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DEVICE FOR MOVING A MEMBER OVER A SUPPORT WITHOUT PLAY

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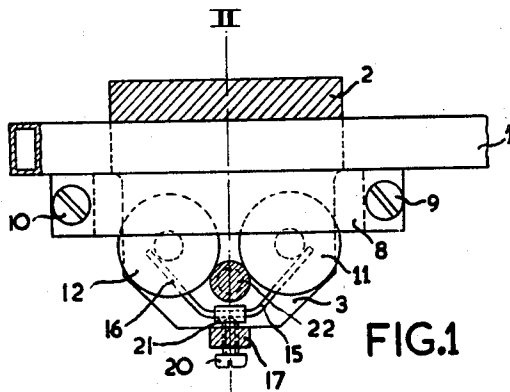


FIG. 1

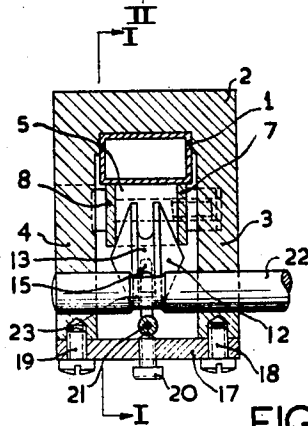


FIG. 2

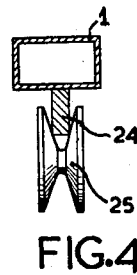


FIG. 4

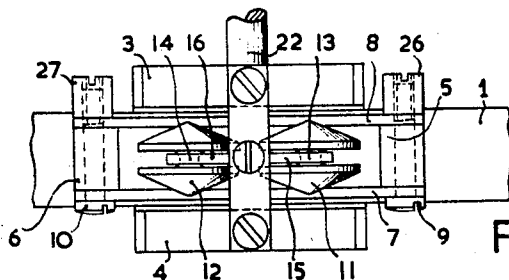


FIG. 3

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DEVICE FOR MOVING A MEMBER OVER A SUPPORT WITHOUT PLAY

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5 Claims. (Cl. 74—206)

The invention relates to a device for moving a member over a support without play. When such devices, which may, for example, be used in machine tools, measuring instruments, telecommunication tuning devices and the like, have to satisfy exacting requirements with respect to freedom from play, they require careful manufacture and precision finishing so that generally they are expensive and complicated. In contradistinction thereto, the device in accordance with the invention can be manufactured with the normal precision according to simple methods of manufacture and provide a movement of the member to be displaced which is substantially entirely free from play.

According to the invention such a device is characterized in that the support is provided with at least one guiding member which extends parallel to the direction of length of the support and the member to be moved is provided with two universally movable rollers each comprising two members which are rigidly connected together by a spindle and are partially bounded by equal cone surfaces, provision being made of preferably adjustable pressure members which engage the spindles and both press the cone surfaces to the guiding member or members and urge the rollers to one another, the cross-section of the guiding member or members being such that the contact between the guiding member or members and the cone surfaces is invariably a point contact, whilst a shaft is arranged at right angles to the direction of length of the guiding member or members, which shaft can be moved from outside and likewise contacts each of the two universally movable rollers in one point only.

According to one embodiment of the invention, the pressure members preferably comprise a spring which acts upon both spindles at points which are symmetrical with respect to a plane at right angles to the guiding member or members.

According to an alternative embodiment, it is of advantage for the angle between the radial passing through the point at which the spring acts and the perpendicular passing through the centre of the roller on the guiding member to be approximately 120°, whilst the angle between the radial passing through the points at which the shaft which is movable from outside acts on the movable members and the said perpendicular is likewise approximately 120°. Thus, each roller is provided with a kind of three point suspension, so that the position of the roller is accurately determined.

According to a further alternative embodiment of the invention, the guiding members may comprise two parallel strips of rectangular cross section between which are arranged parts of the cone surfaces of the members which are partly bounded by cone surfaces. However, according to a still further alternative embodiment of the invention provision may be made of one guiding member comprising a strip of rectangular cross section which is partly embraced by the cone surfaces of the members which are partly bounded by cone surfaces.

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The shaft which is rotatable from outside may be journaled so that it can only rotate; according to a still further alternative embodiment of the invention, this shaft is so journaled as to permit of a slight axial displacement within predetermined limits. This is of advantage in view of the universal mobility of the rollers and any lack of parallelism of the guiding member or members and the support. In this arrangement the rollers and the shaft alternately adjust themselves to the correct position.

In order that the invention may readily be carried into effect two embodiments thereof will now be described with reference to the accompanying drawing, in which:

Fig. 1 is a cross-sectional view of a device for moving a member over a support without play taken along the line I—I of Fig. 2 and viewed in the direction of the arrows.

Fig. 2 is a sectional view of the device shown in Fig. 1 along the line II—II.

Fig. 3 is a bottom plan view of the device shown in Fig. 2, and

Fig. 4 is an alternative embodiment of the support, guiding member and rollers shown in Fig. 1.

In the figures, reference numeral 1 designates a support which comprises a hollow tube of rectangular cross-section which may, for example, act as a wave guide in a telecommunication apparatus. A member 2 must be able of moving over this support without play. The member 2 comprises a U-shaped casing having two limbs 3 and 4. The support 1 is provided with two projections 5 and 6 to which two strips 7 and 8 are secured by means of screw bolts 9 and 10. The strips 7 and 8 have a rectangular cross-section, as will be seen from Fig. 2. In addition, provision is made of two rollers 11 and 12. These rollers each comprise two members which are partially bounded by a cone surface and are rigidly connected together by spindles 13 and 14 respectively. The rollers are arranged so that the two opposed cone surfaces of each roller partly fall between the strips 7 and 8. The rollers are consequently universally movable and are held by a spring having two arms 15 and 16. Each arm engages the spindle connecting the two members which constitute a roller. Thus, arm 15 engages spindle 13 and arm 16 engages spindle 14. The line which passes through the centre of the roller and the point at which the spring acts on the spindle is at an angle of approximately 120° to the perpendicular. The limbs of the U-shaped support 2 are connected by a coupling member 17 which is connected to the limbs by means of screws 18 and 19. Said coupling member 17 is provided with a pressure screw 20, whilst the two spring arms 15 and 16 are rigidly connected together by a coupling member 21. The pressure screw 20 exerts an adjustable pressure upon the coupling member 21, so that the spring pressure is adjustable. By the spring arms 15 and 16 the rollers 11 and 12 are pressed to one another and to the strips 7 and 8. Between the rollers provision is made of a shaft 22 which is adapted to be moved from without, is journaled in the limbs 3 and 4 and is capable of a slight axial displacement, for example, by means of adjusting screws or like parts (not shown). This shaft 22 has a portion 23 of smaller diameter which on both sides of the spring arms engages the cone surfaces of the rollers 11 and 12; the line passing through this point of contact and the centre of the associated roller is again at an angle of 120° to the perpendicular through the centre of the roller. This results in a kind of three-point suspension of the roller, the points being the point of contact of a cone surface with the guiding member, the point of contact between the spring and the spindle and the point of contact between the rotary shaft and the cone surface, so that the position of the rollers is determined. The

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guiding-members or the rotary shaft 22 need not be manufactured with a high degree of accuracy, since due to the universal mobility of the rollers their correct positioning is invariably ensured automatically. In addition, a reducing transmission is produced between the movement of the shaft 22 and the movement of the rollers so that the support can be adjusted accurately. One of the limbs 3 or 4 may be provided with an aperture and the side wall of the support 1 which thus becomes visible may be provided with a graduation from which the correct position of the support can always be read.

As is shown in Fig. 4, the two guiding-members 7 and 8 may be replaced by a single guiding member 24 of rectangular cross-section. In this arrangement, use must be made of rollers of the shape shown by the member designated 25 in which the apex angles of the cone surfaces face one another in contra-distinction to the rollers 11 and 12 in which the apex angles of the cone surfaces are remote from one another. However, in the construction comprising two guiding members as shown in Figs. 1, 2 and 3 the transmission ratio between the shaft rotation and the movement of the support can exceed that of the construction shown in Fig. 4. Furthermore there is no need for the guiding member 24 to be of rectangular cross-section. The cross-section may, for example, be circular or polygonal. However, satisfactory operation of the device requires that the contact between the guiding members and the cone surfaces is invariably a point only, so that a guiding member, the cross section of which, for example, is bounded by inclined surfaces the slope of which is equal to that of the cone-surfaces is not admissible.

In the embodiment shown the movement of the support is limited by two boxnuts 26 and 27 which are screwed on the bolts 9 and 10 and project so far that the limb 3 strikes said nuts on movement of the support to either side; if, however, the support is required to be capable of unrestricted movement, these boxnuts may be replaced by low nuts.

It has been found that the device described is readily adjustable to within 0.01 mm. and adjusting accuracy of 1 micron is obtainable without great difficulty. In addition, a clockwise rotation of the operating shaft corresponds to a movement to the right of the support, as is obviously desirable in practice. The assembly is stable and there can be no tendency for the support to tip over. In addition, when the path of the support is limited, it is of advantage that the driving mechanism slips when the support reaches the limit.

When the device is arranged approximately vertically it is found to be self-locking so that the support does not slip or move by its own weight.

The universal mobility of the rollers ensures that they invariably adjust themselves correctly and that invariably satisfactory contacts with the guiding-members and the

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shaft are produced irrespective of the greater or lesser degree of precision in the manufacture of the device.

The fact that the driving-shaft is capable of a slight axial displacement within predetermined limits is of advantage in view of a possible lack of parallelism of the guiding-member or members and the support and consequently contributes to cheap manufacture of the device.

What is claimed:

1. A device for moving a U-shaped member over a support without play comprising at least one guiding member extending from said support and parallel to the direction of length of said support, an element connecting the limbs of said U-shaped member, at least two movable rollers positioned between the limbs of said U-shaped member, each having two, spaced, cone-shaped rollers members connected by a spindle, a spring member adjustably mounted on said element and engaging both of said rollers to bias said cone-shaped roller members into point-contact engagement with said guiding member and urge the rollers towards each other, and an externally operated shaft journaled through the limbs of said U-shaped member and extending in a direction perpendicular to the direction of length of said guiding member, said shaft having point-contact only with said two movable rollers.

2. A device for moving a U-shaped member over a support without play as claimed in claim 1 wherein said spring is provided with symmetrical arms, each engaging one of said rollers, the angle formed by a perpendicular passing through the central axis of said shaft and either arm of said spring being approximately 120°.

3. A device for moving a U-shaped member over a support without play as claimed in claim 1 wherein two guiding members are in the form of spaced parallel strips, part of the cone surfaces of said roller members being positioned between said guiding members.

4. A device for moving a U-shaped member over a support without play as claimed in claim 1 wherein said guiding member is a strip of rectangular cross-section positioned between and abutting a portion of the cone surfaces of each roller member.

5. A device for moving a U-shaped member over a support without play as claimed in claim 1 wherein said shaft is mounted for limited axial movement in said U-shaped member.

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