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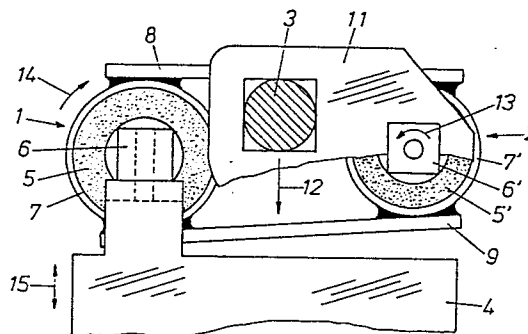
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(54) **Vibration dampened machine handle.**

(57) The machine handle has a hand part (3) which is connected with a source of vibrations (4) via two spring bushings (1, 2) of rubber. The rubber bushings (1, 2) consist of ring-shaped rubber bodies (5, 5') which surround an axle (6, 6') and which are surrounded by a cover (7, 7'). The spring bushings (1, 2) are connected with an intermediate member (8, 9) such that the vibrations are transferred at an attenuated intensity from the source (4) of vibrations to the hand part (3) via the rubber bodies (5, 5'). The axes of the rubber bushings run in parallel with each other within a plane which is transverse to the direction from the source (4) of vibrations to the hand part (3). The ends of the hand part (3) are displaced in a parallel motion when they are pressed on instead of performing a pivotal motion wherein the angle is changed between the longitudinal axis of the hand part and the other parts of the machine tool.

Fig. 1



Description**VIBRATION DAMPENED MACHINE HANDLE**

The invention relates to a vibration dampened machine handle by which a machine tool such as a hydraulic hammer may be pressed in a direction towards a work place.

Machine tools such as hydraulically or pneumatically operated drilling hammers, pneumatic drills, screw tools and angle sander-grinders transmit strong vibrations to the handle by which the operator presses them against the work place. The action of these vibrations on the operator's hands may in the course of time result in permanent occupational injuries, a phenomenon known under the name "white fingers". Efforts are therefore made to develop machine handle devices with improved vibrational dampening.

For two-hand operated machine tools such as hydraulic hammers a design is known wherein the grips are connected to the machine tool via an elastic, shock absorbing rubber body. The grips extend transversely to the longitudinal axis of the machine tool and are connected to these rubber bodies at one end and are furthermore covered by foam rubber or another shock absorbing material. The amplitude of the machine tool vibrations is largest in the direction of its longitudinal axis and due to the elastic intermediate piece and the reduction by lever action these vibrations are only transmitted to the grips with attenuated intensity.

In this design the effectiveness of the vibrational dampening depends substantially on the elasticity properties of the rubber bodies. The vibrational dampening will be the better the softer the rubber bodies are.

However, the rubber bodies may not be made too soft since the grips are to be used for pressing the machine tool against the work place and therefore may not be too yielding. The described design moreover has the drawback that the grips make a swinging movement about the ends where they are connected to the machine tool, in such a manner that their mutual angular position is changed when the operator presses against the machine tool or lifts it by grasping the grips. Particularly the latter has proved to be of comparatively great inconvenience in the use of hydraulic hammers since the operator gets the impression that the tool will not properly follow the movements when lifted from or pressed against the work place.

European published specification no. 0 156 387 describes a vibration dampened machine handle of the kind mentioned above and which as described in the introduction to claim 1 comprises a grip which is connected to an intermediate member via a first body made of rubber or similar material, said intermediate member being connected to the machine tool via a second body made of rubber or similar material. The machine handle device according to the published specification is furthermore provided with an "impact body" arranged loosely within the grip, said "impact body" serving to counteract the vibrations of the grip by striking the

inner walls thereof. The design and the arrangement of the individual units in the machine handle according to the mentioned specification must moreover be chosen and dimensioned such that there occurs a nodal point in the area of the grip where the operator will most probably take hold.

However, by the examples shown in the mentioned specification of grips having a free end, the grip just as is the case of the previously mentioned prior art will produce a swinging movement about the end by which it is connected to the machine tool when lifting the machine tool or pressing same against the work place.

Relative to the prior art it is the task of the invention to provide a vibration dampened machine handle wherein the vibration dampening units cooperate in such a manner that it is possible to use a grip with a free end, without the angle between the longitudinal axis of said grip and the other parts of the machine tool changing when the machine tool is pressed against the work place or is lifted by lifting it at the grip.

According to the invention this task is accomplished by designing the machine handle device described in the introduction to claim 1 with the structural characteristics disclosed in the patent claim.

The rubber bodies used to provide resiliency are according to the invention axially symmetrical and mounted in such a manner that their axes extend parallelly to each other in a plane which is transverse to the direction in which the machine tool is pressed towards the work place. The grip and the intermediate member are connected to the first rubber body in such a manner that they are turned relatively to each other about the axis of the first rubber body under torsional stress thereof when the machine tool is pressed towards the work place. The intermediate member and the machine tool are connected to the second rubber body in such a manner that they are turned relatively to each other about the axis of the second rubber body under torsional stress thereof when the machine tool is pressed towards the work place. Furthermore the grip comprises a substantially axially symmetrical hand part extending in parallel to the axes of the rubber bodies, said hand part being connected to the first rubber body via at least one transverse part, and the hand part is arranged in such a manner relative to the rubber bodies that a line extending from the axis of the hand part in the direction towards the work place intersects the plane, wherein the axes of the rubber bodies are situated, between said axes.

By this design of the machine handle device the hand part of the grip will generally extend transversely to the direction towards the work place, and it will not swing relative to the machine tool but be displaced parallelly thereto by its swinging about the axes of the two rubber bodies due to the machine tool vibrations or due to a pressing or pulling action

on the hand part, which displacement is moreover combined with a quite negligible rotation of the hand part about its own longitudinal axis. The rotation, however, is far less inconvenient than the pivoting movement of the hitherto known grips with a free end about the rubber body by which they are connected to the machine tool.

The design of the machine handle device disclosed in the claim furthermore implies that there is a comparatively long lever arm between the vibration source and the hand part of the handle device, as said path is folded twice about the pivotal joints formed by the rubber bodies. The improvement of the purely kinematic characteristic of motion of the machine handle device is thus accompanied by improvements in the dampening properties. Practical experience moreover shows that in torsion rubber shows dampening and resiliency properties which are highly adapted to the present purpose.

In the preferred embodiment of the invention disclosed in claims 2 and 3 where either rubber body is a cylindrical ring which surrounds an axle and which is surrounded by a cover, the connecting area between the rubber bodies and the adjoining parts is comparatively large which increases the durability of the machine handle. In the embodiment of the invention disclosed in claim 4 where the axis of the hand part lies at a small distance from the plane wherein the axes of the rubber bodies are situated, in a direction away from the machine tool, it is attained that by applying a light pressure in a direction towards the work place of the machine tool, the hand part will take a position in the middle between the rubber bodies whereby the transmission ratios of the vibrations from the machine tool to the hand part due to the configuration of the various levers will be the most favourable ratios possible.

The embodiment of the invention disclosed in claim 5 discloses a simple design of a hand part which may be grasped with both hands.

The invention will be further explained in the following with reference to the accompanying drawings wherein

Fig. 1 is a simplified side view of a vibration dampened machine handle,

Fig. 2 is a top view of the same device as in Fig. 1,

Fig. 3 is a front view of the machine handle including control elements for starting and stopping the machine tool, and

Fig. 4A and

Fig. 4B are simplified views of alternative embodiments of a machine handle according to the invention where it is the axles of the torsion springs which are interconnected instead of the covers.

Figs. 1 and 2 show a vibration dampened machine handle in an end view and a top view, respectively. In the drawing screws and other components for assembling individual units have been left out to facilitate the survey.

The main units of the machine handle are two axially symmetrical rubber springs 1 and 2 the axes of which extend parallelly to each other and with a

grip 3 extending between the rubber springs. The device comprised by the rubber springs and the grip is secured to two retaining plates 4 which are connected to a machine tool which is not shown in detail.

Both rubber springs 1 and 2 consist of a cylinder shaped rubber body 5 which surrounds an axle 6 and which is surrounded by a cover 7. The rubber body 5 is fixedly connected to the axle 6 and the cover 7 so that it is torsion loaded when the axle 6 and the cover 7 are turned relative to each other about the axis of the rubber body. In the drawing the parts forming the second rubber spring 2 are shown by reference designators provided with an apostrophe.

The two rubber springs 1 and 2 are connected via an intermediate member which in the shown embodiment of the invention consists of two connecting plates 8 and 9 that are welded to the opposite sides of the covers 7, 7'.

As will appear from Fig. 2, the axle 6 of the first rubber spring 1 is secured to the retaining plates 4 of the machine tool which is provided with two inwardly bent supporting webs 10. The second rubber spring 2 is connected to the grip 3 via two transverse mounting fittings 11 which extend transversely to the grip 3. In order to facilitate the mounting of the individual parts relative to each other the axles 6, 6' in the rubber springs 1 and 2 are formed with rectangular ends.

The machine handle shown in the drawings is used for pressing the machine tool (not shown) in a direction towards the work place. This is effected by pressing the grip 3 in the direction shown by an arrow indicated by the reference numeral 12 in Fig. 1. The force action on the grip 3 causes the axle 6' in the rubber spring 2 to turn a little in the direction indicated by the arrow 13, and the cover 7 of the rubber spring 1 turns a little in the direction indicated by the arrow 14. The turning of the cover 7 in the direction of the arrow 14 causes the centre in the rubber spring 2 to travel a distance on a circular path about the centre in the rubber spring 1. The rubber spring 2 therefore approaches the machine tool somewhat against the opposite torsion moment built up thereby in the rubber body. Conversely, the grip 3 describes a circular path about centre in the rubber spring 2 against the torsional moment thereby built up in the rubber body 5', said moment operating opposite the turning as shown by reference numeral 13.

The aggregate effect of the described movements is that both the rubber spring 2 and the grip 3 approach the machine tool 4 a little under the effect of the force indicated by the arrow 12.

The movement made by the grip 3 is composed by two oppositely directed circular arc shaped movements in such a manner that the grip will approximately move on a straight line. It is therefore a parallel displacement of the grip 3 in the direction 12, i.e. in the direction towards the work place.

The design of the machine handle shown in Figs. 1 and 2 therefore means that the angle between the longitudinal axis of the grip 3 and the machine tool is not changed when pressing the machine tool in a direction towards the work place. This implies a very

pleasant handling of the machine tool since the operator may apply his full weight in the pressure without thereby having to change the angular position of his wrists relative to the tool.

The torsional rigidity in the springs 1 and 2 is substantially determined by the properties of the rubber body and may be freely fixed by the production thereof. The dimensioning should be such that the grip 3 lies approximately halfway between the two connecting plates 8 and 9 when the machine tool is used. This produces a wide clearance of movement for the grip 3 in both directions.

The design of the machine handle shown in Figs. 1 and 2 moreover brings along the advantage that the grip 3 will strike the upper connecting plate 8 when the machine tool is lifted in a direction opposite the arrow 12. The operator is thereby given the impression that the grip is firmly secured and solid and the machine tool may be handled highly accurately and purposefully. Finally it should be mentioned that there is a comparatively long way for the vibrations 15 produced by the machine tool to be transmitted to the grip 3. The grip 3 is arranged on a comparatively long lever arm which contributes to make the vibrational dampening in the machine handle quite effective.

In Fig. 3 the machine handle is shown in a view in the direction indicated by III in Fig. 2. Some units have been left out in Fig. 3 to facilitate the survey and moreover various control means for starting and stopping the machine tool have been included.

As will appear from Fig. 3, the grip 3 is provided with a release pawl 16 which is pivotable about an axle 17. The pawl 16 engages a release pawl 18 which is pivotably suspended in a bearing 19 on the retaining plates 4 which are in connection with the machine tool. The release pawl 18 exerts a pressure on a starting button 20 starting the machine tool.

Due to the design of the machine handle the vibrations of the machine tool are practically exclusively converted into vertically reciprocating parallel displacements of the grip 3. The pawl 16 thus slides up and down the pawl 18 but at no time is there any risk that the machine tool will stop because of the fact that the release mechanism on the grip 3 moves relative to the machine tool during the work. When the machine tool is to be stopped, the hold on the lever 21 on the pawl 16 is released whereby the release button 20 which is spring loaded in the direction shown by the arrow 22 will swing both the pawl 18 and the release handle 16 in a direction towards the disengaged position.

The design of the machine handle thus makes it possible to provide a very simple solution of the problem of designing the actuator mechanism on a vibration dampened machine handle.

Figs. 4A and 4B show two alternative embodiments of vibration dampened machine handles according to the invention. In these two embodiments it is the axles of the rubber springs which are interconnected instead of the covers in that the covers then serve as connecting units to the machine tool and the grip, respectively. The embodiment shown in Fig. 4B will particularly be advant-

ageous in cases where the grip is designed to be gripped by one hand only.

Having read this specification it will be obvious to a person skilled in the art that the rubber springs 1 and 2 may either be designed with through-going axles or with an axle journal vulcanised into both ends. The specific design shown in the drawings of the individual structural components of the machine handle is moreover merely to be understood as examples in that the individual parts will always have to be adapted to the constructional limits set by the machine tool in question.

Claims

1. Vibration dampened machine handle by which a machine tool such as a hydraulic hammer may be pressed in a direction towards a work place and which comprises a grip which is connected to an intermediate member via a first body made of rubber or similar material, said intermediate member being connected to the machine tool via a second body made of rubber or similar material,

characterised in that the rubber bodies (5,5') used to provide resiliency are axially symmetrical and mounted in such a manner that their axes extend parallelly to each other in a plane which is transverse to the direction (12) in which the machine tool is pressed towards the work place, that the grip (3,11) and the intermediate member (8,9) are connected to the first rubber body (5') in such a manner that they are turned relatively to each other about the axis of the first rubber body (5') under torsional stress thereof when the machine tool is pressed towards the work place, that the intermediate member (8,9) and the machine tool are connected to the second rubber body (5') in such a manner that they are turned relatively to each other about the axis of the second rubber body (5') under torsional stress thereof when the machine tool is pressed towards the work place, that the grip (3,11) comprises a substantially axially symmetrical hand part (3) extending in parallel to the axes of the rubber bodies (5,5'), said hand part (3) being connected to the first rubber body (5') via at least one transverse part (11) and that the hand part (3) is arranged in such a manner relative to the rubber bodies (5,5') that a line extending from the axis of the hand part (3) in the direction (12) towards the work place intersects the plane, wherein the axes of the rubber bodies (5,5') are situated, between said axes.

2. Machine handle according to claim 1. **characterised** in that either rubber body (5,5') is a cylindrical ring which surrounds an axle (6,6') and which is surrounded by a cover (7,7'), that the intermediate member (8,9) extends between the covers (7,7'), and that the grip

(3,11) is connected to the axle (6') of the first rubber body (5') and the machine tool is connected to the axle (6) of the second rubber body (5).

3. Machine handle according to claim 1, **characterised** in that either rubber body (5,5') is a cylindrical ring which surrounds an axle (6,6') and which is surrounded by a cover (7,7'), that the intermediate member (23) extends between the axles (6,6'), and that the grip (3,) is connected to the cover (7') of the first rubber body (5') and the machine tool is connected to the cover (7) of the second rubber body.

4. Machine handle according to one of claims 1-3, **characterised** in that the axis of the hand part (3) lies at a small distance from the plane wherein the axes of the rubber bodies (5,5') are situated, in a direction away from the machine tool.

5. Machine handle according to one of claims 1-4, **characterised** in that the hand part (3) is longer than the rubber bodies (5,5') and has two free ends covered by rubber or similar material.

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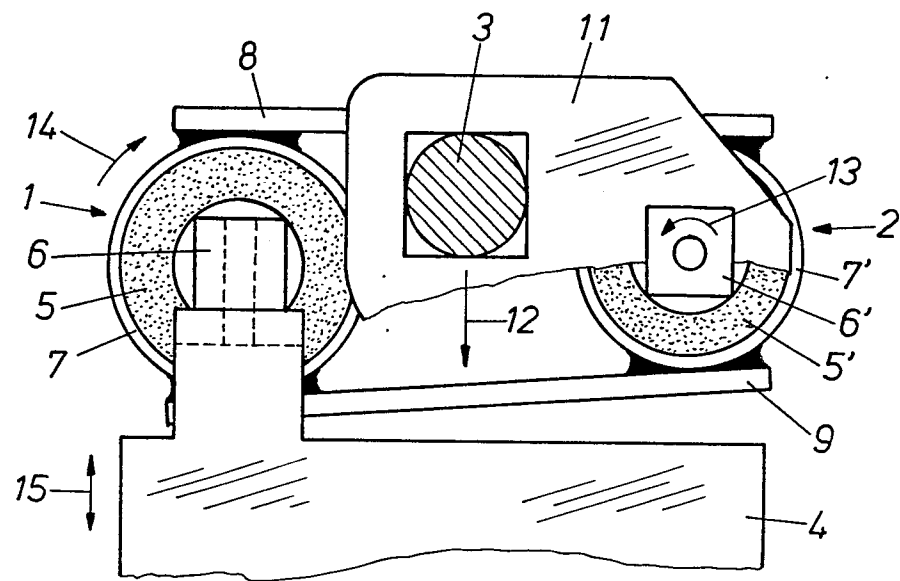


Fig. 1

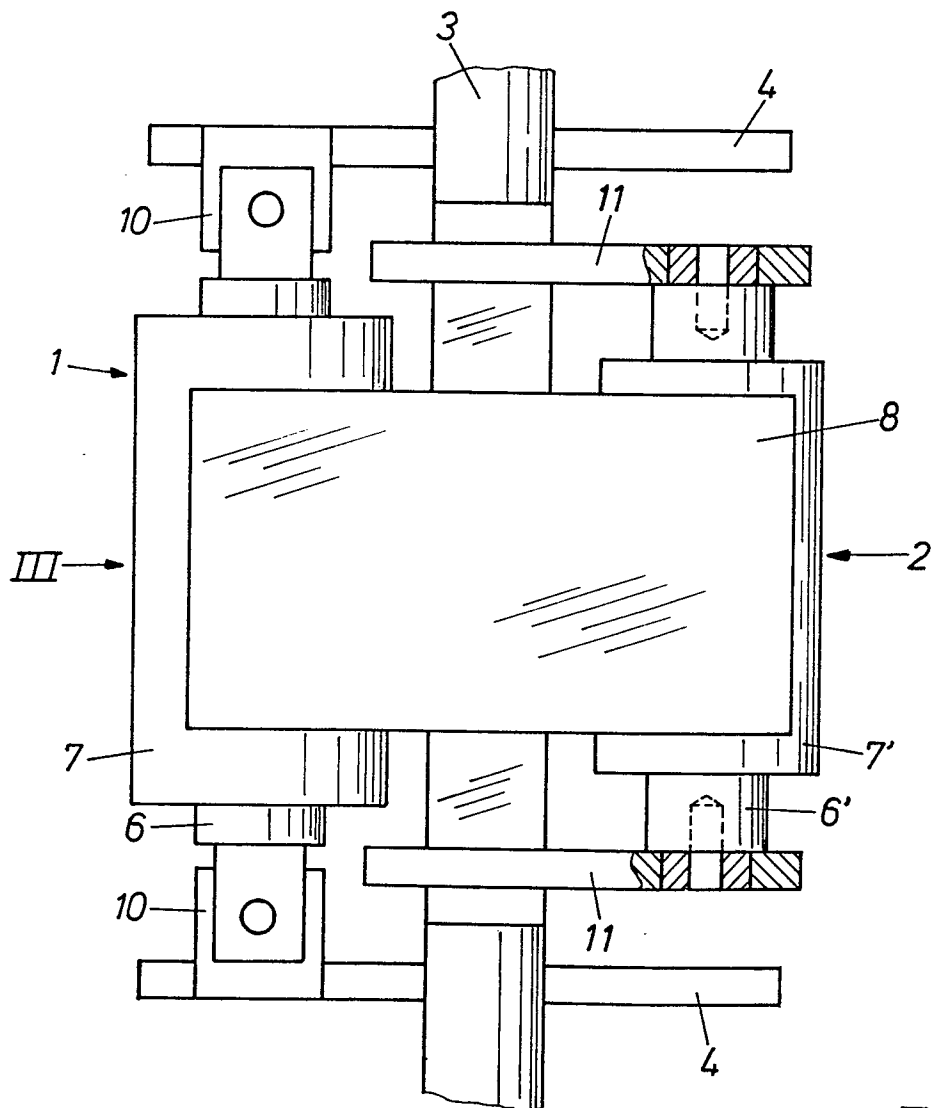


Fig. 2

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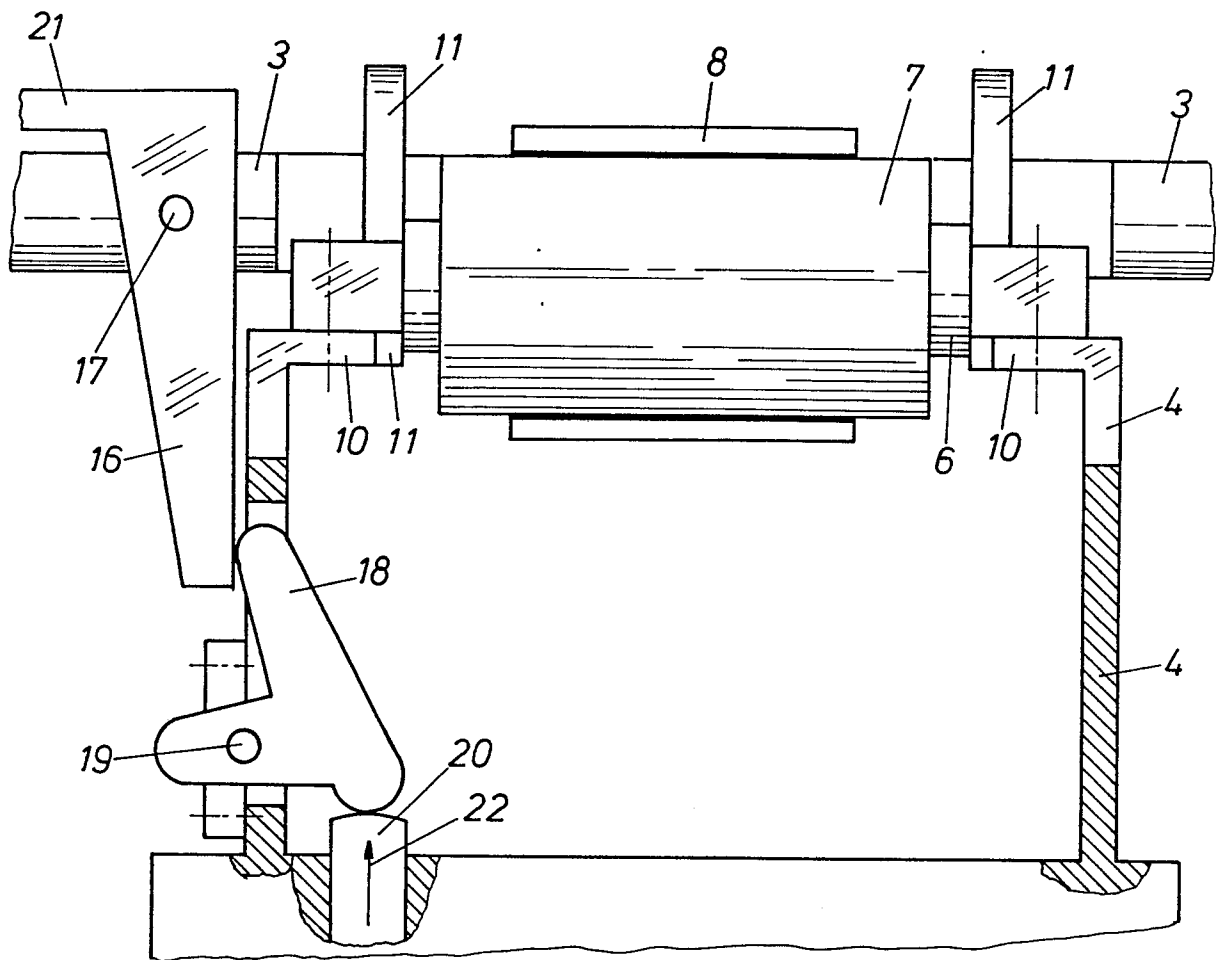


Fig. 3

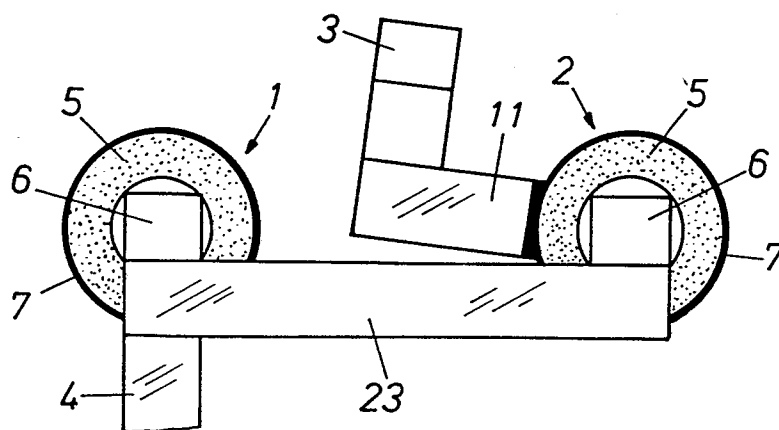


Fig. 4B

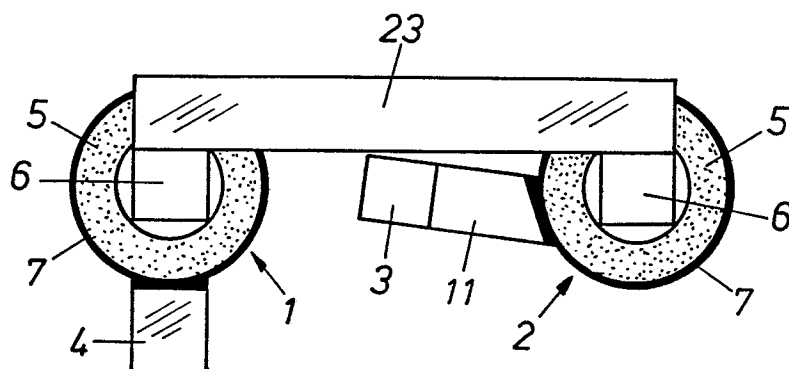


Fig. 4A