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FEED ROLLER FOR ROLLING MILL

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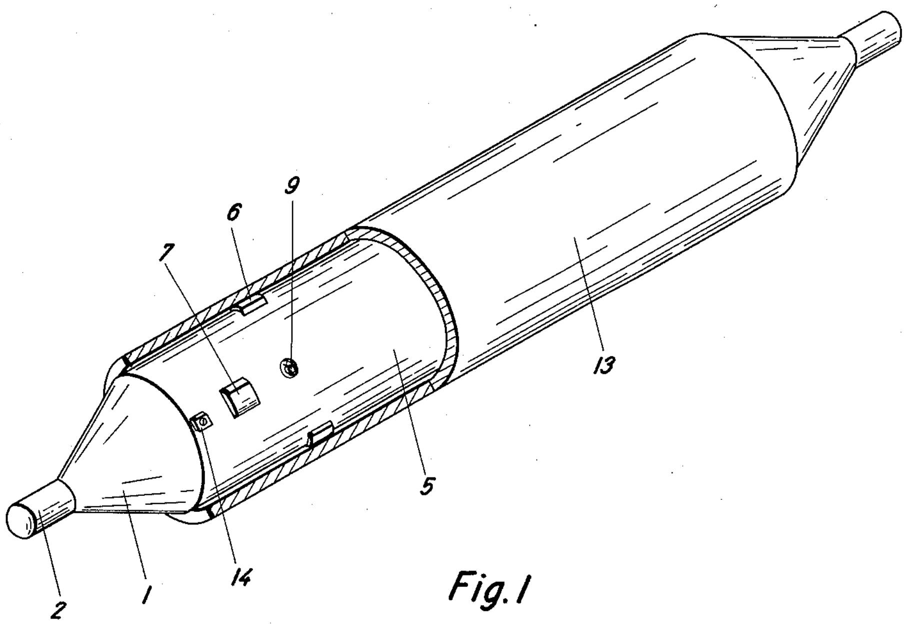

Fig. 1

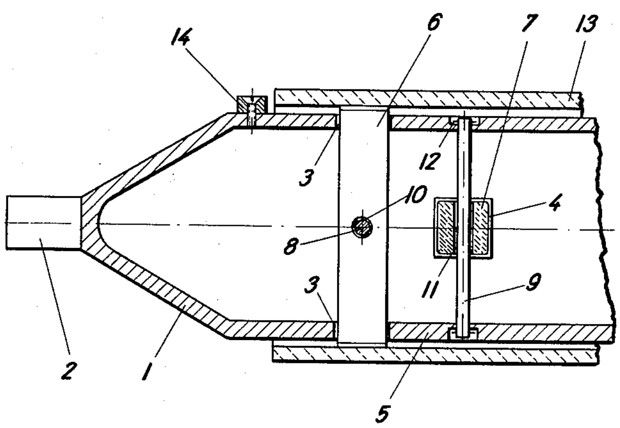

Fig. 2

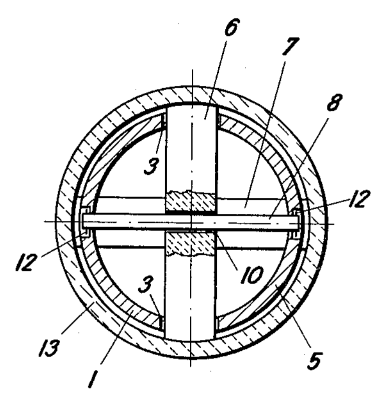

Fig. 3

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FEED ROLLER FOR ROLLING MILL

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The present invention relates to improvements in feed or conveying rollers for strip rolling-mill trains.

In rolling-mill trains, there are two different types of rollers to be distinguished. One type of roller is used for working the material and is thus subjected to very great mechanical stresses. These rollers must therefore be made of very solid materials, generally of a high-quality steel. The other rollers primarily serve for conveying the worked materials and only need to support the weight thereof. They may therefore be made of materials of less solidity. Both types of rollers must, however, be capable of withstanding the high temperature of the rolled stock of approximately 800 to 1000° C. and of producing a stock with as smooth a surface as possible.

At the high prevailing temperatures, steel rollers have a certain tendency toward scaling, and since the rolled materials are also coated with scale, they will never be entirely smooth but always be provided with some surface irregularities. Such steel rollers are therefore applied only where absolutely necessary, that is, only for those rollers which are used for working the material. The feed or conveying rollers, however, which are subjected to less mechanical stresses, are frequently made of other materials, for example, of graphite. Such rollers have, however, the disadvantage that they cannot withstand the high working temperatures and therefore partly burn off. The resulting dross then becomes deposited on the thin layer of scale on the rolled stock. Furthermore, graphite rollers have to be frequently re-turned, are consumed relatively quickly, and are therefore rather expensive.

Aside from silicon carbide, such feed rollers have also been made of hard porcelain, and the cylinders thus made were sometimes coated with a hard glaze.

The known types of nonmetallic, highly scale-resistant materials have, however, the disadvantage that they do not have sufficient solidity to permit the entire body of a feed roller to be made thereof. Especially the bearing portions of such rollers caused considerable difficulties which could never be fully solved. Although it has also been proposed to avoid these difficulties by the use of compound rollers which consist of a combination of such nonmetallic materials with a metallic supporting structure, this idea could so far not be applied in actual practice because the difference in the expansion of the two materials at the high temperatures involved did not permit the construction of such compound rollers of a reasonable durability.

It is now the object of the present invention to provide such a durable compound roller of two or more different materials which are combined in such a manner as to attain all of the advantages of a steel roller without the mentioned disadvantages thereof, and so as to avoid the prior difficulties attending the construction and use of compound rollers.

According to the present invention it has been found that a compound feed roller which is especially adapted for conveying hot metallic materials and to be used in strip rolling-mill trains may be attained very simply and inexpensively by making such feed roller of a metallic supporting roller, of a cylindrical jacket thereon which consists of a nonmetallic highly scale-resistant material and at least partly of oxides and which has an inner di-

ameter of a sufficient size so as to avoid a direct contact with the supporting roller, and of a plurality of spokes which secure the jacket to the supporting roller and are made either of the same material as the jacket or at least of a material which has substantially the same coefficient of thermal expansion as that of the jacket.

The supporting roller may consist of the conventional hollow cylinder of metal, especially steel, which, because of its relatively small wall thickness will be heated very quickly. The most suitable materials for making the highly scale-proof, nonmetallic, at least partly oxide jacket have been found to be baked ceramic sintering materials, for example, hard porcelain and metallic powders, molten oxide materials, and a glass which is rich in silicic acid. Excellent results have been attained especially if such jackets were made of quartz glass or quartz ware because of the low thermal expansion thereof.

The construction of a feed roller consisting of a supporting roller and a jacket of different materials is attended, however, by considerable difficulties which are caused by the difference in the coefficient of expansion of the jacket and the metallic supporting structure. At a maximum operating temperature of 1000° C., a steel roller expands very considerably; for example, at a diameter of 200 mm., the thermal expansion of such a roller amounts to about 2 mm. The inner diameter of a quartz cylinder will, however, increase under the same conditions no more than about one-tenth of a millimeter. In order to prevent a jacket consisting of a quartz tube from being burst from the inside when being heated, its inner diameter must be made so large that at the highest occurring temperature of, for example, 1000° C., it will still be slightly larger than the outer diameter of the supporting roller which it encloses. Although this requirement is as such well known, the proper conclusions to be drawn from the prevailing differences in the temperature of the two bodies as well as from the resulting great differences in the expansion thereof are now being applied for the first time in the construction of a really successful feed roller for rolling mills which complies with all the requirements.

The difficulties resulting from the necessary differences between the diameters of the metal supporting structure and the outer jacket of the feed roller apply not only to the manner of its construction, but also to its application, for example, in a rolling mill inasmuch as the tubular jacket has to rest on the supporting roller so as to form an intermediate hollow space and since, because of such hollow structure, the jacket might be broken when subjected to great stresses, especially impacts. According to the present invention, these difficulties are overcome by connecting the supporting roller with the tubular jacket by means of spokes which are designed so as to take up the loads to which the tubular jacket is subjected, to maintain the jacket in the proper position on the supporting roller, and to compensate for any differences in the expansion of the jacket and the supporting roller. In order to attain these results, the spokes should have a coefficient of thermal expansion which corresponds as accurately as possible to that of the jacket, and therefore they should preferably be made of the same kind of material as the jacket. Thus, if the jacket of the feed roller is to consist of a quartz tube, the supporting spokes should preferably also be made of quartz.

Another important feature of the present invention consists in providing at least two pairs of supporting spokes for each tubular jacket, and in mounting each pair at a suitable distance from the respective end of the roller and so that the two spokes of each pair extend at an angle of 90° to each other and through the inner steel roller. These spokes are designed so as to form the actual support of the tubular jacket, the inner diameter of which is made a few millimeters larger than the outer diameter of the steel roller. Consequently, the supporting spokes project slightly above the outer surface of the steel roller. The most suitable number of spokes to be used depends upon the load which the particular feed roller has to carry and upon the diameter of such roller. If a larger number of spokes are required, it may be advisable to mount the adjacent sets of spokes so as to be turned at an angle relative to each other so that the loads upon the entire length of the jacket will be more evenly taken up by the spokes.

The supporting spokes may be simply mounted in suitable apertures in the cylindrical wall of the steel roller and be held in a position coaxial with the latter by bolts of a small diameter which also permit the tubular quartz jacket to be easily adjusted relative to the inner steel roller. If, for example, steel bolts of a diameter of 15 mm. are used, the thermal expansion thereof at a temperature of 1000° C. would only increase such diameter at a maximum of two-tenths of a millimeter. Consequently, to compensate for the thermal expansion, each spoke would only need to be provided with a bore which is three-tenths of a millimeter larger than the diameter of the steel bolt. Such a play between the bolt and the spoke will be too small to allow any noticeable knocking between, or shifting of the parts relative to each other.

The above-mentioned and other objects, features, and advantages of the present invention will become further apparent from the following detailed description thereof, particularly when read with reference to the accompanying drawings, in which—

FIG. 1 is a general view of the feed roller of the invention with the outer layer partially cut away.

FIGURE 2 shows, largely in section, one end of a feed roller according to the invention as shown in FIG. 1, the nonmetallic parts of which may consist, for example, of quartz; while

FIGURE 3 shows a cross section taken along line A—A of FIGURE 2.

Referring to the drawings, the hollow tubular body **1** of the inner steel roller has a bearing member **2** on each end and a pair of bores **3** and **4** within the cylindrical part **5** thereof at a suitable distance from each end. Each of these bores **3** and **4** extends diametrically through the wall of the cylindrical part **5** and at an angle of 90° to the adjacent bore, and they are made of a diameter which is only a few hundredths of a millimeter larger than the diameter of the spokes **6** and **7** which are inserted into these bores **3** and **4**, respectively. These spokes **6** and **7** are secured in a fixed position within the tubular body **1** by bolts **8** and **9**, respectively, which extend transversely through central bores **10** and **11** in spokes **6** and **7**, respectively, and are secured to the cylindrical part **5** of the tubular body **1** in any suitable manner, for example, by cotter pins **12**. Since bolts **8** and **9** only serve for properly positioning spokes **6** and **7** relative to the cylindrical part **5** of the tubular body **1**, they are not subjected to any particular stresses and therefore only need to be of a diameter of about 12 to 15 mm., and only a few tenths of a millimeter smaller than the width of bores **10** and **11** in spokes **6** and **7**, respectively.

Spokes **6** and **7**, which may be of any suitable cross-sectional shape, for example, a square shape as shown in the drawings, form the direct support of the outer cylindrical member **13** which forms a jacket around the cylindrical part **5** of the inner body **1** and the revolving surface for conveying the rolled stock. This outer cylinder **13** consists of nonmetallic, highly scale-resistant material, preferably quartz. In order to allow for the greater thermal expansion of the cylindrical part **5** of the metallic supporting body **1** as compared with the thermal expansion of the outer nonmetallic cylinder **13**, the inner diameter of the latter, as well as the length of spokes **6** and **7** are made sufficiently larger than the outer diameter of the cylindrical part **5**. Spokes **6** and **7** are made of a material which has substantially the same coefficient of thermal expansion as the outer cylinder **13** and they are preferably made of the same material as cylinder **13**, for example, of quartz. Spokes **6** and **7** may be connected to cylinder **13** in any suitable manner and at least so as to prevent any relative movement between them in the direction of rotation. Thus, spokes **6** and **7** may be integral with cylinder **13** or be nonrotatably secured to the latter by any suitable means. Cylinder **13** is further prevented from sliding in the axial direction relative to the cylindrical part **5** of the metallic supporting body **1**, for example, by suitable stops **14** which are secured to the latter near each end of the cylindrical part **5** and at a suitable distance from the outer end surfaces of cylinder **13** to allow for the small thermal expansion of the latter.

By connecting the outer conveying cylinder **13** of quartz or other suitable nonmetallic, scale-resistant material to the inner metallic supporting body **1** by means of two or more pairs of spokes **6** and **7** which have substantially the same coefficient of thermal expansion as cylinder **13** and extend transverse to each other and are each, in turn, secured to the inner supporting body **1** by steel bolts **8** and **9**, the present invention attains a compound feed roller for rolling-mill trains which is far superior to a feed roller which is made entirely of steel or graphite, and which is of a very solid construction, even though it allows for considerable differences in the expansion of its different parts, while requiring only a very little play between these parts.

Although in the drawings, I have only indicated one pair of spokes **6** and **7** of quartz or similar material near each end of the outer quartz cylinder **13**, the latter may of course be braced against the supporting body **1** by a greater number of such spokes, depending upon the length of the particular feed roller and the load to which it is to be subjected. In this event it may be advisable to mount the adjacent spokes so as to extend at an angle to each other.

Instead of consisting of quartz or a material having a high content in quartz, the outer cylinder **13** and the spokes **6** and **7** may also be made of other suitable nonmetallic, scale-resistant materials, such as baked ceramic sintering materials, highly siliceous glass, or the like.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A feed roller for conveying hot metallic materials comprising a metallic supporting roller, a cylindrical jacket for said roller consisting of a nonmetallic, highly scale-resistant, at least partly oxidic material having an inner diameter larger than the outer diameter of said metallic supporting roller, and a plurality of spokes connecting said jacket to said supporting roller in spaced relation substantially consisting of a material having substantially the same coefficient of thermal expansion as the material of said jacket.

2. A feed roller for conveying hot metallic materials comprising a metallic supporting roller, a cylindrical jacket for said roller consisting of a nonmetallic, highly scale-resistant, at least partly oxidic material having an inner diameter larger than the outer diameter of said metallic supporting roller, said supporting roller having a plurality of apertures therein, and a plurality of spokes within said apertures in said supporting roller and the ends thereof radially projecting therefrom and connected to said jacket in spaced relation, said spokes substantially consisting of a material having substantially the same coefficient of thermal expansion as the material of said jacket.

3. A feed roller for conveying hot metallic materials comprising a metallic supporting roller, a cylindrical jacket for said roller consisting of a nonmetallic, highly scale-resistant, at least partly oxidic material having an inner diameter larger than the outer diameter of said metallic supporting roller, said supporting roller having a plurality of apertures therein, a plurality of spokes within said apertures in said supporting roller and the ends thereof radially projecting therefrom and connected to said jacket in spaced relation, said spokes substantially consisting of a material having substantially the same coefficient of thermal expansion as the material of said jacket, and a rod-shaped member having a small diameter extending transversely through each of said spokes substantially centrally thereof and connected to said supporting roller for maintaining said spoke in the proper position relative to said supporting roller.

4. A feed roller for conveying hot metallic materials comprising a metallic supporting roller having a hollow tubular central portion and a bearing portion at each end of said central portion, a cylindrical jacket for said roller consisting of a nonmetallic, highly scale-resistant, at least partly oxidic material having an inner diameter larger than the outer diameter of said metallic supporting roller, said central tubular portion of said supporting roller having a plurality of apertures at diametrically opposite points thereof, and a plurality of spokes of the same material as said jacket disposed within said apertures, each of said apertures being slightly larger than the cross-sectional size of one of said sprockets so as to allow for the difference in the thermal expansion of said sprocket and the wall of said aperture, the ends of said sprockets radially projecting from said apertures in said supporting roller and connected to said jacket in spaced relation.

5. A feed roller for conveying hot metallic materials comprising a metallic supporting roller having a hollow tubular central portion and a bearing portion at each end of said central portion, a cylindrical jacket for said roller consisting of a nonmetallic, highly scale-resistant, at least partly oxidic material having an inner diameter larger than the outer diameter of said metallic supporting roller, said central tubular portion of said supporting roller having a plurality of apertures at diametrically opposite points thereof, a plurality of spokes of the same material as said jacket disposed within said apertures, the ends of said sprockets radially projecting from said apertures in said supporting roller and connected to said jacket in spaced relation, each of said spokes having a substantially central transverse aperture therein, and a rod-shaped member of a material substantially similar to the material of said supporting roller and having a small diameter extending through said aperture in said spoke, means for securing said rod-shaped member to said supporting roller at diametrically opposite points of the wall thereof, each of said apertures in said central tubular portion of said supporting roller and in said sprockets being slightly larger than the cross-sectional size of said sprocket and of said rod-shaped member, respectively.

6. A feed roller as defined in claim 1, wherein said cylindrical jacket and said spokes consist of baked ceramic sintering materials.

7. A feed roller as defined in claim 1, wherein said cylindrical jacket and said spokes consist of highly siliceous glass.

8. A feed roller as defined in claim 1, wherein said cylindrical jacket and said spokes consist of a material having a high content in quartz.

References Cited in the file of this patent

UNITED STATES PATENTS

1,394,684	Matsuo	Oct. 25, 1921
2,742,999	Davidson	Apr. 24, 1956

FOREIGN PATENTS

4,626	Great Britain	Feb. 25, 1909