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(54) **GUIDE ROLL FOR A WEB FORMING MACHINE AND METHODS FOR MANUFACTURING AND USING THE CORRESPONDING GUIDE ROLL**

FÜHRUNGSWALZE FÜR BAHNBILDUNGSMASCHINE UND DEREN HERSTELLUNG UND VERWENDUNG

ROULEAU DE GUIDAGE POUR UNE MACHINE DE FORMATION DE BANDE ET METHODES DE FABRICATION ET D'UTILISATION DU ROULEAU DE GUIDAGE CORRESPONDANT

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Description

[0001] The present invention relates to a guide roller for a web forming machine, according to the preamble of claim 1.

[0002] The invention also relates to a method for manufacturing and to the use of the guide roll.

[0003] A guide roller according to the preamble of claim 1 is known from US 4,062,098 A. The plate piece of this guide roller is parallel to the end plate thereof.

[0004] DE 196 01 844 A1 relates to a paper web guide roller having a body and projecting support elements on both sides as well as means for adjusting the roller body deflection in opposition to deflection resulting from stress to the web.

[0005] Numerous guide rolls are used in a web forming machine, for example a paper or board machine. Examples are the guide rolls used to support a felt or wire. The segment of the guide roll that is covered is usually small, so that it is lightly loaded. In addition, in a web forming machine there are special paper guide rolls, over which only the paper is transported. In that case, the linear load on the paper guide roll will be in the order of 1 kN/m. In known guide rolls, the shell is made from sheet steel, which is bent and welded. Cast end pieces, which are attached to the shell, are used in a guide roll. In the prior art, the shell is finally machined and the guide roll balanced.

[0006] The known end pieces are made by machining cast pieces. In practice, the machining requirements determine the construction and dimensioning of the shell and the end piece, even though the loading requirement is small. This makes the guide roll excessively massive and expensive relative to its operating purpose. In addition, a cast end piece and thin shell are an unsatisfactory combination in terms of vibration. In practice, deflection also occurs in the sheet construction shell and cannot be compensated for in known guide rolls.

[0007] The invention is intended to create a new type of guide roll for a web forming machine, which is lighter and with a simpler construction than previously. The invention is also intended to create a new type of method for manufacturing a guide roll intended for a web forming machine, which method is simple and which easily creates new properties in the guide roll.

[0008] The characteristic features of the guide roll according to the present invention appear in the accompanying Claim 1. Correspondingly, the characteristic features of the manufacturing method according to the invention appear in the accompanying Claim 10.

[0009] In the guide roll according to the invention, there is a new type of shell and end-piece construction, so that a simple and economical guide roll is created. In addition, the use of the manufacturing method permits a considerable reduction in costs, while keeping the properties of the guide roll at least at the previous level. On the other hand, properties that increase the usability and manufacturability of the guide roll can be incorporated in the

guide roll. In addition, the guide roll according to the invention can be used in a new and surprising manner, in which case the deflection of the guide roll, for example, can be brought under control. At the same time, the guide roll can be rotated at higher rotation speeds than previously.

[0010] In the following, the invention is examined in detail with reference to the accompanying drawings showing embodiments of the invention, in which

Figure 1 shows the paper guide roll according to the invention fitted to the press section of a web forming machine,

Figure 2a shows an axonometric view of part of the guide roll according to the invention,

Figure 2b shows a schematic drawing of the end component of the guide roll according to the invention,

Figure 3 shows a schematic drawing of a cross-section of a second embodiment of the end component of the guide roll according to the invention,

Figure 4 shows a schematic drawing of a cross-section of a third embodiment of the end component of the guide roll according to the invention,

Figure 5 shows a schematic drawing of a partial cross-section of a fourth embodiment of the end component of the guide roll according to the invention,

Figure 6 shows a schematic drawing of a support embodiment of the guide roll according to the invention.

[0011] Figure 1 shows a side view of the press section of a web forming machine. Usually the web forming machine is a paper or board machine, in which the guide roll is used in various positions. The embodiment of Figure 1 also include two paper guide rolls 15, which also have their own drives. The guide roll 15' according to the invention can also be used in connection with the fabric (figure 1). Later the guide roll is referred to more simply as the roll. Generally the roll 15 includes a shell 10 of sheet material and end pieces 11 at both ends, to support the roll 15 rotatably in bearing arrangement 12 (Figure 2a). The shell can also incorporate surface treatment or a cover. The end pieces 11 also have a protruding shaft 14 for the bearing arrangement 12.

[0012] Figures 3 and 4 partly show a cross-section of a roll according to the invention. According to the invention, the end plate 13 and protruding shaft 14 belonging to the end piece 11 are arranged as a separate piece. In addition, between the end plate 13 and the protruding shaft 14 at least one shaped plate piece 19 is fitted separately in the axial direction at the point of contact of the end plate 13 and the protruding shaft 14. In other words, the plate piece 19 is arranged in such a way that its inner edge or edge area in a radial direction is attached to the

protruding shaft 14 and the radially outer edge or edge area is attached to the end plate 13, or to the shell, or to both, either directly or through an intermediate piece/intermediate pieces. Thus the various part of the end piece can be manufactured separately, which will avoid the casting and machining of large pieces. In addition, the parts can even be made in different ways and from different materials. At the same time, thinner materials than previously can be used. In addition, by using a plate piece at the end of the roll a stiff but light cell construction is formed, which can be easily support by the protruding shaft. At the same time, the deflection of the protruding shaft will be less than previously.

[0013] In the lightly-loaded roll according to the invention, it is possible to use a simple protruding shaft 14, which can be supported in many different ways. In Figures 3 and 4, the end plate 13 and the protruding shaft 14 are separately machined bodies of revolution. In this case, the protruding shaft is a cast piece, which is machined. On the other hand, the end plate can even be of a sheet material, in which there is a hole for the protruding shaft. The manufacture of the separate pieces is simple and they can be dimensioned precisely for each operating purpose.

[0014] The construction of the plate piece can vary in different embodiments. Figures 3 and 4 show a unified plate piece 19 with a curved shape, which like the shell 10 is made from a thin sheet material. The desired shapes can then be easily obtained in the structures, while new methods can be used to attache the pieces. According to the invention, there is a force-fit joint between the end plate 13 and the protruding shaft 14. In practice, the protruding shaft 14 is preferably fitted to the end plate 13 using a shrink joint. In that case the positioning between them will be retained precisely and, if necessary, the protruding shaft can even be replaced. In the embodiment of Figure 3, the attachment of the plate piece 19 to the protruding shaft 14 is ensured by welding, which is shown by the arrow in Figure 3. The actual moment is transmitted through the aforesaid force-fit joint.

[0015] The plate piece according to the invention is curved or conical. A conical plate piece 19 is shown in Figure 5. The same reference numbers are used for components that are functionally similar. Besides its shape, the position of the plate piece can also vary in different embodiments. In Figure 3, the shaped plate piece 19 is arranged to open out away form the opposing end piece. Correspondingly in Figure 4 the plate piece 19 opens out towards the opposing end piece. In the embodiment of Figure 3, the plate piece is inside the shell, so that the total length of the roll is as short as possible. This allows the roll to be fitted even in cramped positions. The plate piece in the embodiment of Figure 4, on the other hand, is a continuation of the shell, so that the free length of the protruding shaft is as short as possible. This avoids detrimental deflection of the protruding shaft.

[0016] Besides using a separate protruding shaft and plate piece, the different components are attached to

each other in a new way. According to the invention, at the point where the shell 10, the end plate 13, and the plate piece 19 come together, there is a weld 16, which is made from outside the shell 10 from the point shown by the arrow. In Figure 3, the plate piece 19 is attached to the inner surface of the shell 10. In addition to this, the end plate 13 is set onto both the shell 10 and the plate piece 19. Thus, by welding at the point shown by the arrow, all three pieces are attached to each other rapidly and simply. In other words, the shell 10, the end plate 13, and the plate piece 19 are welded together simultaneously. The same principle is also realized in Figure 4, in which the plate piece 19 is end-on to the shell 10. In this case, the end plate 13 is at the intersection of the shell 10 and the plate piece 19, so that the weld 16 attaches the pieces securely to each other. Figure 4 also shows an attachment collar 17, to which the protruding shaft 14 is attached by a force-fit joint, welded to the plate piece.

[0017] The attachment collar described above can also be used in the embodiment of Figure 5. In that case, the conical plate piece 19 is fitted directly to the protruding shaft 14. According to the invention, in addition a damping and/or insulating material 24' can be arranged in the space delimited by the shell 10 and the end pieces 11. The shell will then certainly remain round and the material will effectively prevent vibration in the shall. The material used is, for example, styrox, cellular plastic, or some other relatively light material. A cellular structure is light, but is sufficiently stiff to achieve damping. A damping and/or insulating material 24 can also be arranged in the space delimited by the end plate 13 and the plate piece 19. The material will further increase the stiffness of the conical triangular cell, which will also reduce the vibration of the roll. The material is installed from solid pieces during the manufacture of the roll, or it can be, for example, extruded into the finished roll.

[0018] The diameter of a roll according to the invention is usually less than 500 mm. According to the invention, the plate piece 19 is roll-formed and/or deep-drawn from a thin-sheet material. In practice, the plate piece can be made from a single blank, in which case the plate piece will be seamless. A roll-formed or deep-drawn plate piece will also retain its shape well, which will further improve the stiffness of the roll. On the other hand, the plate piece can be made from one or more pieces by welding. The cast components, for example, the protruding shaft, are made by traditional methods by casting and machining. In the manufacture of the shell and plate piece, on the other hand, laser cutting is used in addition to the above shaping methods. In will then be possible to use even a thin-sheet material with a thickness of less than 5 mm. In addition to its ease of shaping, the sheet material can also be laser-welded with good results. According to the invention, the plate piece is indeed attached to the shell and end plate by laser-welding. The locking weld between the protruding shaft and the plate piece can also be made using a laser. The weld point is shown by the

small arrow in Figures 3 - 5.

[0019] The use of laser-cutting and welding is an easy way to give the roll accurate dimensions and shape. The roll is thus ready-to-use without machining. If necessary, the circularity of the roll can be arranged as desired by covering the shell 10. The cover 20 is shown in Figure 4. At the same time, grooves, for example, can be machined in the cover, the shape and dimensions of which can be selected as required. Other machining of the roll is usually unnecessary, as the seam formed by laser-welding without a filler is very smooth.

[0020] The new type of end piece also makes it possible to use bearing arrangement that differ from those known. According to the invention, the bearing arrangement 12 are attached either to the protruding shaft 14, or to the plate piece 19. On the other hand, the bearing arrangement can also be attached to both the plate piece 19 and the end plate 13. In Figure 3 and 4, the protruding shaft 14 is attached to the end piece 11, in which case the bearing arrangement 12 are attached to the protruding shaft 14 according to Figure 2a. The bearing arrangement in question is also shown in the right-hand end part of the roll of Figure 6. In Figure 2b, on the other hand, the protruding shaft 14 does not rotate, so that the bearing arrangement 12 are in either the plate piece or the end plate, or in both. By arranging at least two support surfaces in the bearing arrangement 12 of at least one end piece 11, it is possible to turn the bearing arrangement 12 or the protruding shaft 14 to compensate for deflection in the roll. In Figure 2b, the nonrotating protruding shaft 14 is turned, so that the alignment of the roll can be changed. In this case, the turning takes place relative to only a single pivot point 21, but if necessary several degrees of freedom can be arranged in the support and turning and the necessary movements implemented using suitable elements and devices (not shown).

[0021] In practice, in the bearing arrangement 12 at least two bearings 18 are arranged, which are fitted at a distance to each other in the axial direction, in order to create support surfaces. Thus the necessary support surface can be created easily by using two simple bearings. In the left-hand end of the roll of Figure 6, there are two bearings 18, which are supported by a rocker element 23 in the structures of the web forming machine. A corresponding rocker element could also be fitted at the other end of the roll, but a change of angle in the protruding shaft can be achieved using a single special bearing.

[0022] In its entirety, the roll according to the invention is light, but stiff. In addition, the manufacture of the roll is simpler and more economical than previously. Similarly, the specific frequency of the roll increases, so that its sensitivity to vibration decreases. In addition, the protruding shaft can be selected more freely, permitting the use of shaft diameters that are smaller than previously. At the same time, the bearings can be selected more freely. Damping can also be arranged in the roll and the end piece. In addition, even the deflection of the roll can be compensated.

Claims

1. Guide roller (15,15') for a web forming machine, comprising
 - a shell (10) of a sheet material,
 - an end pieces (11) attached to both ends of the shell (10) respectively, suitable for supporting the guide roller (15, 15') rotatably in bearing arrangements (12) in the web forming machine, wherein said end piece (11) is assembled from separate pieces, comprising
 - an end plate (13)
 - a protruding shaft (14), and
 - at least one shaped plate piece (19), wherein
 - the protruding shaft (14) for the bearing is arranged in the end plate (13), and
 - between the end plate (13) and the protruding shaft (14) the at least one shaped plate piece (19) is fitted separately,

characterized in that the points of contact of the shaped plate piece (19) with the end plate (13) and with the protruding shaft (14) are spaced in the axial direction, and **in that** the plate piece (19) is curved or conical such that the plate piece (19) opens out away from or towards the opposing end piece.
2. Guide roller according to Claim 1, **characterized in that** the end plate (13) and the protruding shaft (14) are separately machined bodies of revolution.
3. Guide roller according to Claim 1 or 2, **characterized in that** the shell (10) and the plate piece (19) are of a thin sheet material.
4. Guide roller according to any of Claims 1 - 3, **characterized in that** there is a force-fit joint between the end plate (13) and the protruding shaft (14).
5. Guide roller according to any of Claims 1 - 4, **characterized in that** at the point where the shell (10), the end plate (13), and the plate piece (19) come together there is a weld (16), to attach the shell (10), the end plate (13), and the plate piece (19) to each other.
6. Guide roller according to any of Claims 1 - 5, **characterized in that** damping and/or insulating material (24) is arranged in the space delimited by the shell (10) and the end pieces (11).
7. Guide roller according to any of Claims 1 - 6, **characterized in that** damping and/or insulating material (24) is arranged in the space delimited by the end plate (13) and the plate piece (19).
8. Use of a guide roller (15) according to any of Claims

1 - 7, in which the guide roller (15) is a roll in contact with the paper.

9. Use of a guide roller according to any of Claims 1 - 7, in which the guide roller (15) is a roll in contact with a fabric. 5

10. Method for manufacturing a guide roller for a web forming machine, in which method 10

- a shell (10) is made from a sheet material,
- end pieces (11) are made, each of which comprises an end plate (13), a protruding shaft (14) for a bearing arrangement (12) and a shaped plate piece (10), and 15
- the end pieces (11) are attached to both ends of the shell (10), respectively, wherein the end plate (13) and the protruding shaft (14) are arranged as separate pieces and are connected by at least one shaped plate piece (19), in order to form a cell construction, 20

characterized in that the points of contact of the shaped plate piece (19) with the end plate (13) and with the protruding shaft (14) are spaced in the axial direction, and **in that** the plate piece (19) is curved or conical such that the plate piece (19) opens out away from or towards the opposing end piece. 25

11. Method according to Claim 10, **characterized in that** the shell (10), end plate (13), and plate piece (19) are simultaneously welded to each other. 30

12. Method according to Claim 10 or 11, **characterized in that** the plate piece (19) is of a roll-shaped and/or deep-drawn thin-sheet material, or it is manufactured from one or several parts by welding. 35

13. Method according to any of Claims 10 - 12, **characterized in that** the bearing arrangement (12) is attached to either the protruding shaft (14) or the plate piece (19), or to the plate piece (19) and the end plate (13). 40

Patentansprüche

1. Leitwalze (15,15') für eine Bahnbildungsmaschine, welche Folgendes aufweist: 50

- einen Mantel (10) aus einem plattenförmigen Material,
- Endstücke (11), die jeweils an beiden Enden des Mantels (10) angebracht und geeignet sind, die Leitwalze (15,15') drehbar in Lageranordnungen (12) in der Bahnbildungsmaschine zu halten, wobei das Endstück (11) aus einzelnen Teilen zusammengebaut ist und Folgendes auf- 55

weist:

- eine Endplatte (13)
- eine vorstehende Welle (14) und
- wenigstens ein geformtes Plattenteil (19), wobei
- die vorstehende Welle (14) für das Lager in der Endplatte (13) angeordnet ist, und
- zwischen der Endplatte (13) und der vorstehenden Welle (14) das wenigstens eine geformte Plattenteil (19) separat angeordnet ist,

dadurch gekennzeichnet, dass die Kontaktpunkte des geformten Plattenteils (19) mit der Endplatte (13) und mit der vorstehenden Welle (14) in der axialen Richtung beabstandet sind, und dass das Plattenteil (19) derart gekrümmt oder konisch ist, dass das Plattenteil (19) sich von dem gegenüberliegenden Endstück weg oder in dessen Richtung öffnet.

2. Leitwalze nach Anspruch 1, **dadurch gekennzeichnet, dass** die Endplatte (13) und die vorstehende Welle (14) separate, maschinell bearbeitete Rotationskörper sind.

3. Leitwalze nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Mantel (10) und das Plattenteil (19) aus einem dünnen Blechmaterial bestehen.

4. Leitwalze nach einem der Ansprüche 1 - 3, **dadurch gekennzeichnet, dass** zwischen der Endplatte (13) und der vorstehenden Welle (14) eine kraftschlüssige Verbindung besteht.

5. Leitwalze nach einem der Ansprüche 1 - 4, **dadurch gekennzeichnet, dass** an dem Punkt, an dem der Mantel (10), die Endplatte (13) und das Plattenteil (19) zusammenkommen, sich eine Schweißnaht (16) befindet, um den Mantel (10), die Endplatte (13) und das Plattenteil (19) aneinander anzubringen. 45

6. Leitwalze nach einem der Ansprüche 1 - 5, **dadurch gekennzeichnet, dass** in dem durch den Mantel (10) und die Endstücke (11) begrenzten Raum ein Dämpfungs- und/oder Isoliermaterial (24) angeordnet ist. 50

7. Leitwalze nach einem der Ansprüche 1 - 6, **dadurch gekennzeichnet, dass** in dem durch die Endplatte (13) und das Plattenteil (19) begrenzten Raum ein Dämpfungs- und/oder Isoliermaterial (24) angeordnet ist.

8. Verwendung einer Leitwalze (15) nach einem der

Ansprüche 1 - 7, bei welcher die Leitwalze (15) eine mit dem Papier in Verbindung stehende Rolle ist.

9. Verwendung einer Leitwalze nach einem der Ansprüche 1 - 7, bei welcher die Leitwalze (15) eine mit einem Gewebe in Verbindung stehende Rolle ist. 5
10. Verfahren zur Herstellung einer Leitwalze für eine Bahnbildungsmaschine, wobei in dem Verfahren 10
 - ein Mantel (10) aus einem plattenförmigen Material hergestellt wird, 10
 - Endstücke (11) hergestellt werden, von denen jedes eine Endplatte (13), eine vorstehende Welle (14) für eine Lageranordnung (12) und ein geformtes Plattenteil (19) aufweist, und 15
 - die Endstücke (11) jeweils an beiden Enden des Mantels (10) angebracht werden, wobei die Endplatte (13) und die vorstehende Welle (14) als separate Teile ausgeführt und mittels wenigstens eines geformten Plattenteils (19) verbunden werden, um eine Zellenkonstruktion zu bilden, 20
 - dadurch gekennzeichnet, dass** die Kontaktpunkte des geformten Plattenteils (19) mit der Endplatte (13) und mit der vorstehenden Welle (14) in der axialen Richtung beabstandet sind, und dass das Plattenteil (19) derart gekrümmt oder konisch ist, dass das Plattenteil (19) sich von dem gegenüberliegenden Endstück weg oder in dessen Richtung öffnet. 25
11. Verfahren nach Anspruch 10, **dadurch gekennzeichnet, dass** der Mantel (10), die Endplatte (13) und das Plattenteil (19) gleichzeitig miteinander verschweißt werden. 30
12. Verfahren nach Anspruch 10 oder 11, **dadurch gekennzeichnet, dass** das Plattenteil (19) aus einem rollgeformten und/oder tiefgezogenen, dünnen Blechmaterial besteht oder durch Schweißen aus einem oder mehreren einzelnen Teilen hergestellt wird. 40
13. Verfahren nach einem der Ansprüche 10 - 12, **dadurch gekennzeichnet, dass** die Lageranordnung (12) entweder an der vorstehenden Welle (14) oder an dem Plattenteil (19) oder an dem Plattenteil (19) und der Endplatte (13) angebracht wird. 45

Revendications

1. Rouleau tendeur (15, 15') pour une machine de formation de bande, comprenant 55
 - un corps (10) en un matériau en feuille,
 - des pièces d'extrémité (11) attachées respec-

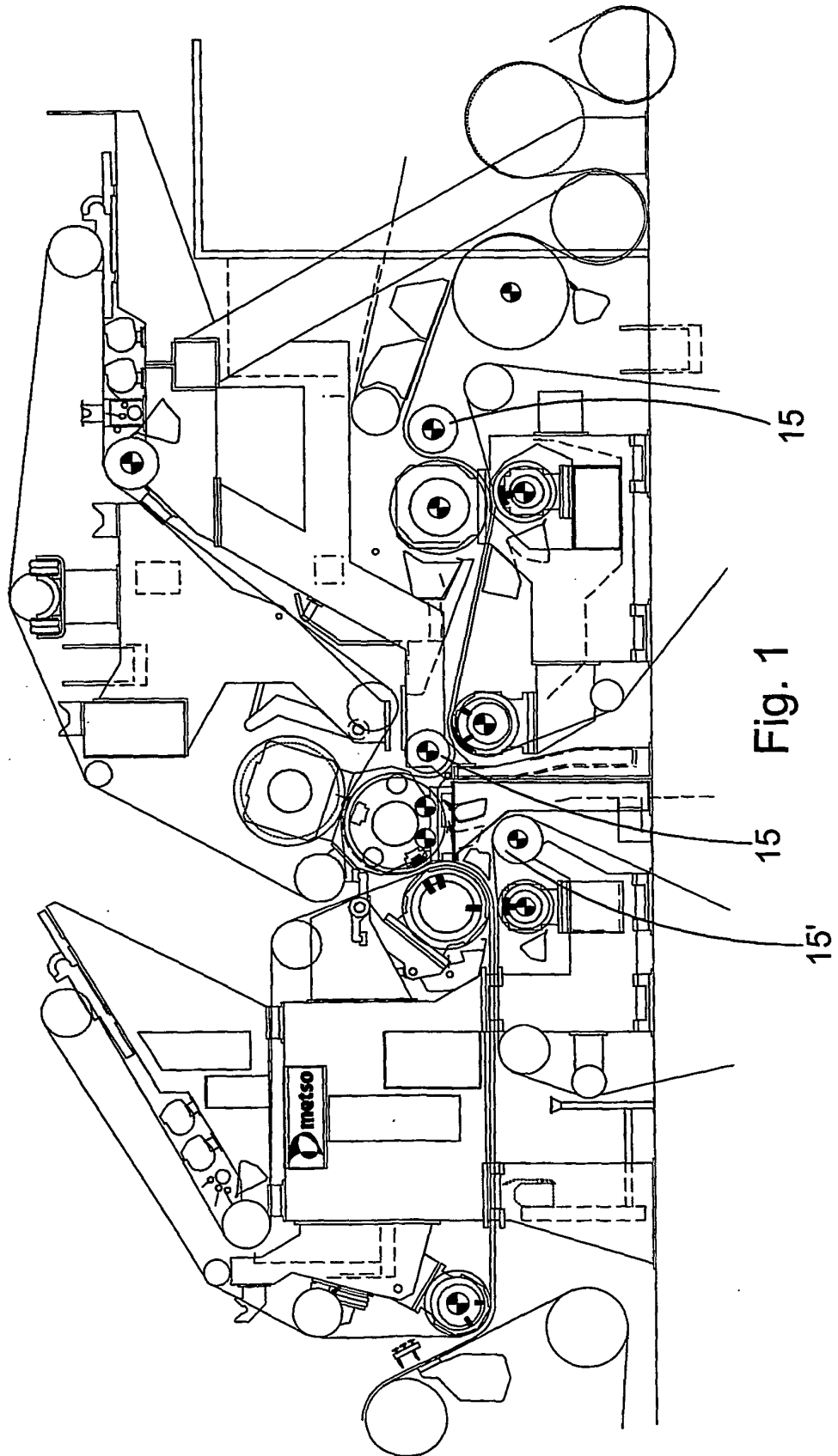
tivement aux deux extrémités du corps (10), agencées pour supporter le rouleau tendeur (15, 15') de façon rotative dans des dispositifs paliers (12) dans la machine de formation de bande, dans lequel ladite pièce d'extrémité (11) est assemblée à partir de pièces séparées, comprenant

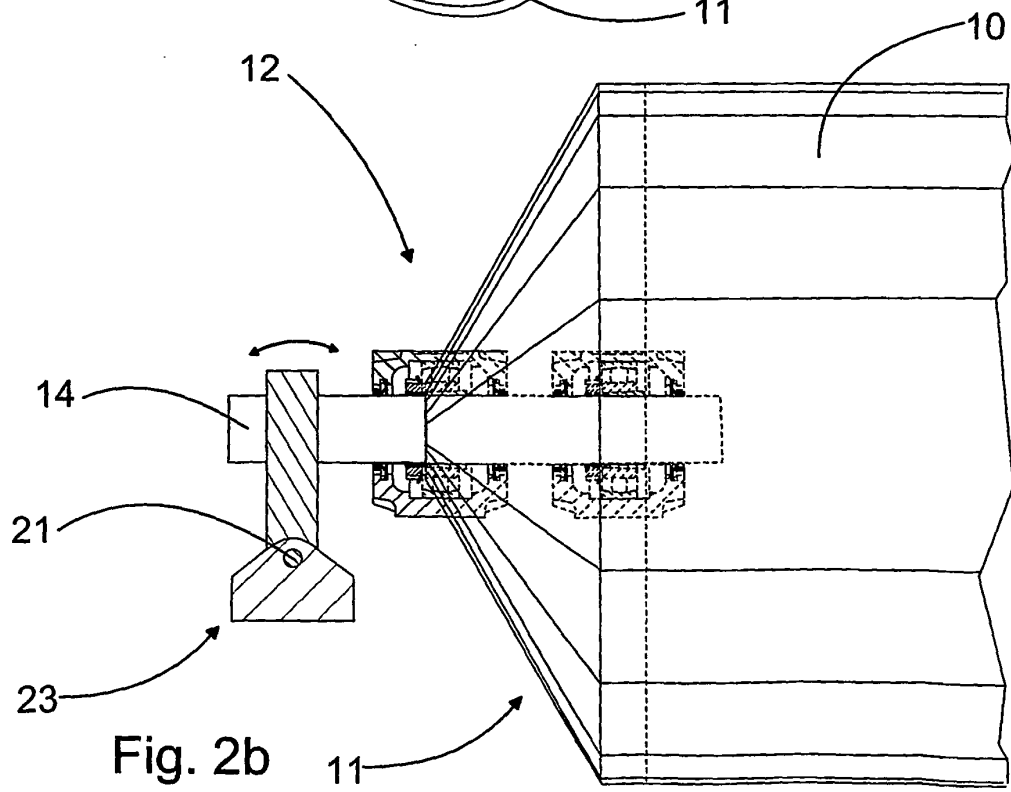
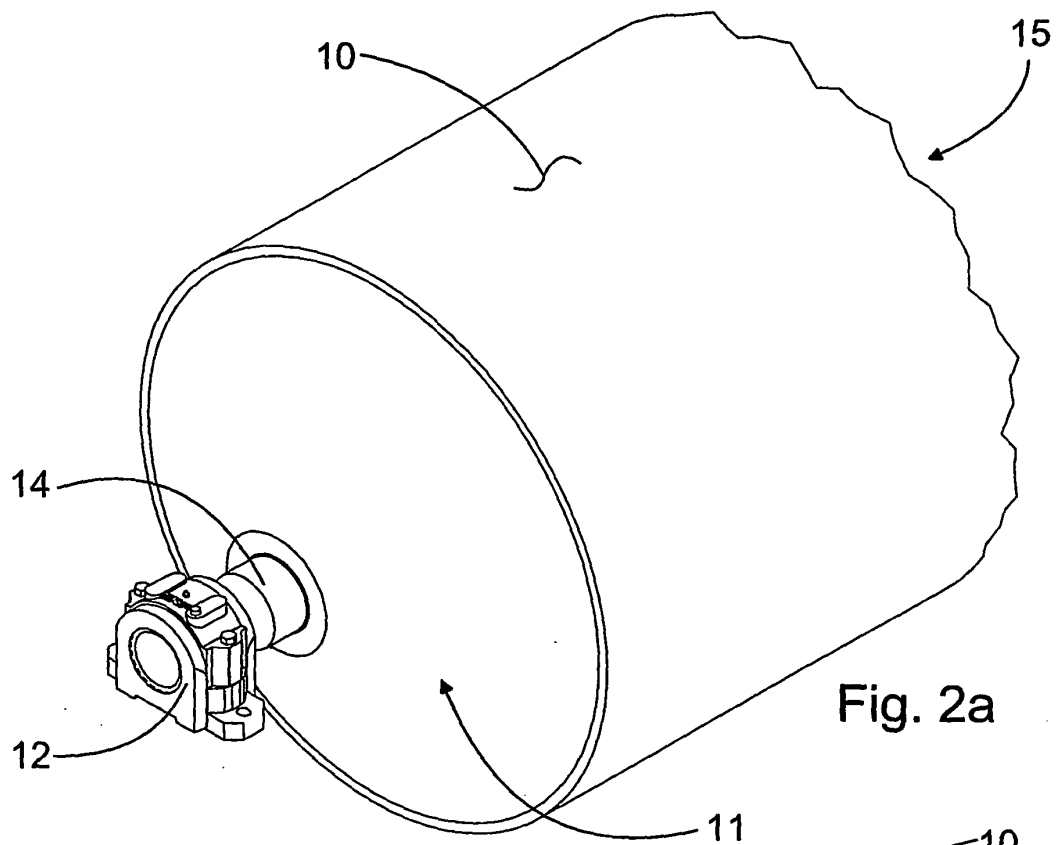
- une tôle d'extrémité (13)
 - un arbre saillant (14), et
 - au moins une pièce de tôle façonnée (19), dans lequel
 - l'arbre saillant (14) prévu pour le palier est ménagé dans la plaque d'extrémité (13), et
 - la au moins une pièce de tôle façonnée (19) est montée séparément entre la tôle d'extrémité (13) et l'arbre saillant (14),
- caractérisé en ce que** les points de contact de la pièce de tôle façonnée (19) avec la tôle d'extrémité (13) et avec l'arbre saillant (14) sont espacés dans la direction axiale, et **en ce que** la pièce de tôle (19) est courbée ou conique de façon que la pièce de tôle (19) s'ouvre dans le sens qui s'éloigne ou qui se rapproche de la pièce d'extrémité opposée.

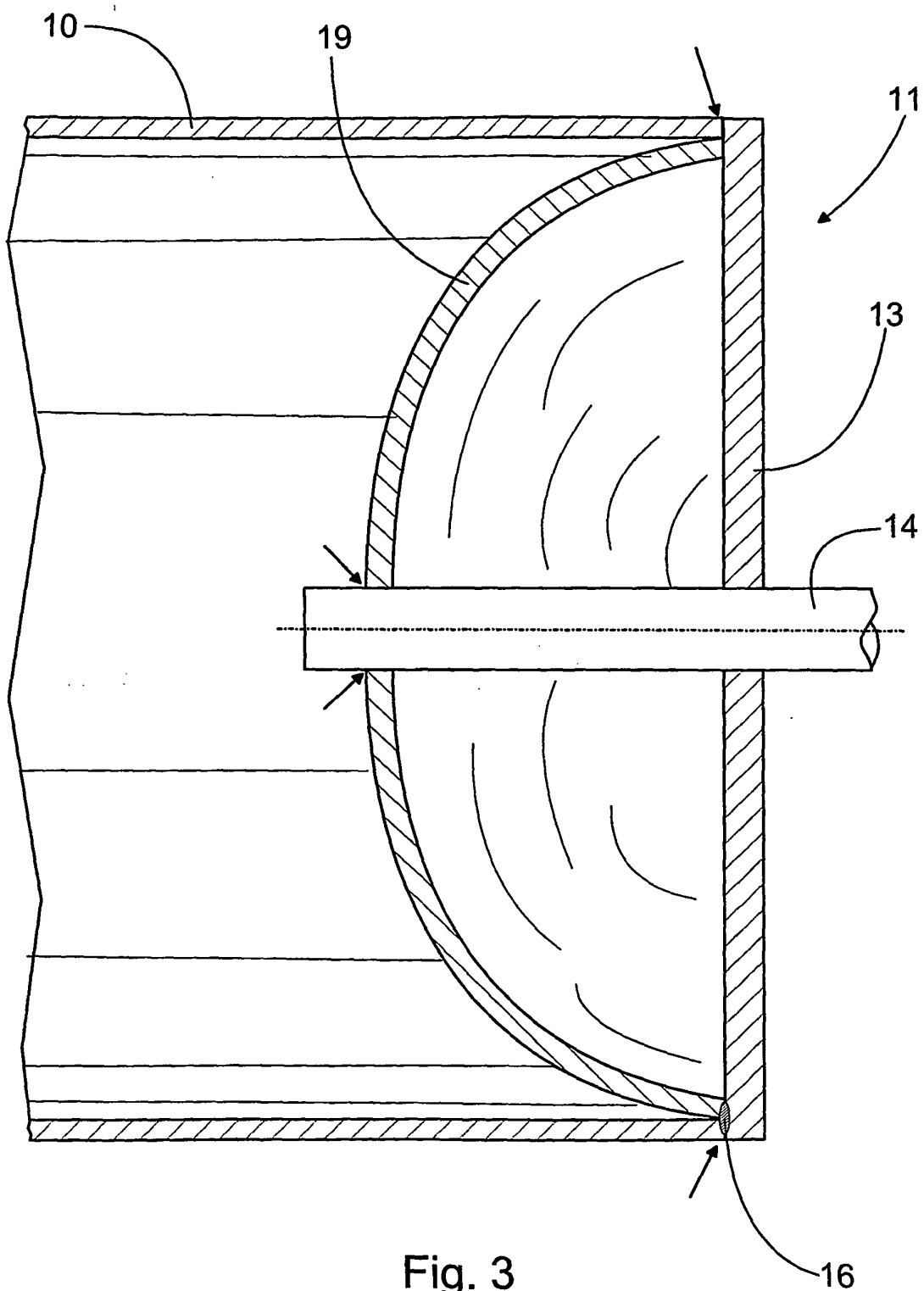
2. Rouleau tendeur selon la revendication 1, **caractérisé en ce que** la tôle d'extrémité (13) et l'arbre saillant (14) sont des corps de révolution usinés séparément.
3. Rouleau tendeur selon la revendication 1 ou 2, **caractérisé en ce que** le corps (10) et la pièce de tôle (19) sont réalisés en matériau en feuille mince.
4. Rouleau tendeur selon l'une quelconque des revendications 1 à 3, **caractérisé en ce qu'il** y a un joint à serrage entre la tôle d'extrémité (13) et l'arbre saillant (14).
5. Rouleau tendeur selon l'une quelconque des revendications 1 à 4, **caractérisé en ce qu'au** point où le corps (10), la tôle d'extrémité (13) et la pièce de tôle (19) se rejoignent, il y a une soudure (16), pour fixer le corps (10), la tôle d'extrémité (13) et la pièce de tôle (19) l'un à l'autre.
6. Rouleau tendeur selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** du matériau isolant et/ou amortisseur (24) est disposé dans l'espace délimité par le corps (10) et par les pièces d'extrémités (11).
7. Rouleau tendeur selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** du matériau isolant et/ou amortisseur (24) est disposé dans l'espace délimité par la tôle d'extrémité (13) et par la pièce de tôle (19).

8. Utilisation d'un rouleau tendeur (15) selon l'une quelconque des revendications 1 à 7, dans lequel le rouleau tendeur (15) est un rouleau en contact avec le papier. 5
9. Utilisation d'un rouleau tendeur selon l'une quelconque des revendications 1 à 7, dans laquelle le rouleau tendeur (15) est rouleau en contact avec une toile synthétique. 10
10. Procédé pour fabriquer un rouleau tendeur pour une machine de formation de bande, procédé dans lequel
- un corps (10) est réalisé en un matériau en feuille, 15
 - des pièces d'extrémités (11) sont réalisées, chacune desquelles comprenant une tôle d'extrémité (13), un arbre saillant (14) prévu pour un dispositif palier (12) et une pièce de tôle façonnée (19), et 20
 - les pièces d'extrémité (11) sont fixées respectivement aux deux extrémités du corps (10), la tôle d'extrémité (13) et l'arbre saillant (14) étant agencés en tant que pièces séparées et étant reliées par au moins une pièce de tôle façonnée (19), de manière à former une construction en cellule, 25
- caractérisé en ce que** les points de contact de la pièce de tôle façonnée (19) avec la tôle d'extrémité (13) et avec l'arbre saillant (14) sont espacés dans la direction axiale, et **en ce que** la pièce de tôle (19) est courbée ou conique de façon que la pièce de tôle (19) s'ouvre dans le sens qui s'éloigne ou qui se rapproche de la pièce d'extrémité opposée. 30 35
11. Procédé selon la revendication 10, **caractérisé en ce que** le corps (10), la pièce d'extrémité (13) et la pièce de tôle (19) sont soudés simultanément l'une à l'autre. 40
12. Procédé selon la revendication 10 ou 11, **caractérisé en ce que** la pièce de tôle (19) est réalisée en un matériau en feuille mince enroulée et/ou emboutie, ou est fabriquée par soudage à partir d'une ou de plusieurs parties. 45
13. Procédé selon l'une quelconque des revendications 10 à 12, **caractérisé en ce que** le dispositif palier (12) est fixé soit à l'arbre saillant (14) ou à la pièce de tôle (19), ou à la pièce de tôle (19) et à la tôle d'extrémité (13). 50

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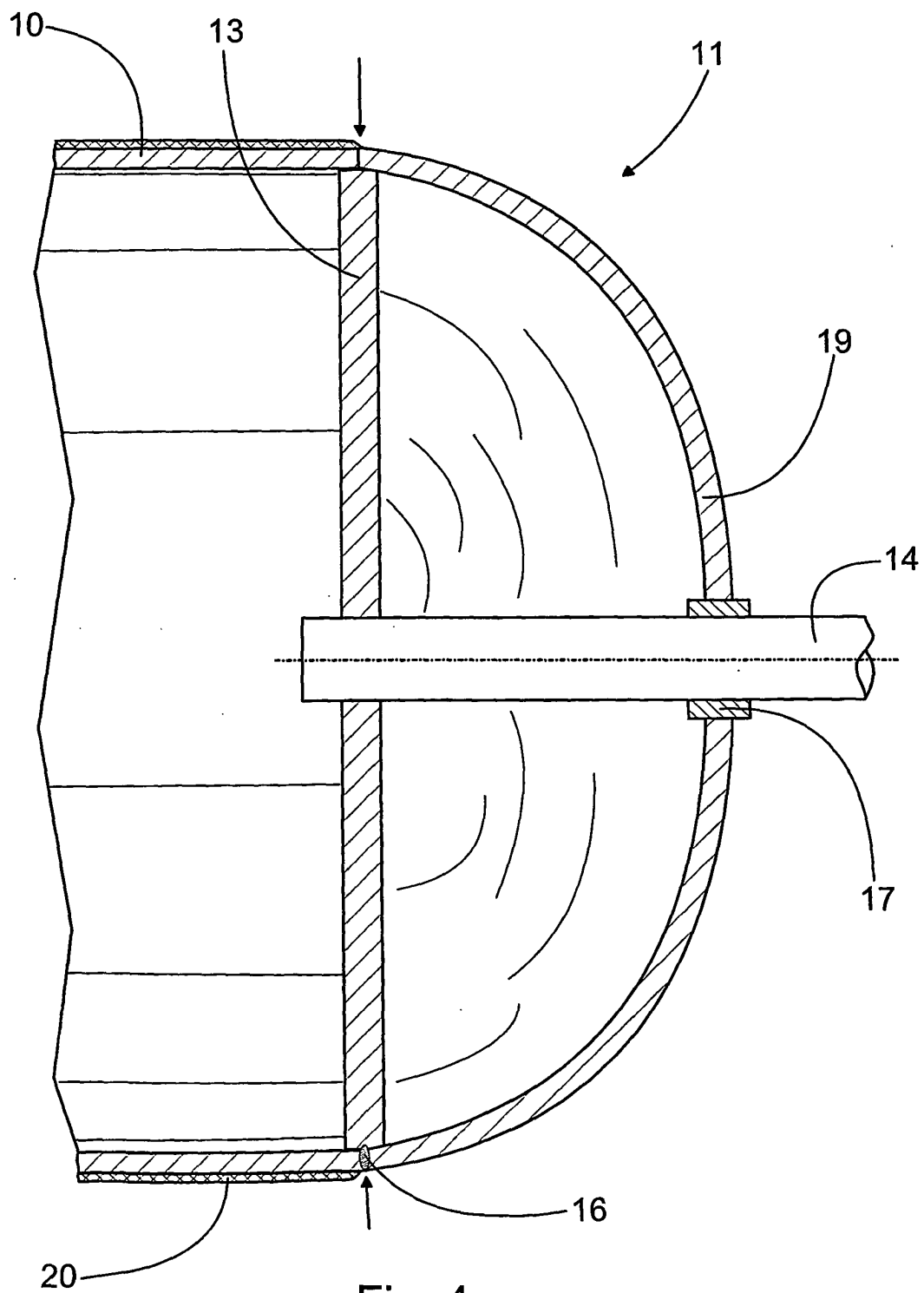


Fig. 4

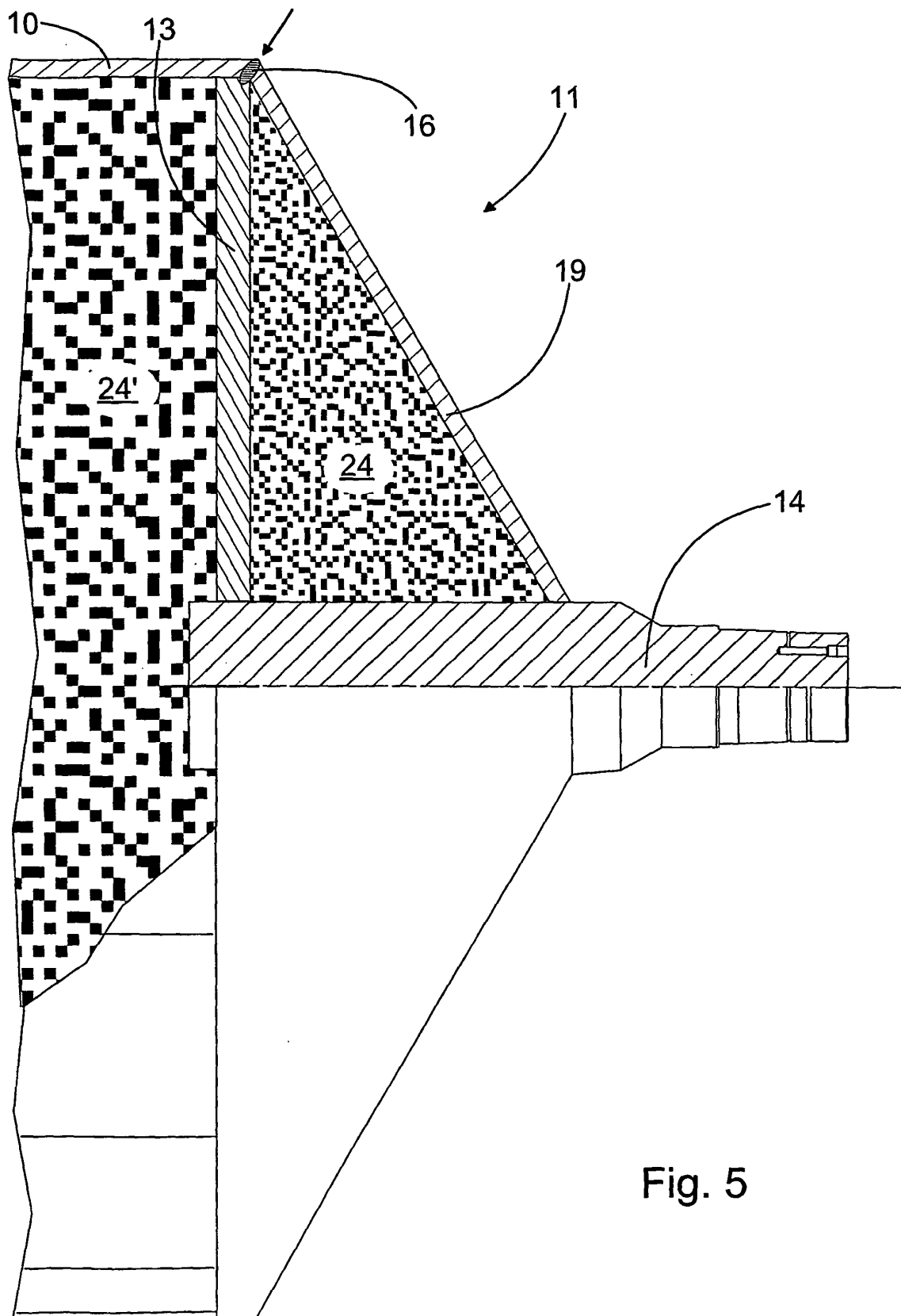
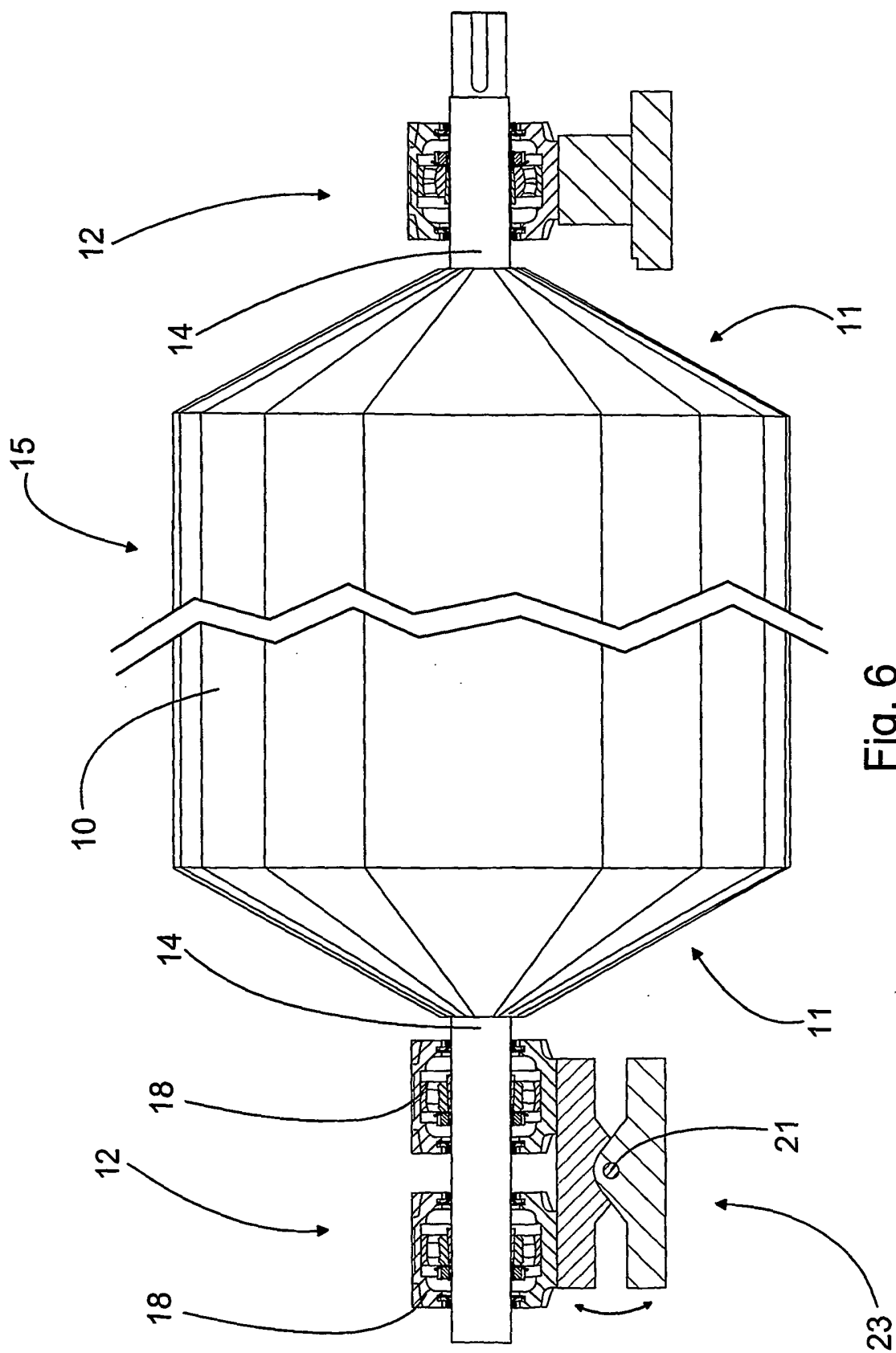


Fig. 5



REFERENCES CITED IN THE DESCRIPTION

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