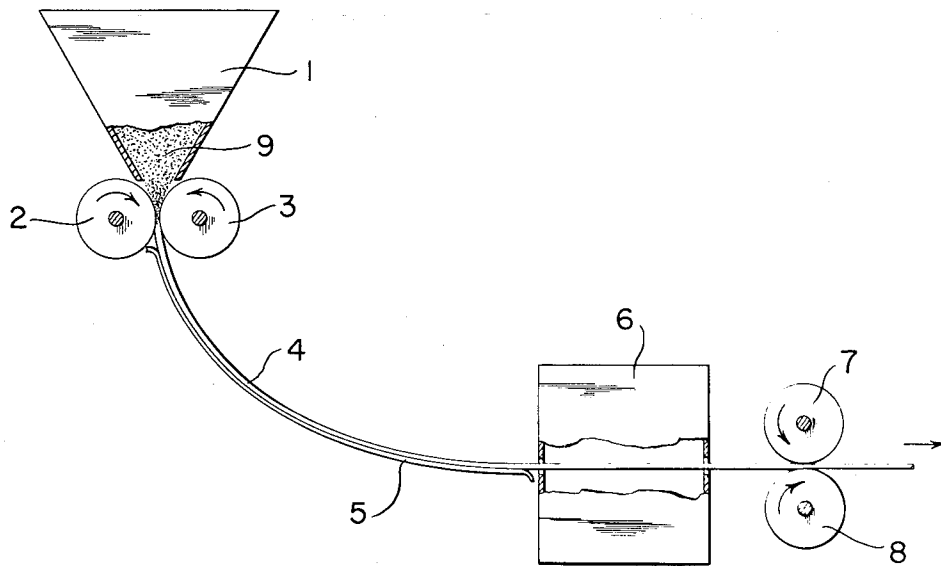


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G. NAESER
APPARATUS FOR THE PRODUCTION OF WROUGHT
METAL SHAPES FROM METAL POWDER
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INVENTOR.

Gerhard Naeser

BY *James Edmund Martin*
Barrows and Taylor

ATTORNEYS

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APPARATUS FOR THE PRODUCTION OF WROUGHT METAL SHAPES FROM METAL POWDER

Gerhard Naeser, Duisburg-Huckingen, Germany, assignor to Mannesmann Aktiengesellschaft, Dusseldorf, Germany, a German company

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2 Claims. (Cl. 266—5)

This invention relates to an apparatus for the compression of metal powders into wrought metal shapes such as strips, rods, wires, sheets, and the like. More particularly, the invention relates to a rolling mill for more completely densifying a wrought metal article after it has been initially compacted into a wrought metal shape from metal powder and after it has been subjected to at least one sintering treatment.

According to the present invention, metal powder is compressed into wrought metal shapes by introducing the metal powder into a roll gap formed by laterally spaced, oppositely disposed pressure rolls. The roll gap may be so regulated as to produce the metal shape of substantially the cross section desired. As the metal powder passes through the roll gap, it is subjected to pressure sufficient to cause the metal powder particles to cohere. After this initial compaction of the metal powder, the wrought metal article resulting is then subjected to a sintering treatment in order to increase the strength and ductility of the compacted article. Thereafter the wrought metal article is further rolled, either hot or cold, to effect a further densification thereof.

I have found that the metal strip or sheet when subjected to a further rolling operation, either hot or cold, to effect this further densification, after the metal powder has been initially compacted and subjected to a sintering treatment, that the subsequent rolling thereof when using a normal rolling mill with a small roll diameter the strip or sheet is very apt to develop cracks. Metal strips or sheets which have previously been rolled from metal powder and subjected to a sintering treatment, cannot be densified to any great extent with such a normal rolling mill in which the rolls have a small diameter in relation to the thickness of the strip or sheet being produced. In order to gain sufficient densification with the use of such a normal rolling mill, it is necessary to first anneal the strip or sheet, and only then can it be further rolled to effect sufficient densification.

I have found that this drawback may be obviated by setting up a rolling mill after the initial compaction of the metal powder and after the sintering furnace with rolls in which the diameter of the rolls is at least 50 times and preferably 100 to 1,000 times as great as the thickness of the strip or sheet being rolled. By using such rolls for further densifying wrought metal articles, which have been initially compacted from metal powder and sintered, it is possible to further densify such wrought metal articles to a much greater extent without the formation of cracks than was heretofore possible. I have rolled a porous sintered iron strip of 40 x 5 mm. in one cold pass down to 40 x 2 mm. by using pressure rolls 40 mm. wide and with a diameter of 1,010 mm. without causing cracks to form therein.

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Thus by using rolls having a diameter of at least 50 times the thickness of the rolled product, the article can be densified to the extent of 70 per cent in one pass through the rolls without causing the formation of cracks.

5 With a normal rolling mill, however, I have found that the article cannot be densified much beyond 20 per cent without forming cracks in the article being rolled. Thus it is possible to convert a porous once-sintered article directly by one pass into an article having a normal density.

10 For a more detailed description of the invention, reference may be had to the drawing which shows one modification of a rolling mill constructed in accordance with the present invention.

Referring to the drawing, the metal powder 9 is first deposited in a hopper 1 for feeding the metal powder into a roll gap formed by the pressure rolls 2 and 3. As shown, the hopper 1 is seated partially down into the roll gap formed by the rolls 2 and 3 to facilitate guiding the metal powder between the rolls. A porous metal strip 4 is shown exuding from between the rolls 2 and 3 onto a guide member 5 which guides the porous metal strip 4 into a suitable sintering furnace 6. After the porous metal strip 4 has been sintered, it is then passed through another rolling mill comprising pressure rolls 7 and 8 to subject the porous sintered strip to further densification. As has hereinbefore been pointed out, the pressure rolls 7 and 8 must have a diameter of at least 50 times and preferably 100 to 1,000 times as great as the thickness of the strip 4 being rolled. The diameter of the rolls 7 and 8, however, must not exceed 1,000 times the thickness of the strip.

Many types of metal powder such as copper, nickel, cobalt, lead, iron and the like, may be rolled with the rolling mill of the present invention. Alloys of metals may also be produced by employing mixtures of metal powders.

I claim:

1. An apparatus for rolling and further consolidating metal articles originally partially consolidated from a metal powder and subsequently sintered, comprising oppositely disposed, laterally spaced pressure rolls forming a roll gap having a diameter of at least 50 and not more than 1,000 times the thickness of the metal product being rolled, for effecting a further consolidation of the originally consolidated metal article.

2. An apparatus for the production of wrought metal shapes from metal powder comprising a first set of oppositely disposed, laterally spaced pressure rolls defining a roll gap, means for introducing metal powder into the roll gap formed by the pressure rolls whereby the metal powder is partially consolidated into strip form, a sintering furnace for effecting a sintering operation on the partially consolidated metal strip to further increase its mechanical strength and ductility, a second set of oppositely disposed, laterally spaced pressure rolls forming a roll gap located in back of the sintering furnace for further consolidating the metal strip after it has been sintered, said second pressure rolls having a diameter of at least 50 and not more than 1,000 times the thickness of the consolidated strip produced by said first set of pressure rolls.

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