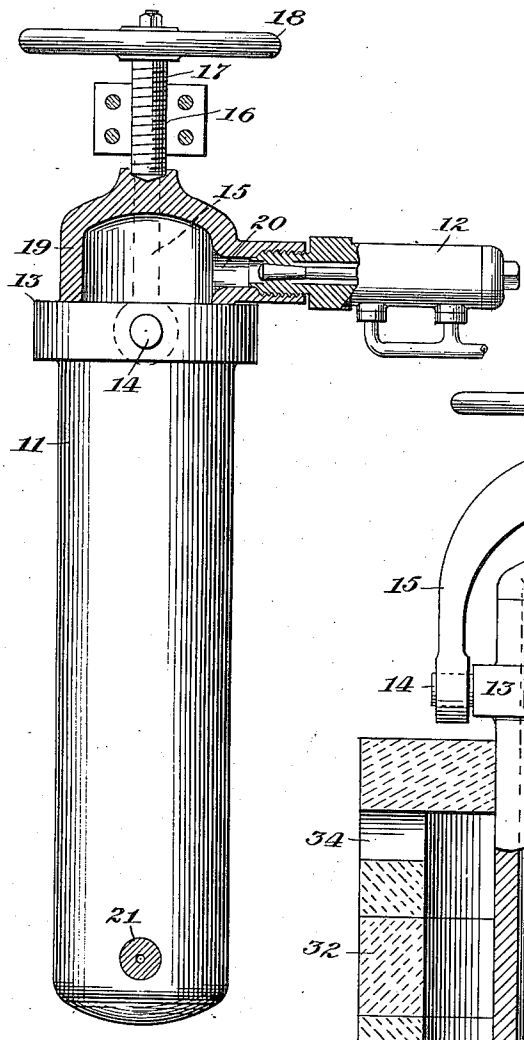


Fig. 3.

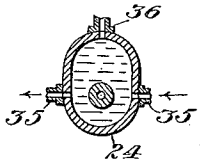


Fig. 4.

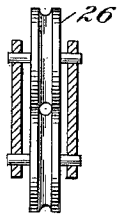


Fig. 1.

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UNITED STATES PATENT OFFICE.

GRENVILLE MELLEN, OF EAST ORANGE, NEW JERSEY, ASSIGNOR OF ONE-HALF TO UNITED ALUMINUM INGOT COMPANY, A CORPORATION OF NEW YORK.

PROCESS FOR MAKING EXTRUDED ARTICLES OF METAL OR OTHER MATERIAL.

1,092,934. Specification of Letters Patent. Patented Apr. 14, 1914.

Application filed April 20, 1912. Serial No. 692,151.

To all whom it may concern:

Be it known that I, GRENVILLE MELLEN, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Processes for Making Extruded Articles of Metal or other Material, of which the following is a specification.

My invention relates to a method of producing articles, such as plates, rods, angle bars, tubes, wire, and similar products, which may be made from molten metal or other fluid or plastic material, contained in a receptacle and extruded through a die, the metal or other material congealing within the passage constituting the die, and being continuously removed therefrom; additional metal or plastic material being added to the receptacle from time to time, to permit the formation of articles of great length when desired.

The annexed drawing illustrates an apparatus for carrying out my invention, in which—

Figure 1 illustrates, partly in section, the crucible mounted in the furnace body, with the die and rolls; Fig. 2 illustrates a view at right angles to Fig. 1, partly in section, showing the crucible and feeding device attached to the cap; Fig. 3 illustrates a water-cooled die; and Fig. 4 illustrates a pair of finishing rolls.

In the illustrations, a crucible 11 made of a metal that will sustain a sufficiently high pressure when heated sufficiently to keep molten the metal or alloy used in forming the extruded products, is removably placed within a furnace 29, the lower end of the crucible projecting through the bottom of the furnace, as shown. The crucible should be made from such metal as high-speed tool steels, such as the tungsten steels, which are especially adapted to this use; although other metals or alloys having the property of sustaining high pressures when at, or above, a red heat, are also applicable. At the top of the crucible is a collar 13 having trunnions 14 on either side; mounted on the trunnions is a brace 15 having a threaded hole 16 in the upper part; coöperating with the brace is a pressure-screw 17 attached to a handle 18, and which can be turned to exert pressure against a removable cap 19 covering the opening to the crucible 11. The cap 19 is provided with an opening 20 at which is attached an automatic feeding device 12 to supply a material, such as water, oil, etc., adapted to expand and exert pressure against the surface of the molten metal, forcing it through a die at the base of the crucible. The automatic feeding device preferably used is the subject-matter of my application Serial Number 692,150, filed April 20, 1912, and serves to maintain a constant gaseous pressure within the crucible. At the base of the crucible is an opening 21 into which is inserted a removable die 22, the bore 23 of which is of the shape to produce the metal article desired. Surrounding the die is a water-jacket 24 provided with openings for the entrance and exit of water, and also may be provided with means to carry off steam should its formation endanger the safety of the die. Adjacent the orifice of the die are finishing rolls 26 which join each other tightly and serve to compress the extruded metal into a dense body, without leaving a web of metal on the sides of the wire or rod. The lower part of the crucible is surrounded by a supporting ring 27 which rests upon a suitable base-plate 28.

Surrounding the crucible is a suitable furnace 29, having a flame passage 30, which is closed by a door 31, through which may project any suitable oil or gas burner; or the flame passage may be connected to a coal burning fire-box, and heated with coal. The furnace is lined with suitable refractory fire-brick 32. Above the supporting ring 27 is a row of fire-brick 33 which can be removed to permit the removal of the crucible 11 when desired.

At 34 is an outlet for the products of combustion.

The exposed parts of the crucible are suitably covered with asbestos or the like to prevent heat losses.

The water-cooled die, shown in Fig. 3, is preferably made with the water-jacket elliptical, having the die at the lower focus, and water entrance and exit pipes 35 opposite the horizontal axis of the die. This arrangement gives a large water space above

the die to allow for the accumulation of any steam; a pipe 36 may also be provided to conduct off steam, if formed.

The rolls shown in Fig. 4 are the usual metal-finishing rolls used in rolling rod, pipe, etc., and adjusted so that the rolls press very tightly against each other, giving a finished appearance, and without leaving a web, on the article produced.

The process for making the extruded metal or material is conducted as follows: The furnace is heated to a temperature sufficient to maintain the metal in a fluid state, molten metal is poured in the crucible at the top, and the cap placed on and clamped tightly against the collar by means of the screw 17. The brace 15 being mounted on trunnions, may be swung to one side while filling the crucible. The feeding device is now attached to the cap 19 at its opening 20, and water or other suitable fluid from any suitable source and under sufficient pressure to force the metal through the die is admitted through the feeding device. The heat of the crucible and its contents converts the fluid into vapor, which fills the space above the molten metal; and when the vapor-pressure within the crucible exceeds the fluid-pressure, the feeding-device automatically shuts off the fluid-supply until the vapor pressure within the crucible is below that of the fluid, when the feeding-device automatically admits more fluid, thus forming more vapor; when the pressure of the latter exceeds that of the fluid, the feeding-device automatically closes the supply until the pressure is again reduced. By this method, the vapor-pressure within the crucible is maintained practically constant.

Since some molten metals react with steam, forming an oxid and separating hydrogen, I may substitute for water an oil which volatilizes without decomposition; or I may add a readily fusible flux to the crucible which will cover the surface of the metal and protect it from oxidation. The oil vapor would reduce some metallic oxids, and serve to keep the metal clean; the layer of flux would combine with, or absorb, any oxids on the surface of the metal and serve to purify it. A reducing flux, such as potassium cyanid, would serve both purposes with some metals.

The pressure of the steam within the crucible forces the metal through the die 22 wherein it is solidified by the cooling action of the water-jacket. After leaving the die, the article produced, such as plate, rod, angle bar, tube, wire, etc., depending upon the die used, is passed through the finishing rolls 26, wherein it is compressed to a dense body, and the surface of the article given a finished appearance. These rolls have an opening preferably smaller than the opening in the die, and are so perfectly adjusted as not to leave any seam upon the metal showing the place of contact of the rolls.

The heated water from the water-jacket surrounding the die may, if desired, be used in the automatic feeding device and injected into the crucible, thus reducing, to some extent, the quantity of heat which would be absorbed from the crucible and its contents.

After the process has been properly started, very little fuel is required to continue the operation.

In the claims, the expressions "gaseous state", "gaseous pressure", and "gas pressure" are intended to describe vaporized oil, or steam, or any other vapor, or gas, or volatilized liquid, that may be used in this process. So, also, the term "molten" is intended to include the conditions of semi-fluid, plastic, flowing, etc., through which metals and other materials pass on heating.

I claim:—

1. The process of forming extruded products, comprising maintaining a material molten in a closed chamber, injecting a liquid under pressure into the chamber above the molten material, expanding the liquid to a gas, maintaining the gas under substantially constant pressure, and pressing the molten material through a die by the compressed gas.

2. The process of forming extruded products, comprising maintaining a material molten in a closed chamber, injecting water under pressure into the chamber above the molten material, expanding the water to steam, maintaining the steam under substantially constant pressure and pressing the molten material through a die by the compressed steam.

3. The process of forming extruded products, comprising maintaining a material molten in a closed chamber, injecting water under pressure into the chamber above the molten material, expanding the water to steam, maintaining the steam under substantially the same pressure as the water, and pressing the molten material through a die by the compressed steam.

4. The process of forming extruded metal products, comprising maintaining a material molten in a closed chamber, protecting the metal from oxidation by a covering of flux, injecting into the chamber above the metal a liquid under sufficient pressure to press the molten metal through a die, expanding the liquid to a compressed gas, maintaining the gas pressure substantially equal to the liquid pressure, pressing the molten metal through a die by the compressed gas, and solidifying the metal in the die.

5. The process of forming extruded metal products, comprising maintaining a metal molten in a closed chamber, injecting into

the chamber above the metal water under sufficient pressure to press the molten metal through a die, expanding the water to steam under pressure by the heat of the chamber and the molten metal, pressing the molten metal through a die by the compressed steam while maintaining the steam pressure substantially the same as that of the water pressure, and solidifying the molten metal as it passes through the die.

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

GRENVILLE MELLEN.

Witnesses:

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