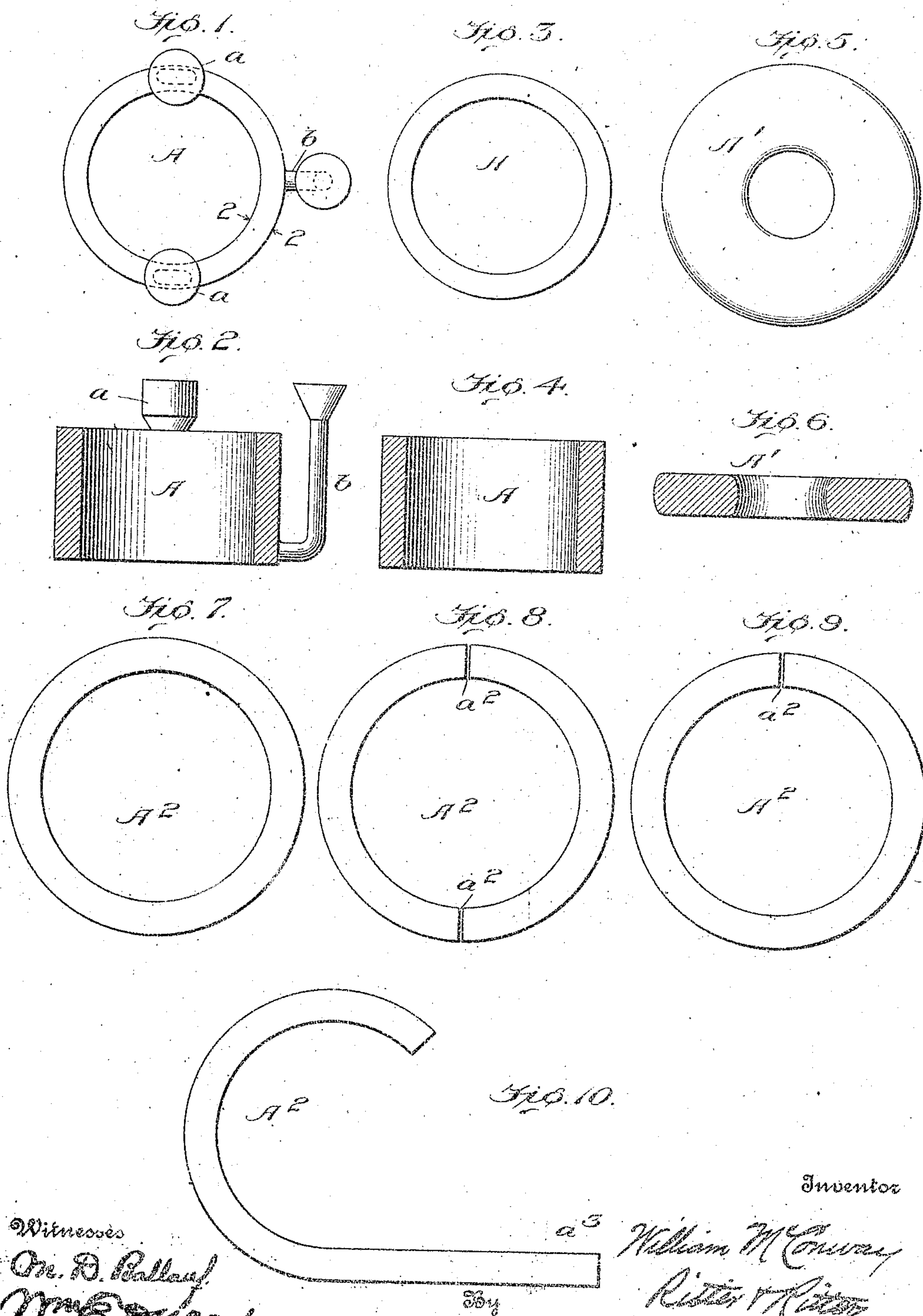


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METHOD OF PRODUCING STEEL BARS AND PLATES.
APPLICATION FILED FEB. 17, 1911.

994,326.

Patented June 6, 1911.



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METHOD OF PRODUCING STEEL BARS AND PLATES.

994,326.

Specification of Letters Patent.

Patented June 6, 1911.

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To all whom it may concern:

Be it known that I, WILLIAM McCONWAY, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Producing Steel Bars and Plates; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a method of producing steel bars and plates devoid of piping, of uniform quality throughout and in an economical manner.

Heretofore in the manufacture of steel bar and plate the usual method has involved the casting of a steel ingot of such cross sectional area and shape as when elongated by forging and rolling the ingot will produce a bar or plate of the desired length and cross sectional area. These ingots are usually square or rectangular in cross section and of such dimensions that in cooling the metal draws from the center of the ingot toward the surface forming what is technically known as a "pipe" resulting in defects that require the rejection of a considerable portion of the ingot, and furthermore the lack of uniformity in the cooling or setting of the molten metal throughout the mass results in the segregation of the steel elements which causes different parts of the ingot to vary in quality.

From an ingot of square or rectangular cross section and of the required length, said ingot produced in the manner hereinbefore specified, the piped or defective portion is either first cut off, or from the ingot elongated in the rolls there is removed that portion found to be defective from the same cause. This, usual, method of producing steel bar and plate, results first in a material loss from the ingot which greatly adds to the cost of manufacture, and second gives rise to a constantly existing uncertainty as to whether or not the metal in the bar or plate is of uniform quality throughout, or up to sample.

To overcome the loss incident to, and the defects in the bar or plate resulting from the present practice of producing steel bar and plate is the object of my present invention.

To this end, my invention taken as a whole, and generally stated consists in first

casting an annular ingot of attenuated section, that is to say of a thickness which will permit the quick and uniform setting of the molten metal throughout the mass whereby piping within the ingot is avoided; secondly, transforming the ingot by pressure which increases one dimension and diminishes another dimension of the ingot, third, rolling the annulus or blank thus produced to increase its diameter and reduce its cross section; and finally dividing the rolled annulus to form a billet, so that the same or the sections thereof may be subjected to rolling in the usual plate or bar mills for the production of the ultimate plate or bar.

In the drawings chosen for the purpose of illustrating my invention, Figure 1 is a plan view of an annular steel ingot, adapted for the purposes of my invention, as it comes from the mold with the sprue and sinking heads attached; Fig. 2 is a section of the annular ingot as it comes from the mold; Fig. 3 is a plan view of the ingot with the sprue and sinking heads removed; Fig. 4 is a sectional view of the ingot shown in plan in Fig. 3; Fig. 5 is a plan view of the annular ingot after it has been subjected to pressure to increase its diameter and decrease its length; Fig. 6 is a sectional view of the ingot shown in Fig. 5; Fig. 7 is a plan view of the annular ingot shown in Figs. 5 and 6 after it has been subjected to rolling to increase its diameter and decrease its cross section; Fig. 8 is a plan view of the annulus shown in Fig. 7 divided into a plurality of sections for final rolling; Fig. 9 is a plan view of the annulus shown in Fig. 7 cut at a single point to enable it to be opened out for final rolling, and Fig. 10 is a plan view of the annulus shown in Fig. 9 after it has been opened out to enable one end thereof to be introduced into the bar or plate rolls.

Like symbols refer to like parts wherever they occur.

I will now proceed to describe my invention more fully so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates an annular cast steel ingot illustrative of the first step followed in carrying out my invention, with the sinking heads *a* and the spruce *b* attached thereto as when withdrawn from the mold. The main point to be attended to in producing this annular casting is to see that

the same has what I term an "attenuated" section, that is to say, the cross section or thickness of the ingot, as at 2—2, is such that a quick and uniform setting or congelation of the molten metal throughout the mass will ensue, or in other words, the radiating surface of the casting is so proportioned to the thickness and total weight of the molten mass that no portion of the mass remains fluid long enough to be drawn to another portion of the mass, as would occur if one part solidified materially earlier than another. As a result of this step of my process "piping" in the ingot is avoided, and a uniform quality of metal is obtained throughout the mass.

Sinking heads a may or may not be employed in casting the hollow steel ingot A, and this will be measurably determined by the dimensions of the ingot, as it is well understood by those skilled in the art that in large castings the use of sinking heads to compensate for shrinkage of the mass in cooling will insure greater solidity in the casting, and furthermore "piping," if any occurs, will take place in the sinking heads with a resultant minimum of loss. Having thus obtained a hollow cast steel ingot A of attenuated section, and of the required length to give the desired dimensions when reduced to bar or plate form, said ingot is transformed by pressure, preferably hydrostatic pressure, so as to diminish the length and increase the diameter thereof. This operation will result, in the case of the annular ingot A, in the production of an annular blank A', wherein the metal of the mass has been displaced laterally or radially both inwardly and outwardly from the center of the ingot, and is in the best condition for the

operation of rolls in the subsequent reduction of the blank. The blank A' is then subjected in its annular form to the operation of rolls which increase the diameter of the annulus and reduce its cross section to the dimensions required for submission to the rolls of a bar or plate mill as the case may be, as indicated at A², after which the rolled annulus A² is cut at one or more points a^2 , and the single billet or the several sections thereof are reduced to ultimate bar or plate form in suitable mills. In case of a single section of the rolled annulus A², as shown in Fig. 9, the blank may be opened out as indicated at a^2 , Fig. 10, to enable the end of the billet to be entered in the bar or plate rolls.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

An improvement in the method of manufacturing steel bars and plates, which consists in producing a hollow ingot of attenuated section to permit quick and uniform setting of the molten mass, transforming said ingot by pressure which increases the diameter and reduces the length thereof, rolling the annular blank thus produced to increase the diameter and reduce the cross section thereof, and finally severing the annular rolled blank and submitting the billet or billets obtained to rolling in suitable mills to produce the ultimate bar or plate.

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

WILLIAM McCONWAY.

Witnesses:

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