Aug. 14, 1956 H. FRANSSEN 2,758,336

ROLLING STRIPS FROM METAL POWDER

Filed Dec. 3, 1952 3 Sheets-Sheet 1

FIG 1

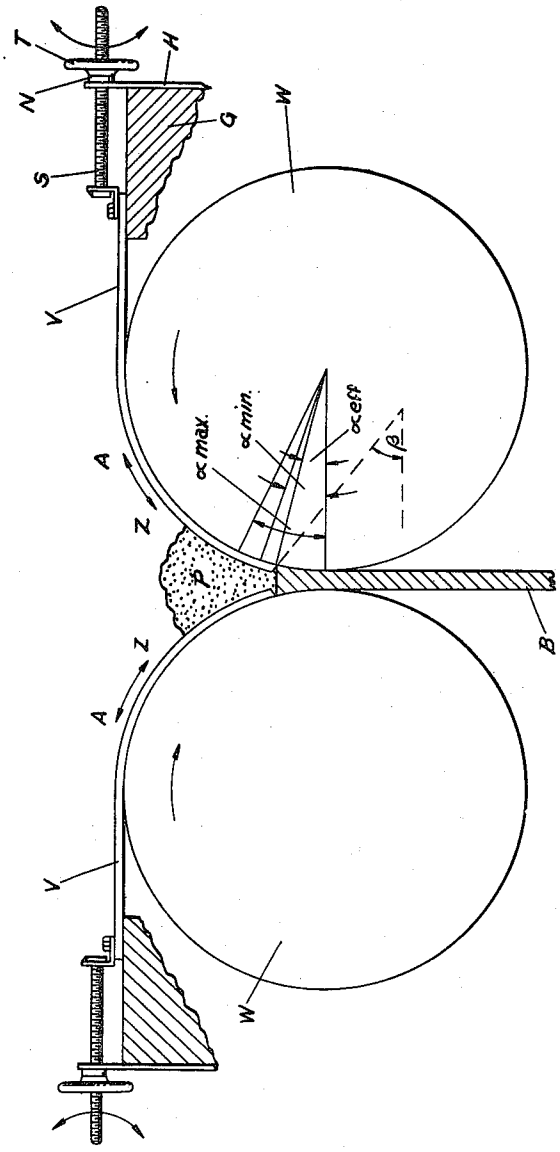

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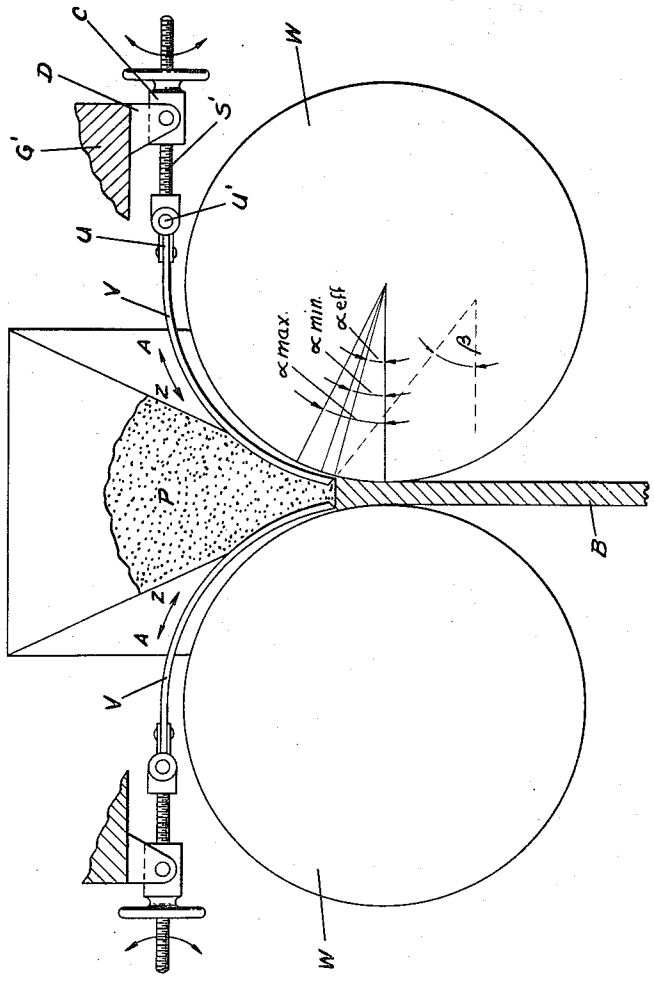
FIG 2



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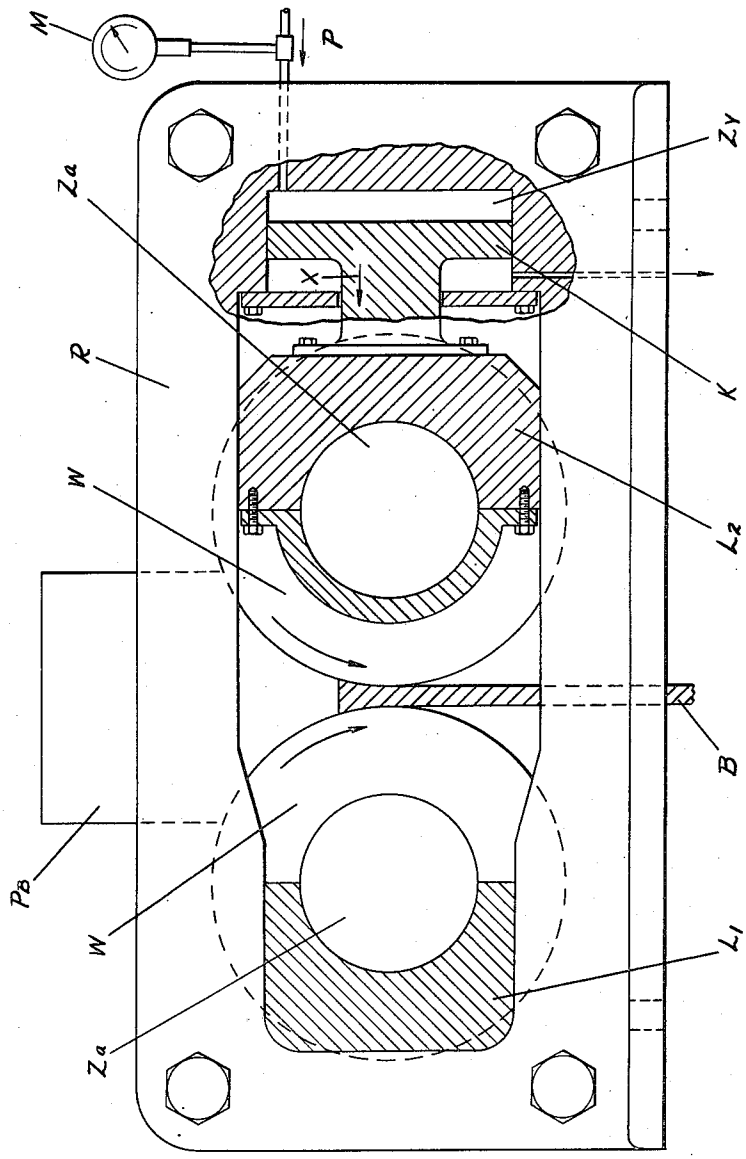

FIG 4

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United States Patent Office 2,758,336
Patented Aug. 14, 1956

2,758,336

ROLLING STRIPS FROM METAL POWDER

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Application December 3, 1952, Serial No. 323,766

3 Claims. (Cl. 18—9)

In the manufacture of endless strips, plates and similar items from metal powder by the compression of the powder between a pair of rolls it is not possible to control off-hand the thickness and density of the strips. It has been proposed to introduce metal tongues into the space left between the rolls with the view of limiting the amount of metal powder. But in doing so, it is necessary that the metal powder be gripped and compressed at a certain angle. This can be materialized only if the surface finish of the rolls does not undergo any alteration. In the case of an alteration at some point, the gripping angle may also change. But this change cannot be determined beforehand and, therefore, may result in a non-uniform density of the material at some points which will give rise to difficulties in the subsequent processing.

The present invention is intended to avoid these difficulties by the control of the flow of the metal powder by means of covering plates adapted to the rolls. The flow of the metal powder is controlled in such a way that the probable gripping angle of the rolls, which is kept large enough, only releases an effective angle which will be smaller than the smallest possible angle of the rolls even in the case of an alteration of the surface finish.

Figure 1 shows how the invention works out in practice. The two rolls W, which are suitably located at the same horizontal level, will grip the metal powder at the most largest possible angle α max. and at least at the smallest possible angle α min. The covering plates V, which can be displaced and adjusted in either direction of A—Z, only release the amount α eff. (effective) of the metal powder gripped at the probable gripping angle, the slope gradient of the metal powder considered.

By "grip angle" is meant the angle having its apex on the axis of the roll and having one leg located in the horizontal plane, whereas the other leg is determined by the point of the circumference of the roll at which the powder is gripped and pressure is exerted by the rolls on the powder. The gripping angle is to be considered from each axis of the two rolls so that each roll has associated therewith a gripping angle, but the gripping angles of the two cooperating rolls are equal. In other words the gripping angle may be defined as the angle at which the powder fed into the gap between the rolls begins to be gripped and compressed by said rolls. The control of the respective gripping angle considered most favorable in connection with the respective powder being worked and product to be produced is effected by the cover plates which will now be described in detail.

The covering plates V may consist of flexible sheet metal adapted snugly to fit against the surface of the respective roll W. One end of this covering plate is connected to a spindle S which latter threadedly engages a nut N rotatably journalled in a support H connected to the framework G. The nut N is provided with a flange T by means of which it can be rotated to thereby

effect a longitudinal movement of the spindle S and thus to move the respective cover plate V toward or away from the adjacent surface portion of the adjacent roll W.

According to another embodiment of the cover plates illustrated in Fig. 2, each of the cover plates V is carried by a fork-like holding member U which latter is pivotally connected to the spindle S' at U'. The spindle S' passes through a threaded member C which is rotatably journalled in an ear D connected to the frame G'. By rotating the threaded member C, the spindle S' is moved in longitudinal direction as a result of which the cover plate V moves toward or away from the adjacent surface of the adjacent roll W.

Inasmuch as the effective gripping angle α eff. is being chosen smaller than the smallest possible gripping angle α min. called for by the roll and powder properties, the pull and the compression sets in as soon as the metal powder comes into contact with the roll surface, irrespective of whether the roll surface would correspond to the gripping angle α max. or α min. or to an angle of a magnitude therebetween. The primary feature of the invention being to control the flow of the metal powder by covering up the possible gripping angle and thus varying the effective gripping angle, it will be possible over the entire width of the roll to obtain a surface compactness of the strip which results from the flow compactness of the metal powder and the width of the gap prevailing between the rolls and along the entire length thereof; said surface compactness may be measured in grams per square cm. surface.

According to the heretofore employed method of adjusting the rolls by means of pressure spindles or wedges, it has been impossible to achieve the required thickness of volume density, even if the requirements as to a uniform surface compactness of the strips over their entire width were met, according to the general physical laws applicable to the compression of a given powder, every surface compression (measured for instance in t./cm.^{2}, results in a corresponding degree of compactness which may be defined by the volume taken up by the compacted powder. Therefore, it is not advisable to fix the distance between the two rolls by means of wedges or spindles, because such a practice would make it impossible to achieve with certainty the desired surface compressions in the gap left between the rolls.

Therefore, according to another feature of the invention, pressing of the two rolls against one another is effected by pneumatic or hydraulic means, whereby it will be possible to exert a uniform pressure upon the powder and thus to obtain a uniform degree of compactness of the powder without beforehand establishing the width of the gap.

Figure III shows an arrangement according to the invention employing hydraulic pressure. The necks Za of the rolls W are journalled in bearings L_1 and L_2 respectively. The piston K, which is reciprocable in the cylinder Zy, due to the pressure p exerted thereupon by a pressure medium, for instance oil under pressure, presses the rolls W against one another in the direction of the arrow X, the frame R exerting the counter-pressure.

If with a given density or compactness, it is desired to obtain a certain thickness of the band or strip, it will be possible without any change in the pressure exerted upon the rolls, to open or to close the covering plates V (Fig. 1) in the direction of A or Z respectively until at the respective level of the adjusted effective gripping angle α eff. just so much powder is being fed into the gap between said rolls that a band or strip of the desired compactness and thickness is obtained. By the combination of the above mentioned two features

according to the invention it will be possible to control the compression of powder by means of rolls also as to the quantity of the powder in the product.

In addition thereto, the employment of hydraulic means offers the advantage of relieving the pressure on the rolls by opening a valve in the event of any difficulties encountered during the operation, whereas with the usual mechanical feeding device such pressure relief can frequently be carried out only by exposing the rolls to danger or even causing them to break.

What I claim is:

1. A rolling arrangement for compacting powder in a continuous process to bands or strips of great length, which comprises in combination: a first rotatable roll, a second rotatable roll spaced from said first roll so as to be able to grip and compact powder between the latter and said first roll, and adjustable covering means extending over a portion of said rolls for varying the total effective powder contacting area of said rolls.

2. A rolling arrangement for compacting powder in a continuous process to bands or strips of great length, which comprises in combination: a first roll, a second roll, said rolls being adjustable relative to each other to vary the gap therebetween for receiving powder to be compressed, and adjustable covering means respectively covering a circumferential portion of each of said rolls and movable selectively into and out of the gap between said rolls to thereby vary the effective gripping angle of said rolls.

3. A rolling arrangement for compacting powder in a continuous process to bands or strips of great length, which comprises in combination: a first roll, a second roll normally spaced from said first roll so as to form a gap between said rolls for receiving powder to be processed, pressure fluid operable means arranged for selectively moving said rolls relative to each other to thereby selectively enlarge or reduce said gap, and adjustable flexible curved plate means selectively movable into or out of said gap to thereby vary the effective gripping angle of said rolls.

References Cited in the file of this patent

UNITED STATES PATENTS

1,439,544	Gaisman	Dec. 19, 1922
2,159,044	Paterson	May 23, 1939
2,165,718	Mun	July 11, 1939
2,693,739	Risaku-Okawa et al.	Nov. 9, 1954