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Timmermans

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[54] **METHOD OF PRODUCING COMPOSITE BUSHINGS AND BEARINGS**

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[*] Notice: The portion of the term of this patent subsequent to Oct. 14, 1991, has been disclaimed.

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[52] **U.S. Cl.** ..... **72/68,** 72/80, 72/700, 29/149.5 S

[51] **Int. Cl.** **B21b 3/00**

[58] **Field of Search** ..... 29/DIG. 6, 149.5 S, 527.7, 29/148.4 R, 149.5 R, 149.5 C; 72/68, 69, 110, 80, 700

[56] **References Cited**

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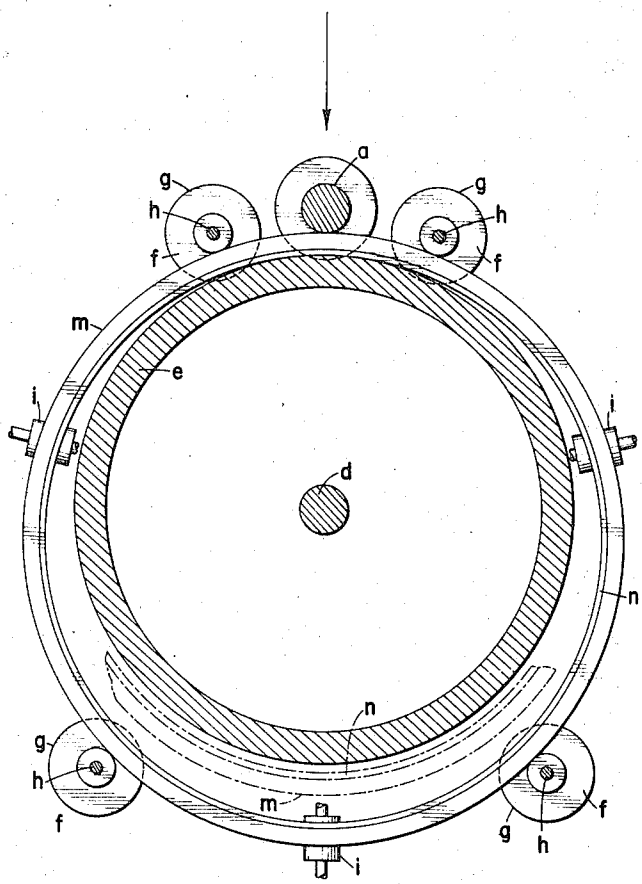
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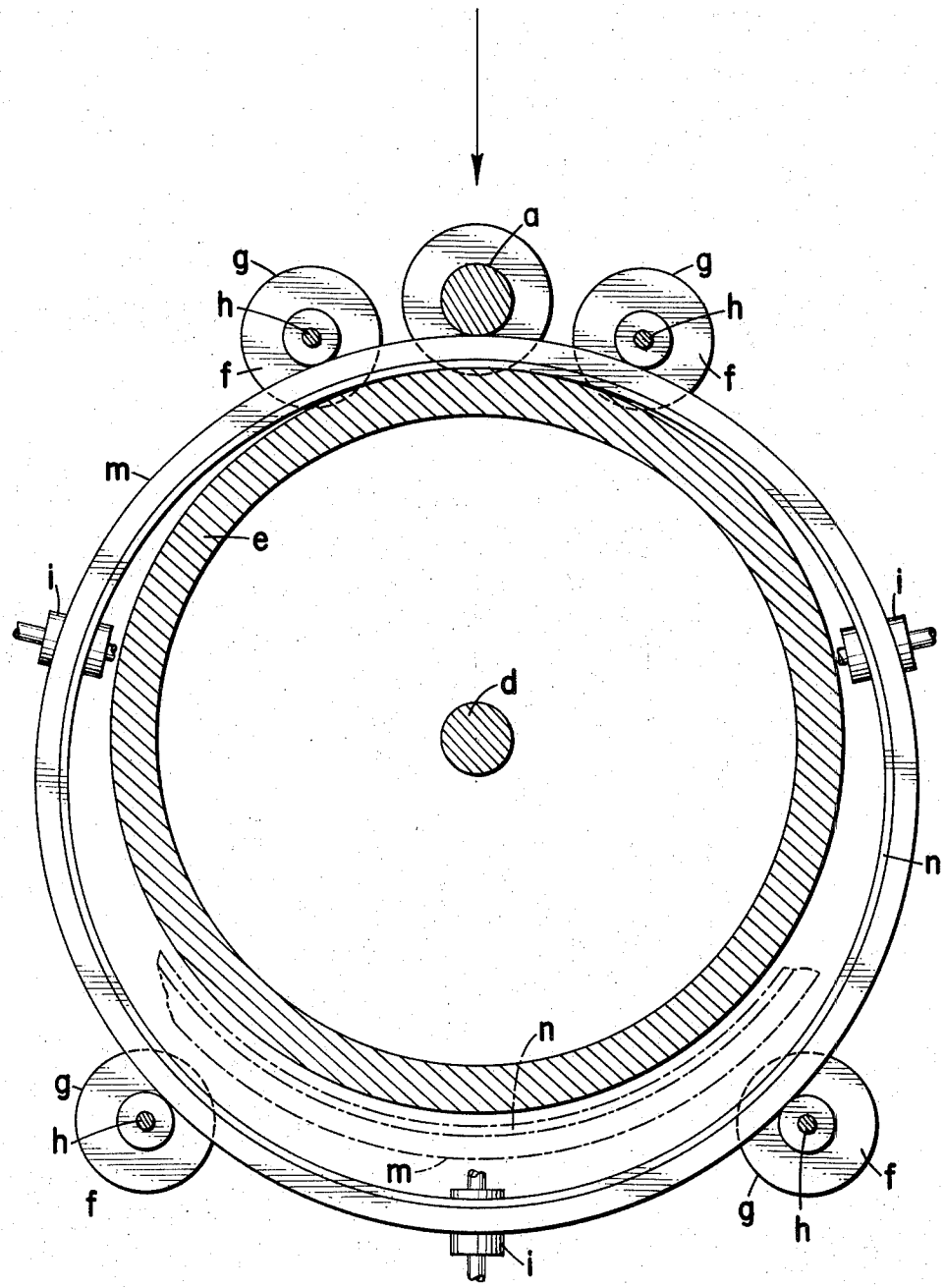
[57] **ABSTRACT**

Bearings may be formed by a composite material consisting of a sheet of steel lined with a bearing material.

The lining process is performed by rotating a steel cylinder internally lined with a bearing metal, applying pressure by means of a roll of relatively small diameter upon the outer surface and applying pressure by means of a roll of relatively large diameter upon the inner surface of the cylinder while rotating the same, and cutting the cylinder open upon completion of the rolling process.

2 Claims, 1 Drawing Figure




a
g
h
f
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METHOD OF PRODUCING COMPOSITE BUSHINGS AND BEARINGS

BACKGROUND OF THE INVENTION

When a steel cylinder which has been internally lined by centrifugal action with a bearing metal, e.g., with lead bronze, is subsequently cut open (e.g., along the weld initially established to form a steel cylinder out of a sheet of steel), the slotted steel cylinder must be flattened and rolled between rolls in order to obtain a material that lends itself to the formation of bearings. The aforementioned rolling process is a source of considerable difficulties because the layer of bearing metal spreads more under the action of pressure rolls than the layer of steel. As a result of the fact that the spreading-out of the layer of bearing metal under the action of pressure rolls by far exceeds the spreading-out of the steel backing of said layer under the action of such rolls, one obtains a bearing metal steel composite that is curved rather than planar.

It is the principal object of this invention to provide a rolling process for bearing metal and steel laminates which eliminates the aforementioned drawbacks, and results in a product having improved performance characteristics.

SUMMARY OF THE INVENTION

The rolling process according to this invention includes the steps of arranging a steel cylinder which is internally lined with bearing metal within a gap formed by a pair of juxtaposed rolls of which one roll has a relatively small diameter and the other roll has a relatively large diameter, thereafter applying a relatively large pressure by said one roll having a relatively small diameter against the outer surface of said steel cylinder and applying a relatively small pressure by said roll having a relatively large diameter against the inner bearing-metal-lined surface of said steel cylinder and causing said pair of rolls to rotate while applying pressure against said outer surface and against said inner surface of said steel cylinder, cutting said steel cylinder open upon rolling thereof, and causing said steel cylinder to assume a planar shape after having been cut open.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is an end view of a roller system for carrying this invention into effect and shows some of the constituent parts of the system sectionalized trasversely.

DESCRIPTION OF PREFERRED METHOD

In the drawing reference character *m* has been applied to indicate a cylinder of steel which is internally lined with lead bronze. Reference character *e* has been applied to indicate a roll having a relatively large diameter supported by, and rotatably around, the axis *d*. The outer diameter of roll *e* is smaller than the inner diameter of bronze lined cylinder *m*. Reference character *a* has been applied to indicate a roll engaging under pressure the radially outer surface of cylinder *m*, i.e., the steel layer thereof. The diameter of roll *a* is considerably less than the diameter of roll *m*. Reference character *n* has been applied to indicate the internal lining of lead bronze of cylinder *m*. Rolls *g* rotatably mounted on shafts *h* are arranged below cylinder *m* for the purpose of stabilizing the assembly when cylinder *m* is caused to rotate by rolls *e* and *a*. A pair of rolls *g* rotatably mounted on shafts *h* arranged above cylinder *m* serve substantially the same purpose as lower rolls *g*. All rolls *g* are provided with flanges *f* for positioning cylinder *m*. The drawing further shows four small rollers *i* provided to prevent lateral motion of cylinder *m*. Reference character *m* has been applied to indicate the composite steel-lead-bronze cylinder in its final shape upon completion of the rolling application. This shape of cylinder *m* has been indicated in solid lines. The dotted line *m* indicates the shape of the steel-lead-bronze cylinder *m* before the rolling process is intiated. When the steel-lead-bronze cylinder *m* assumes the shape indicated in solid lines the same is removed from the rolling machine, cut or sliced in axial direction, and the spread out or flattened to form a planar lead-bronze lined sheet of steel. This material may then be formed into bearings of bushings, as is well known in the art. The composite lead-bronze lined steel sheets obtained by the above described rolling process are characterized by a fine or dense metallurgical bond between the two layers of which the laminate is formed.

Another important advantage of the process according to this invention resides in the fact that it lends itself very well to automation. In case of automation the large diameter inner roll *e* ought to be subdivided into two roll sections which may be separated by relative movement in axial directions. This feature facilitates placement of composite cylinder *m* on roll *e*. The admission to and removal from the roll *e* of cylinder *m* is preferably effected by means of electromagnets. Loading of roll *e* with steel cylinders *m* involves a temporary removal of upper rolls *a,g* from roll *e*. The slicing of cylinders *m* along a generatrix thereof and the flattening of the sliced steel cylinders is effected by another machine, not shown.

It will be understood that in the basic structure illustrated the specific pressure exerted by roll *a* on the steel backing of cylinder *m* is larger than the specific pressure exerted by roll *e* on the load-bronze lining of cylinder *m* on account of the fact that the diameter of roll *a* is less than that of roll *e*. The difference in pressure exerted by rolls *a,e* compensates in part for the tendency of the lining layer *n* to spread, or extend, more than the steel layer. The surplus or excess of spreading out or extension of the lining layer over that of the steel backing layer results in subjecting the latter to stresses which are re-inforced by centrifugal forces acting upon the lining layer. These stresses have the tendency to flatten the steel backing layer of cylinder *m*. The magnitude of these stresses depends upon the number of revolutions at which cylinder *m* is rotated. The number of revolutions of cylinder *m* when being rolled may be controlled in such a fashion that cylinder *m* extends into a substantially flat sheet upon being cut open.

I claim as my invention:

1. A method of rolling steel cylinders which are internally lined with a bearing metal including the steps of arranging a steel cylinder internally lined with a bearing metal within a gap formed by a pair of juxtaposed rolls of which one roll has a relatively small diameter and the other roll has a relatively large diameter, thereafter applying a relatively large pressure by said roll of relatively small diameter against the outer surface of said steel cylinder and of applying a relatively small pressure by said roll of relatively large diameter against said

inner bearing-metal-lined surface of said steel cylinder and causing said pair of rolls to rotate while applying pressure against said outer surface and against said inner surface of said steel cylinder, cutting said steel cylinder open upon rolling thereof, and causing said steel cylinder to assume a planar shape after having been cut open.

2. A process as specified in claim **1** wherein the number of revolution of said steel cylinder when being rolled is controlled in such a fashion that said steel cylinder extends into a substantially flat sheet upon being cut open.

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