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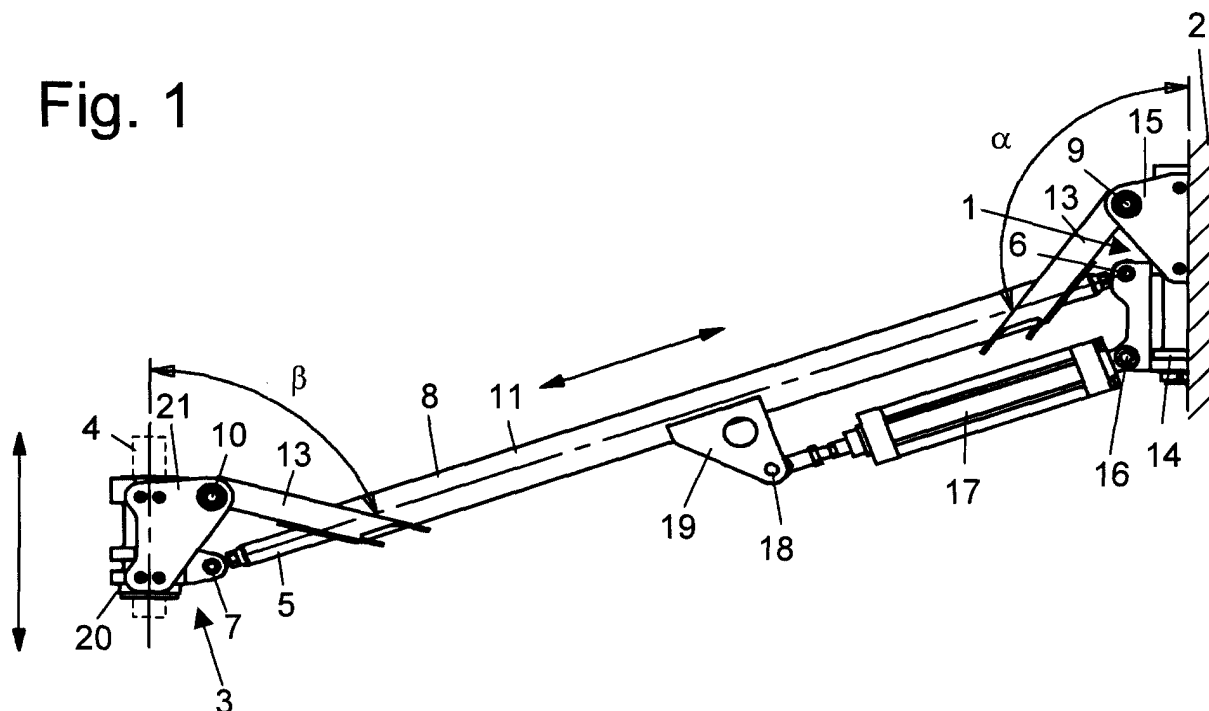
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(54) **Mechanism for angular guiding of tools**

(57) A mechanism for guiding a tool (4) includes two stiff arm elements (5, 8) connected by hinges (6, 9) to a wall support (1) attached to a wall (2) and by hinges (7, 10) to a tool support (3) assembly for carrying the tool. The arm elements and the supports form a parallelogram allowing the tool to be displaced always taking the

same angle to the vertical. For protecting the body of an operator and making the operation of the mechanism easy, the second arm includes a portion (11) that at least partly encloses a portion of the first arm. The enclosing portion has a small extension in a direction between the two arms, this also making the mechanism compact.

**Fig. 1**



## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates to a mechanism for angular guiding of tools, in particular electrically powered portable tools and tools powered by compressed air such as screw-drivers and hand boring and drilling machines.

### BACKGROUND

**[0002]** In some cases, devices for fixing, supporting or guiding hand tools and portable tools require mechanisms allowing that the angular positions of the tools in relation to a reference or base are maintained or are controlled in a an intended way. Such a mechanism can include at least two mechanically stiff elements such as connection arms or bars. They are at one end articulated at hinges of the reference or base and at the other, opposite end articulated at hinges of a support for a tool. The distance between the hinges of each element can e.g. be identical, this allowing the tool support and thereby a tool attached to the support to always have the same angular position in relation to the reference or base and hence, in the case where the reference or base is stationary, also to a vertical or horizontal line. In operating such a mechanism including arms or bars there is a risk that portions of the body, such as fingers, of an operator or another person staying in the vicinity of the guiding mechanism can be pinched or squeezed between the connection arms of the mechanism and cause damage to said body portions.

### SUMMARY

**[0003]** It is an object of the invention to provide a mechanism for guiding a portable tool or hand toll that has a reduced risk for damage to the body of an operator when operating the mechanism.

**[0004]** It is another object of the invention to provide a mechanism for guiding a portable tool or hand tool that is easily operated.

**[0005]** It is another object of the invention to provide a compact mechanism for guiding a portable tool or hand tool.

**[0006]** Thus generally, a mechanism or device for guiding a tool includes two stiff elements, herein called arms, a first arm and a second arm. The first and second arms are connected by hinges at first ends to a first support assembly, that is intended to be stationarily mounted such as attached to a stationary reference or base and is called a wall support assembly. The arms are at second, opposite ends connected by hinges to a second support assembly, which is intended to carry a tool that is rigidly mounted thereto and which is called a tool support assembly. The axes of the all the hinges are parallel to each other. Hence, the hinges allow the second sup-

port assembly to move in a single plane that is fixed in relation to the first support assembly. For protecting the body of an operator and making the operation of the mechanism easy, the second arm includes a portion that at least partly encloses a portion of the first arm. Thus, when the first and second arms move and swing about their respective hinges, the enclosed portion of the first arm moves some small distance along the first arm and also a small distance in a perpendicular direction. The enclosing portion can be easily gripped by an operator for moving the tool and making the arms swing.

**[0007]** The place where the mechanism can be operated, i.e. the enclosing portion, is preferably given a small extension in a direction between the two arms, this giving a compact mechanism. In particular, a line between the hinges of the second arm can pass outside the enclosing portion of the second arm and/or this line can be located at a distance of a plane that is parallel to the axes of the hinges and passes through the outmost portion of the enclosing portion taken in a direction from the hinges of the first arm to the hinges of the second arm and/or a plane through the hinges of the second arm can pass outside the enclosing portion, at some distance thereof, either of these conditions being valid at least in middle swinging positions where the first or second arm takes positions in which a line between its hinges is substantially perpendicular to the line connecting the hinges at the first or second support assemblies.

**[0008]** Advantageously, the enclosed portion of the first arm has an outer shape corresponding to that of a bar or rod that preferably is straight. The enclosing portion is preferably a middle portion of the second arm and it can also have an outer shape corresponding to that of a bar or rod that preferably is straight or at least is similar to the shape of the enclosed portion. The outer dimension of the enclosing portion, taken in a direction perpendicular to the axes of the hinges, can be smaller than the distance between the hinges at first support assembly and/or at the second assembly, at least when the first or second arm takes said middle positions.

**[0009]** The outer dimension of the enclosing portion, taken in a direction perpendicular to the axes of the hinges, can e.g. be at most three times the outer dimension of the enclosed portion taken in the same direction, such between two and three times said outer dimension. It can in a practical embodiment be about 2.5 times said outer dimension.

**[0010]** The second arm can include end portions that also have outer shapes corresponding to those of bars or rods that can be straight and then the hinges of the second arm are located at the end portions. Such end portions then extend in oblique angles to the enclosing middle portion of the second arm, and the oblique angles can e.g. be in the range of 15 - 75° and in particular in the range of 20 - 40°.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]** The invention will now be described by way of non-limiting embodiments with reference to the accompanying drawings, in which:

- Fig. 1 is an elevational view of a mechanism for guiding a portable tool,
- Fig. 2 is a view similar to Fig. 1 of the mechanism in a different position, and
- Fig. 3 is cross-sectional view taken along the line A-A of Fig. 2.

## DETAILED DESCRIPTION

**[0012]** Figs. 1 and 2 are side views of a mechanism for guiding a portable tool, the mechanism including a first support assembly 1 for attachment to a reference or base such as a wall indicated at 2, the first support assembly herein called the wall support assembly, and a second support assembly 3, herein called the tool support assembly, to which the portable tool, indicated by the outline at 4, is intended to be mounted. A stiff, first arm 5 is by hinges 6, 7 pivotably mounted to the wall and tool support assemblies, respectively, the hinges having parallel pivoting axes. Hence, if the wall support assembly 3 is assumed to be stationary, the tool support assembly 3 can only move in one plane. The first arm 5 can be designed e.g. as a substantially straight bar, as illustrated, having a suitable cross-sectional shape. It can have e.g. a rectangular, square or circular outer profile, be a solid bar or a pipe, the latter shape seen in the cross-sectional view of Fig. 3. In a way similar to the first arm, a stiff, second arm 8 is by hinges 9, 10 pivotably mounted to the wall and tool support assemblies 1, 3, respectively, the hinges having pivoting axes parallel to each other and to those of the hinges 6, 7 of the first arm 5.

**[0013]** In the illustrated embodiment, the distance between the pivoting axes of the hinges mounted to the first arm and the distance between the pivoting axes of the hinges mounted to the second arm are equal to each other and the distance between the pivoting axes of the hinges mounted to the wall support assembly 1 and the distance between the pivoting axes of the hinges mounted to the tool support assembly 3 are in the illustrated embodiment equal to each other. Thus, as seen from the side of the mechanism, in directions parallel to the pivoting axes, a parallelogram is formed by the support assemblies and the two arms, the parallelogram having corners at the axes of the hinges. Hence, when the arms 5, 8 are allowed to swing, the sum of the angles  $\alpha$  and  $\beta$  is always equal to  $180^\circ$ , the arms acting as a parallel guide always maintaining the tool support assembly 3 and the tool 4 in the same angle in relation to the wall support assembly 1.

**[0014]** The second arm 8 has a middle portion 11 that at least partly encloses or surrounds a middle portion of

the first arm 5. The enclosing middle portion 11 can be substantially straight and has a bore 12 or through-hole extending in its longitudinal direction, as seen in Fig. 3. The bore or longitudinal hole 12 has a size allowing the enclosed portion of the first arm 5 to be displaced therein, when swinging the arms, the enclosed portion then moving inside and in relation to the enclosing portion 11 both in a direction along the first arm and in directions perpendicular to this direction and also to that of the axes of the hinges 6, 7, 9, 10. The middle portion 11 can for instance include a circular tube or pipe. Thus, as illustrated, the bore or longitudinal hole 12 can be circular and have a diameter that is significantly larger than the largest dimension, such as the diameter, of the cross-section of the first arm 5. If the longitudinal hole 12 is a rectangular, it can have a width substantially agreeing with or being only somewhat larger than the width of the first arm 5, in particular than the width of the enclosed portion. This will give the mechanism an enhanced stability, especially if the first arm has a square or rectangular shape. The width is herein taken in directions parallel to the hinge axes. The rectangle profile of the longitudinal hole must then be given a height allowing the movement of the enclosed portion of the first arm when operating the guiding mechanism to the various positions for which it is intended. The height of the rectangular hole must e.g. be about the sum of the diameter of the enclosed portion and 0.6 of the distance between the hinges at one of the support assemblies for allowing a movement of the mechanism to positions of  $\pm 45^\circ$  from the perpendicular position of Fig. 2.

**[0015]** The first arm 5 and the enclosing portion 11 of the second arm 8 can be pieces of pipes, such as pipes having a uniform wall thickness and cross-sections which have outer and inner profiles that are circular, square or rectangular.

**[0016]** The second arm 8 has end portions 13 connected to the middle portion 11 at their one ends and mounted to the respective hinges 9, 10 at their other ends. These end portions can as illustrated extend in oblique directions from the middle portion, the middle and end portions having generally outer shapes corresponding to that of elongated bodies of constant cross-sections such as those of bars or rods. The oblique angles can e.g. be in the range of  $15^\circ$  -  $75^\circ$  such as in the range of  $20^\circ$  -  $40^\circ$  and about  $30^\circ$  in relation to the longitudinal direction of the middle portion 11. The middle portion 11 and the first arm 5 can e.g. as illustrated be circular pipes having substantially the same wall thickness, the inner diameter of the middle portion being e.g. about 2.5 times that of the first arm or at least the diameter of the portion of the first arm that is enclosed by the second arm when the mechanism is allowed to swing. In another embodiment, not shown, the enclosing portion 11 is a rectangular pipe.

**[0017]** The enclosing portion 11 can be easily gripped or operated by an operator of the hand tool 4 with a small risk of having fingers or other body parts squeezed or

pinched by portions of the first and second arms. The enclosing portion also protects the enclosed portion from mechanical damage. In some cases, the tool 4 carried by the mechanism can put a too strong mechanical stress on the mechanism and then, if the enclosed portion would be bent, the bending will be stopped by the enclosing portion, in particular if the longitudinal through-hole 12 in the enclosing portion 11 is designed to have a minimum diameter or a minimum width, still allowing the normal movement of the first arm 5 when the mechanism is operated.

**[0018]** The guiding mechanism is most often operated by moving the tool 4 or the tool support assembly 4, but it can also be operated at the enclosing portion. As illustrated in the figures, the enclosing portion 11 has a small extension as seen in directions between the two arms 5, 8. Also, in the positions of the mechanism illustrated in Figs. 1 and 2 it is observed that a line between and a plane through the hinges 9, 10 of the second arm 8 are located completely outside the enclosing portion 11 of the second arm. The total outer dimension of the enclosing portion 11, as seen in a direction between the axes of the hinges of one of the support assemblies 1, 3 is suitably also smaller than the distance between the hinges 6, 9 and 7, 10 at the first support assembly and/or at the second assembly, at least when the first or second arm take the positions of Figs. 1 and 2. For example, the outer dimension of the enclosing portion 11, seen in said direction, can e.g. be at most three times the outer dimension of the enclosed portion taken in the same direction, such between two and three times said outer dimension. The outer surfaces of the enclosing portion 11 has advantageously a smooth shape without any sharp edges, e.g. having upper and lower surfaces that are rounded or curved, these being the surfaces of the enclosing portion that are located in directions parallel to a line between the hinges at either support assembly when the mechanism has the perpendicular position of Fig. 2.

**[0019]** In the illustrated embodiment, the second arm 8 takes most of the mechanical stress imposed to the mechanism when using it for guiding a tool 4 that can be quite heavy. The first arm 5 then acts only for maintaining the angular position of the tool and is primarily subjected to buckling stress.

**[0020]** The wall support assembly 1 can include a wall support part 14 intended to be rigidly mounted to e.g. a wall 2 and triangular side plates 15, rigidly attached to the wall support part. The wall support 14 then includes parts of the wall side hinge 6 for the first arm and at the free comers of the triangular plates is the wall side hinge 9 for the second arm mounted. The wall support 14 can have a free end, opposite an end at which the triangular plates are attached, at which a hinge 16 for an inner end of a balancing device 17 is mounted. The balancing device 17 can have an elongated, tubular shape and include some elastic and mechanically attenuating means, not shown. At the opposite, outer end of the bal-

ancing device another hinge 18 is mounted, connecting the balancing device to the second arm 8 via triangular plates 19 attached to the middle portion 11 of the second arm. In the same way as the first support assembly 1, the tool support assembly 3 can include a tool support part 20 intended to carry the tool 4 and triangular side plates 21, rigidly attached to the tool support part. The tool support 20 then includes parts of the tool side hinge 7 for the first arm 5 and at the free comers of the triangular side plates is the tool side hinge 10 for the second arm mounted.

**[0021]** The mechanism described above can be modified in various regards as realized by one skilled in the art without departing from the spirit of the invention. Thus, for example the enclosing portion can only surround the enclosed portion at two or three sides, the space in which the first arm is located then being only a longitudinal recess. The oblique portions of the second arm can have a more triangular shape as seen from the side. A line between the hinges at the wall support can be parallel to the wall or form an angle therewith. The hinge axes can form a geometrical figure that is not a perfect parallelogram, such an arrangement allowing a more complicated guiding movement of the tool. More than two swingable arms can be arranged, e.g. for giving the tool an enhanced stability, a more accurate angle and a more accurate position. At least one arm can then have portion at least partly enclosing another arm, e.g. in a manner to reduce the total size of the mechanism or for providing a shielding to part of the mechanism.

## Claims

1. A device for guiding a tool (4) including two stiff elements, a first element (5) and a second element (8), the first and second elements connected by hinges (6, 9) at first ends to a first support assembly (1) and connected by hinges (7, 10) at second, opposite ends to a second support assembly (3), the first support assembly intended to be attached to a reference or base (2) and the second support assembly intended to carry a tool, rigidly mounted thereto, the axes of the hinges all being parallel to each other, the hinges allowing the second support assembly to move in a single plane that is fixed in relation to the first support assembly, **characterized in that** the second element (8) includes a portion (11) at least partly enclosing a portion of the first element (5), the enclosed portion of the first element moving along the first element when the first and second elements swing about their respective hinges (6, 7; 9, 10), the enclosing portion in particular including an elongated body having a longitudinal direction and the enclosing portion in particular having a longitudinal hole (12) in which the enclosed portion of the first element is located.

2. A device according to claim 1, **characterized in that** a plane through the hinges (9, 10) of the second element (8) passes outside the enclosing portion (11) of the second element and/or that a line between said hinges passes outside and is located at a distance of a plane parallel to the axes of the hinges, the plane passing through the outmost portion of the enclosing portion taken in a direction from the hinges (6, 7) of the first element (5) to the hinges of the second element, at least when the first or second element takes positions in which a line between its hinges is substantially perpendicular to a line connecting the hinges at the first or second support assemblies.
3. A device according to claim 1, **characterized in that** the enclosed portion of the first element (5) has an outer shape corresponding to that of a bar or rod and that the enclosing portion is a middle portion (11) of the second element (8) also having an outer shape corresponding to that of a bar or rod, the outer dimension of the enclosing portion in a direction perpendicular to said axes and to a longitudinal direction of the enclosing or enclosed portion being smaller than the distance between the axes of the hinges (6, 9; 7, 10) at the first support assembly (1) and/or at the second support assembly (3), at least when the first or second element take positions in which a line between its hinges (6, 7; 9, 10) is substantially perpendicular to a line connecting the hinges at the first or second support assemblies.
4. A device according to claim 1, **characterized in that** the enclosed portion of the first element (5) has an outer shape corresponding to that of a bar or rod and that the enclosing portion is a middle portion (11) of the second element (8) also having an outer shape corresponding to that of a bar or rod, the outer dimension of the enclosing portion in a direction perpendicular to said axes and to a longitudinal direction of the enclosing or enclosed portion being at most three times the outer dimension of the enclosed portion in the same direction and in particular between two and three times said outer dimension and preferably corresponding to substantially 2.5 times said outer dimension.
5. A device according to claim 1, **characterized in that** the enclosed portion of the first element (5) has an outer shape corresponding to that of a bar or rod and that the enclosing portion is a middle portion (11) of the second element (8) also having an outer shape corresponding to that of a bar or rod, the second element including end (13) portions also having outer shapes corresponding to those of bars or rods, the hinges (9, 10) of the second element located at the end portions and the end portions extending in oblique angles to a longitudinal direction of the enclosing middle portion, the oblique angles having in particular values in the range of 15 - 75° and preferably in the range of 20 - 40°.
6. A device according to claim 1, **characterized in that** the enclosed portion of the first element (5) has an outer circular shape and that the enclosing portion (11) has a circular bore (12) or a hole having a rectangular cross-section in which the enclosed portion is located, or
- that** the enclosed portion of the first element (5) has an outer rectangular shape, in particular a square shape, and that the enclosing portion has a through-hole having a rectangular cross-section, in particular a square cross-section, in which the enclosed portion is located.
7. A device according to claim 1, **characterized in that** the enclosed portion and the enclosing portion (11) both are pieces of pipes, the pipes in particular having cross-sections of circular, rectangular or square shapes.
8. A device according to claim 1, **characterized in that** the axes of the hinges (6, 7; 9, 10) form, seen in a direction parallel to the axes, a parallelogram.
9. A device according to claim 1, **characterized by** a balancing device (17) articulated at one of the support assemblies (1, 3) and at the enclosing portion (11), in particular through plates (19) attached to the enclosing portion and projecting therefrom, in a direction opposite that of a line from the hinges (6, 7) of the first element (5) to those (9, 10) of the second element (8).

Fig. 1

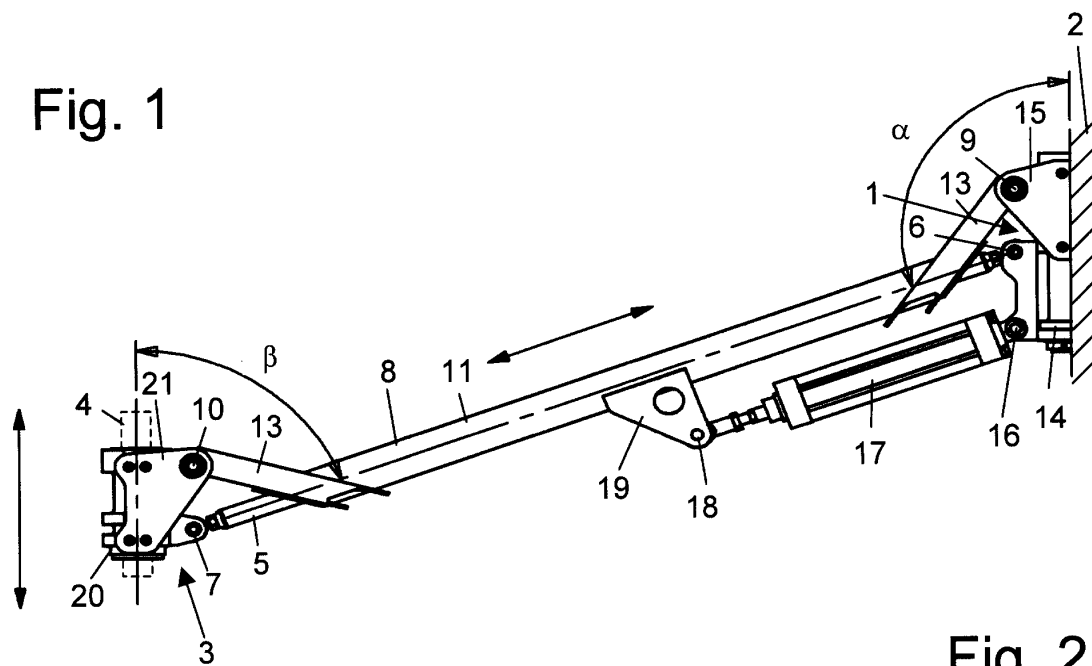


Fig. 2

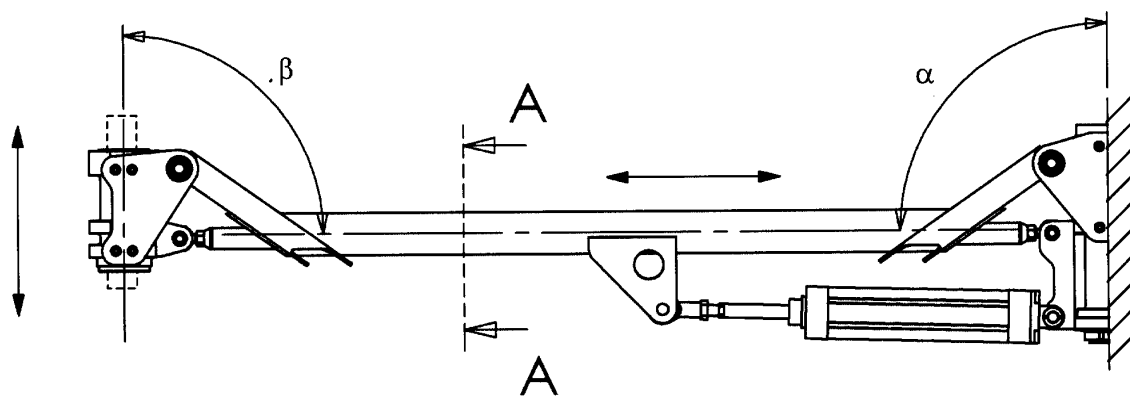
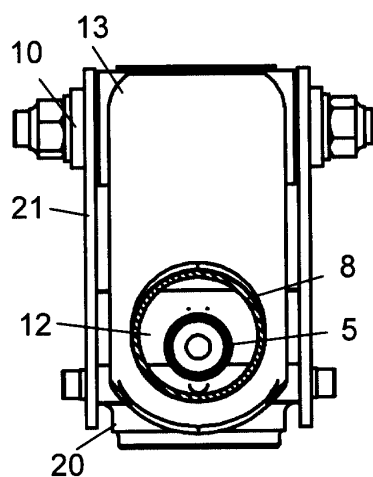


Fig. 3



A-A



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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                     |                                  |                                              |
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| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                     |                                  |                                              |

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