July 4, 1972 G. McHARDY STURGEON ET AL 3,674,390

PRODUCTION OF METAL STRIP FROM METAL POWDER

Filed July 27, 1970

FIG. 1.

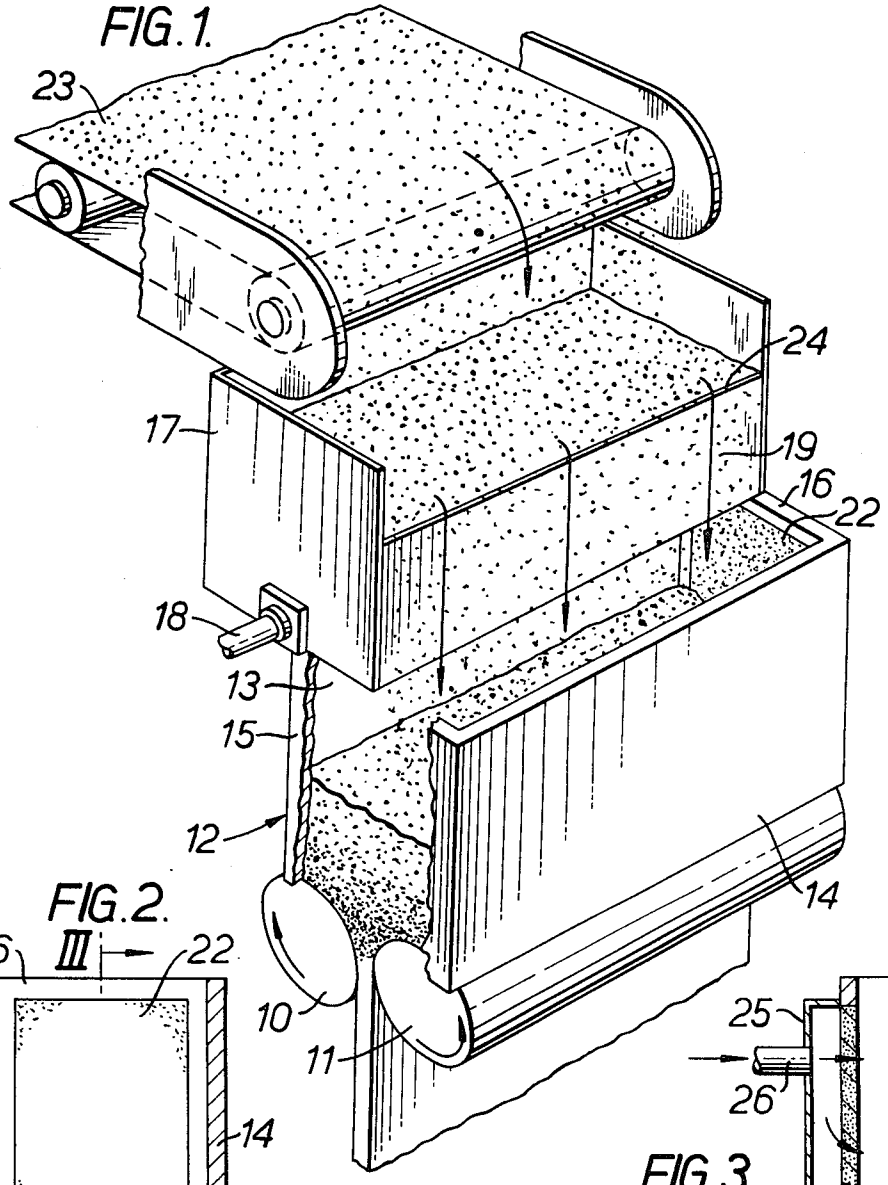


FIG. 2.

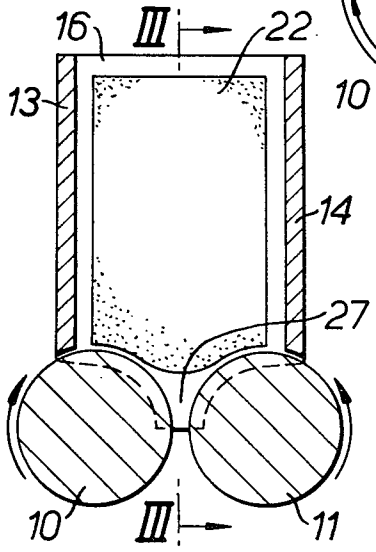
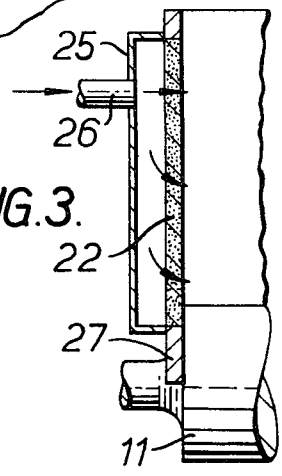


FIG. 3.



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United States Patent Office 3,674,390
Patented July 4, 1972

3,674,390

PRODUCTION OF METAL STRIP FROM METAL POWDER

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Filed July 27, 1970, Ser. No. 58,587
Claims priority, application Great Britain, Aug. 6, 1969, 39,328/69
Int. Cl. B29d 7/14
U.S. Cl. 425—79 4 Claims

ABSTRACT OF THE DISCLOSURE

In the roll compaction of metal powder to form metal strip the powder is supplied to the roll nip by means of a hopper. The end walls of the hopper have a central porous area through which gas can be passed. This prevents the powder sticking to the end walls. Thus, powder can be fed uniformly to the roll nip so that strip of constant weight per unit area across its width can be produced.

This invention relates to the production of metal strip by the compaction of metal powder.

Metal powders can be formed into strip material by supplying the powder to the nip of compacting rolls where the powder is subjected to sufficient pressure to form a self-supporting strip (commonly termed "green strip") and subsequently heating the strip to sinter the metal particles. Thereafter the sintered metal strip may be subjected to mechanical and/or thermal treatment to modify and, in particular, to improve its mechanical properties.

Alternatively, hot metal powder may be supplied to the roll nip so that thermal treatment occurs simultaneously with compaction.

In carrying out this process, several methods can be used to meter the powder into the roll nip. One method is to maintain a heap of powder above the nip of the compacting rolls (the powder flowing into the roll nip assisted by the rotation of the rolls) by means of a hopper which may be defined by two longitudinal walls lying parallel to the axis of the rolls, the lower edges of which bear against the curved surface of the rolls, and two end walls lying transverse to the axis of the rolls, the lower ends of which bear against the ends of the rolls. The enclosure and the upper parts of the curved surfaces of the compacting rolls form, in effect, a hopper for the powder. The powder is generally supplied to the hopper by a mechanical conveyor or pneumatically.

One of the main problems in producing satisfactory green strip for further processing into cold rolled strip is to ensure that the mass per unit area across its width is constant and it is an object of this invention to reduce this problem.

Accordingly, the present invention comprises an apparatus for use in the production of metal strip from metal powder including compacting rolls, a hopper for directing powder to the nip between the rolls, characterised in that the hopper has end walls (i.e. walls transverse to the rolls) with means for forming a layer of pressurised gas on the inside of the end walls whereby to reduce the friction between the end walls and powder in the hopper.

Preferably, the hopper end walls include a portion of porous material through which gas can be passed.

The present invention also comprises a process for the production of metal strip from metal powder in which

metal powder is supplied to the nip of compacting rolls from a hopper, characterised in that a layer of pressurised gas is formed on the inside of the end walls (i.e. walls transverse to the rolls) of the hopper to reduce the friction between the end walls and powder in the hopper.

We have found that with our invention, the friction between the hopper end walls and the powder can be reduced and that strip with improved uniformity of mass per unit area across the strip width can now be produced.

In the accompanying drawings:

FIG. 1 is a perspective view of one embodiment of apparatus according to the invention.

FIG. 2 is an elevation of one end wall of the hopper seen from inside the hopper, and

FIG. 3 is a part view of section III—III (see FIG. 2) across the hopper.

The apparatus comprises a pair or horizontally disposed, parallel, compacting rolls **10** and **11** which are driven by means (not shown) in the directions indicated by the arrows. Superimposed on the rolls **10**, **11** is a hopper **12** made up of two longitudinal walls **13**, **14**, the lower edges of which bear against the curved surfaces of the rolls **10**, **11** respectively and two end walls **15**, **16**, the end wall **15** being broken away in FIG. 1, the lower ends of which bear against the ends of the rolls **10**, **11** (see FIGS. 2 and 3). Positioned above the hopper **12** is a container **17** for a fluidised bed of metal powder; the bottom of the container is provided with an inlet **18**, for gas to maintain the bed in a fluidised condition. One side, **19**, of the container **17** is positioned vertically above and parallel to the nip formed between the rolls **10** and **11** and extends over the length of the nip; side **19** forms a weir over which the fluidised metal powder can flow and then fall into the hopper as more fully described in our application Ser. No. 58,586, filed July 27, 1970.

As shown in FIGS. 2 and 3 the end wall **16** (the end wall **15** being exactly similar) comprises a central portion **22** formed of a porous or foraminous material. Suitable materials include, for example, porous ceramic materials, porous sintered metal sheet and metal sheet having a large number of small holes in it. The central portion **22** is covered on the outside (that is on the outside relative to the hopper) by a gas-tight jacket **25** which is provided with a gas inlet **26**. The bottom portion **27** of the wall, i.e. that portion adjacent the roll nip, is preferably formed solid.

In operation, metal powder is supplied to the container **17** and flows over the weir **19** into the hopper **12**. Gas, for example air, is passed via the gas inlets **26** to the porous part of the hopper end walls **22** and forms a gaseous cushion on the inside of the hopper end walls **15**, **16** thereby reducing the tendency of the powder to stick to the hopper end walls. The powder thus flows into the end portions of the nip at the same rate as into the rest of the nip and then compacted to form a strip.

The powder compacting processes and apparatus of the invention can be used in the compaction of cold powder to form green strip and also in the compaction of hot powder.

We claim:

1. In apparatus for use in the production of metal strip from metal powder including compacting rolls and a hopper for directing powder to the nip between the rolls, the improvement in which comprises hopper end walls transverse to the rolls having means for forming a layer of pressurised gas on the inside of the end walls whereby to reduce the friction between the end walls and powder in the hopper.

2. Apparatus as claimed in claim 1 in which each end wall includes a portion of porous material.

3. Apparatus as claimed in claim 2 in which the bottom portion of each end wall is of solid material.

4. Apparatus as claimed in claim 2 in which a gas-tight jacket is provided on the exterior of each hopper end wall with one or more gas inlets provided to the gas-tight jackets.

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U.S. Cl. X.R.

264—111; 29—420