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TEXTILE GUIDING DRUMS

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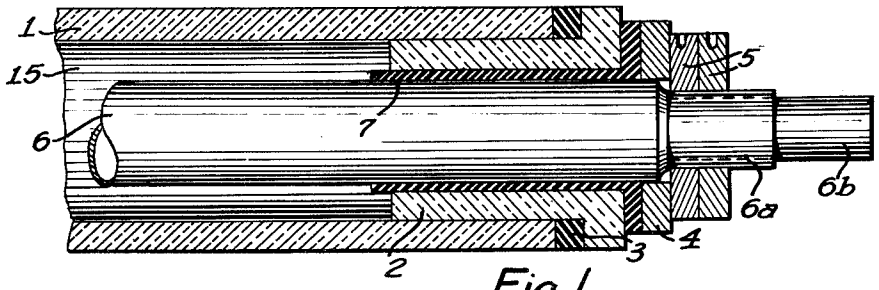


Fig. 1

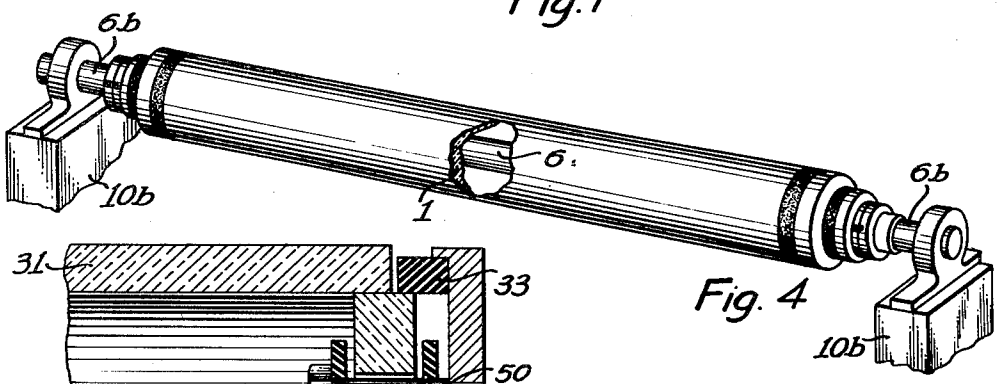


Fig. 4

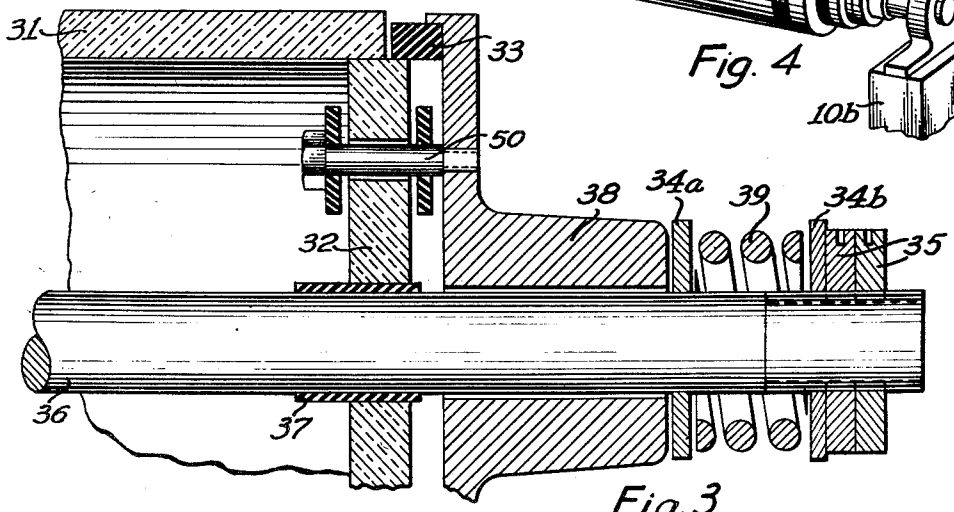


Fig. 3

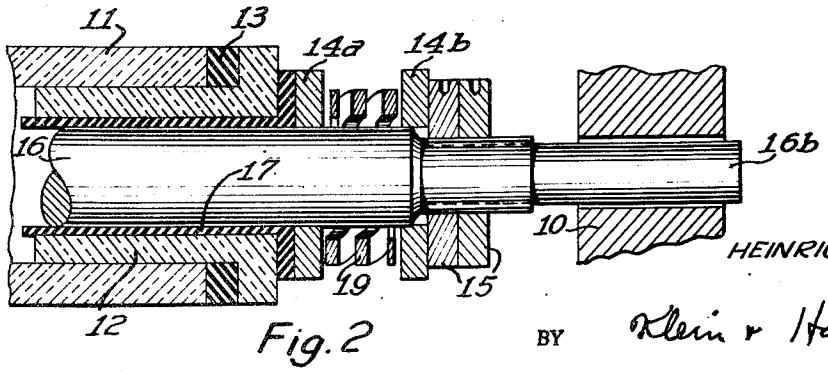


Fig. 2

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TEXTILE GUIDING DRUMS

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8 Claims. (Cl. 29—123)

The present invention relates to drums, hereinafter called textile guiding drums, which are intended to serve for the mechanical guidance of long textile structures that extend in at least one dimension, such as fabrics and yarns, and has for an object to provide improved textile guiding drums adapted to convey textile material which may be wetted or soaked with corrosive liquids at elevated temperatures. It is another object to provide improved textile guide drums which combine high mechanical strength with resistance to acid and to changes of temperature. A more specific object is to provide improved textile guide drums which shall be adequately resistant to the treatment conditions occurring in textile refining apparatus, in which fabrics and yarns run successively through a great variety of operations including dry, wet or hot processes, and in which a plurality of supply and guide drums is required for the material to be treated. It is therefore also an object of the invention to provide improved textile guide drums which are resistant to mordanting, dyeing, bleaching and sizing agents.

It is a feature of the invention to provide guide drums made of ceramic material, more particularly of quartz glass and provided with fracture-resistant coupling means to the driving means, in order to ensure that the ceramic drum bodies, more particularly drums made of quartz glass, are exclusively or mainly stressed in compression and that any expansion, tension, or shearing stress produced by differences in the heat expansion between the ceramic material and any metal parts shall not reach magnitudes liable to exceed the strength of quartz or of ceramic material. This is particularly important in view of the well known fact that in the case of quartz, for example, compression strength is about twenty times higher than the tensile strength.

It is therefore a still further feature of the invention to provide improved textile guide drums, particularly of relatively great length, with a connection between the shell of ceramic material or quartz and the metal parts of the drum, more particularly the shaft of the drum, which will reliably prevent fracture under normal operating stess even when in addition to the stesses produced by difference in the thermal expansion, additional tension, shearing, and torsion stresses are exerted upon the drum material by strong drive forces.

In the guide drums according to the invention, which are particularly intended for moisture-containing material, a shell consisting of quartz glass or similar material encloses a metal drive shaft centered therein and which is supported at least at one side on suitable supporting means, this shaft being connected with the shell by bushes, caps or like centering means provided at the two ends of the shell in such manner that no substantial forces are exerted upon the shell in a radial direction, the residual radial forces being mainly those caused by the difference in heat expansion between the ceramic material and the metal of the shaft, a difference which is small in the radial direction, and which is preferably absorbed by relatively thin elastic sleeves, the shell being held in the desired position on the metal shaft by elastic coupling means which stress the shell only in an axial direction and substantially only by pressure, but which will absorb the considerably greater axial differences of heat expansion.

In order that the invention may be more readily understood, reference will now be made by way of examples to the accompanying drawings.

Figs. 1 and 2 show two forms of guide drums (partly in section) having a bush connection between the shell of ceramic material and the shaft.

Fig. 3 illustrates a different connection between shell and shaft.

Fig. 4 is a perspective view of a guide drum incorporating a connection substantially similar to that illustrated in Fig. 1.

Referring now first to Fig. 1, which shows one end of the guide drum illustrated in Fig. 4, the shaft **6** is formed with reduced diameter ends or shaft pins **6***b* which are journalled in support bearings **10** mounted on lugs **10***b*, and carries an outer shell **1** of ceramic material such as quartz or glass, which is of hollow cylindrical shape and serves as support for the material to be conveyed. The shaft or axle **6** consists of metal, preferably of corrosion resistant steel, and is separated from the shell **1** by an annular gap **15**, which is bridged at each end of the shell by a centering bush **2**. These bushes form the only support for the ceramic shell **1** and transmit load forces from the shell to the shaft pins **6***b*. They consist of the same material as the shell or of an equivalent ceramic material. An elastic sleeve **7**, for example of rubber, is positioned between the metal shaft **6** and shell **1** to absorb the small radial differences in heat expansion between the metal and ceramic bodies.

The shaft and shell are coupled together by two nuts **5** screwed upon threaded portion **6***a* of pin **6***b* of shaft **6**. Two elastic washers **3**, which may, for example, consist of acid-resistant rubber, are interposed respectively between the quartz shell and the centering bush **2** and between an annular metal washer **4** and the centering bush **2**, so that in an axial direction the latter is only stressed in compression. The difference in the axial heat expansion between the metal shaft and the ceramic outer shell, which for example in the case of a guide drum of a length of 2 metres will for an increase of temperature of 100° C., amount to approximately 2 mm., is completely absorbed by the two intermediate rubber packings. It is an additional advantage of the construction according to the invention that the ceramic shell is only connected with the shaft at its end portions **6***b* and that accordingly there is a possibility of making the latter smaller in diameter than the main body **6** of the shaft (a feature which, as is well known does not reduce the strength of the shaft) thereby also reducing correspondingly the absolute amount of the radial heat expansion of the metal. The residual expansion, if the diameter of the shaft pins is reduced, for example, to 50 mm., amounts to only 0.05 mm. for a 100° temperature increase, which can be absorbed without difficulty by the elastic tube sleeve **7**. Since according to the invention the centering bush **2** consists of the same material as the external shell, it reduces the metal portion of the cross section of the drum to the thickness of the shaft pin which can be made as small as is compatible with the required strength, and thereby the radial difference in heat expansion is also reduced.

Fig. 2 illustrates a construction of the guide drum which is preferred in the case of particularly long drums or rollers, and when particularly high differences in temperature occur during operation, resulting in greater differences between the alterations in length of the metal axis and the ceramic shell respectively.

This construction differs from that above described by the fact that, in addition to the provision of resilient rubber washers **13**, a strong helical pressure spring **19** is additionally interposed between the clamping nuts **15**, the metal washers **14***a* and **14***b* and the ceramic centering bush **12**. Spring **19** is adapted to absorb even major temperature expansions without exerting unduly high tensile stresses upon the drum shell **11**. In the illustrated embodiment there is also shown the journal support **10** of the shaft pin **16***b*, which latter is reduced in diameter as compared with the shaft body **16**. The radial expansion stresses are absorbed by the rubber sleeve **17**.

Fig. 3 illustrates a mounting or coupling arrangement which has been found satisfactory for a drum shell **31** of large diameter and a metal shaft **36** of small diameter. In this case a disc **32**, consisting of the same or similar ceramic material as shell **31**, serves only for centering and for reducing the size of the metal portion of the drum cross-section, the coupling between the shaft **36** and the shell being effected by a flanged thrust member **38** consisting of metal, a further rubber ring **33**, and by the strong pressure spring **39**, which is supported against washers **34***a* and **34***b* and the pair of nuts **35**. A set screw **50** determines the axial but not the radial or the angular position of the centering disc **32**. A rubber sleeve **37** on shaft **36** once more absorbs all radial differences in heat expansion. This emodiment will generally be preferred in cases in which the diameter of the drum is large and as a result the centering disc **32** of ceramic material is already exposed to very high tensile stresses by the coupling forces.

In many cases the metal shaft will be made hollow without the strength of the drum as a whole being thereby reduced (see Fig. 1). The choice of material for the metal shaft and for the individual connecting elements such as screws and rings or washers is determined from case to case according to requirements. It will generally be found advisable to employ stainless steel for the metal parts. In many cases it is sufficient for only one end of the drum to be provided with an elastic coupling according to the invention, only a ring or a shoulder being provided at the other end to form an abutment for the centering bush.

The guiding drum according to the invention offers considerable advantages as compared with known textile guiding drums. For example it is free from the drawbacks of rigid connections with cemented-in metal parts or metal shafts which, as experience has shown, are liable to lead to fracture of the drum even under moderate variations of temperature, this advantage of the invention being due to the fact that, if according to the invention the drum shell is clamped by means of flanges of metal or other firm materials with the use of the elastic packings, all forces occurring will act substantially only parallel to the axis.

Substantial advantages are also achieved over elastic connections which employ rubber sleeves slipped upon the metal shaft and applied under pressure to the inner surface of the cylinder shell since these known arrangements will not in the long run ensure the centering of the drum shell; in contrast to this, a construction according to the invention will reliably prevent the drum shell from moving into an eccenrtic position and will produce tension stress only to a very unimportant extent.

Furthermore the invention avoids the drawbacks of other known combined manners of attachment in which for example rubber lined rollers or sleeves mounted on the steel shaft are connected by a layer of cement with the inner surface of the hollow cylinder shell, and in which after hardening of the cement tensile stresses exceeding the permissible limits are liable to occur particularly if the thickness of the rubber layers is kept thin to ensure a sufficient degree of centering.

In addition the improved guide drums according to the invention offer the advantage that their individual elements are readily assembled and readily replaced and that after slipping the quartz shell upon the metal shaft, all other operations can be carried out without difficulty as they extend only to the ends of the drum.

It will be obvious that the invention is not confined to pure guiding and conveyor drums but is also applicable to squeeze or calender rolls and similar means that are required more particularly in textile refining plants. It ensures for example that bleaching of textile material can be carried out in an economic manner, a fact which illustrates the technical importance of the invention.

I claim:

1. A drum comprising a cylindrical metal shaft formed at least at one of its ends with an axle pin for supporting the shaft, a hollow cylindrical shell consisting of a corrosion- and temperature-resistant ceramic material, the inner diameter of this shell being greater than the outer diameter of said shaft and said shell being arranged to surround said shaft in radially spaced relationship thereto, shell carrier means interposed between said shaft and said shell adjacent each end of said shell for centering and supporting said shell on said shaft, said carrier means consisting of a ceramic material having substantially the same thermal coefficient of expansion as the shell material; a sleeve of elastic material interposed between said shell carrier means and said shaft to absorb differences in the radial heat-expansion of said shell and said shaft, and substantially annular thrust and torque transmitting means for taking up and transmitting coupling forces and axial heat-expansion forces, said transmitting means being arranged around the ends of said shaft and acting upon the end faces of the shell solely in axial direction.

2. A drum as claimed in claim 1, in which at least one shell carrier means is a bush mounted on said shaft inside said shell, said bush having an external shoulder interposed between the end face of the shell and said thrust-transmitting means, said thin elastic sleeve being interposed between said shaft and said bush.

3. A drum as claimed in claim 1, in which at least one shell carrier means has the form of an annular disc mounted on said shaft inside said shell, the elastic sleeve being arranged between the disc and the shaft, said drum also including a flanged thrust member interposed between said shell and at least part of said thrust-transmitting means, said thrust member being mounted on said shaft between said disc and said part of the thrust-transmitting means.

4. A drum as claimed in claim 1 in which said thrust-transmitting means includes a helical spring and screw-threaded means for supporting one end of said spring on the axle pin.

5. A drum as claimed in claim 1, wherein said shaft is hollow.

6. A drum as claimed in claim 1, wherein the diameter of the axle pin is smaller than the diameter of the shaft, at least part of said thrust-transmitting means being mounted on the axle pin.

7. The drum of claim 1, wherein the shell material is quartz glass.

8. The drum of claim 1, comprising elastic means mounted intermediate the end faces of the shell and said thrust-transmitting means.

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