Nov. 27, 1928. 1,693,169

W. B. YOUNG

HINGE

Filed Nov. 23, 1926 2 Sheets-Sheet 1

Fig. 1.

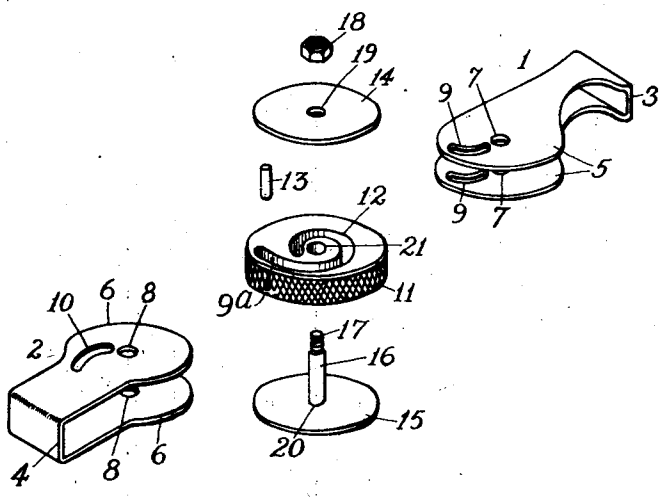


Fig. 4.

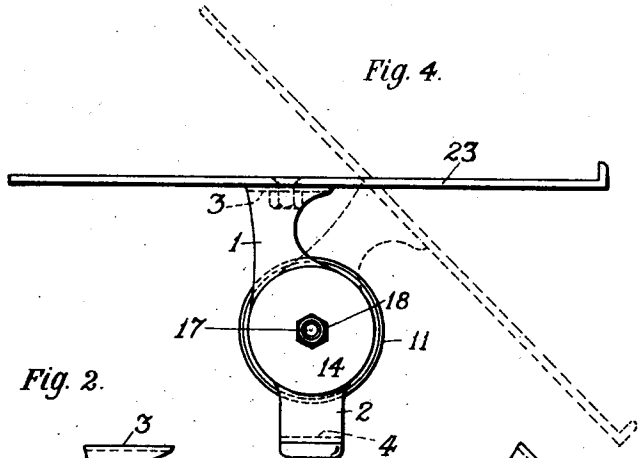


Fig. 2.

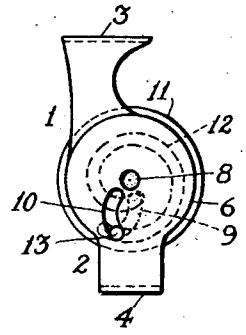
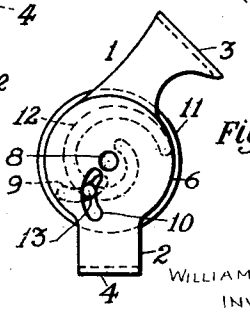


Fig. 3.



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2 Sheets-Sheet 2

Fig. 5.

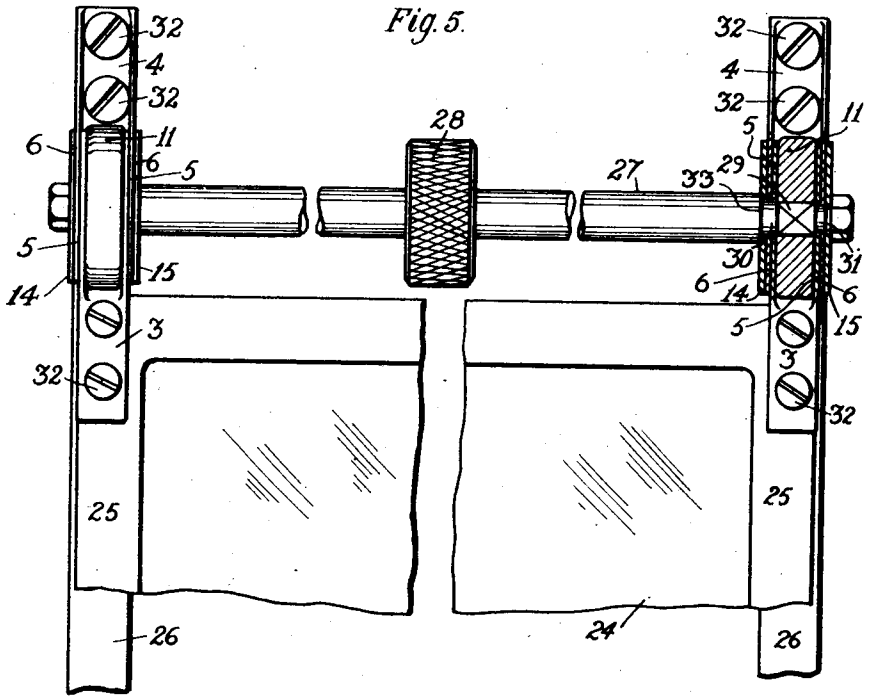
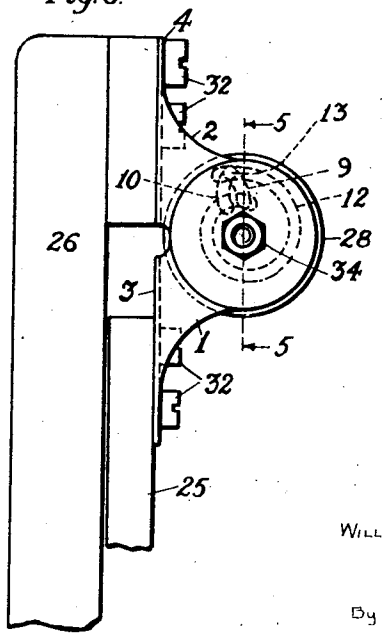


Fig. 6.



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UNITED STATES PATENT OFFICE.

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HINGE.

Application filed November 23, 1926, Serial No. 150,189, and in Great Britain May 29, 1926.

The present invention relates to hinges or hinging devices and one object of the invention is to provide a device of this nature wherein, on the angular relation of the pivotally connected elements or arms (hereinafter termed shortly "arms") being set, they are precluded from being moved to increase the angle between them, or to decrease said angle, or precluded from being moved either to increase or decrease said angle, by force applied to the outer ends of the arms or the end of an arm or to the parts or one of them to which the arms are secured.

A further object of the invention is to provide a device of this nature in which the angular relation of the arms can be varied or permitted to be varied by the actuation of operating means for the purpose forming part of the hinge assembly.

A further object of the invention is to provide a device of this nature in which the angular relation of the arms can be increased or decreased at will by actuation of operating means for the purpose forming part of the hinge assembly and a still further object is to provide a device as just described which shall be self-locking, that is to say in which the angular relation of the arms can be varied only by actuation of the operating means for the purpose and not by applying force to the outer ends of the arms or either of them or to the parts or either of them to which the arms are secured.

A still further object of the invention is to provide a device of this nature which is of simple and economical construction, of neat external appearance, which can be readily operated by the employment of one hand only to alter the inclination of display stands or trays mounted upon pedestals, of windscreens on motor cars, of mirrors, ventilators, swinging windows, telephone transmitters, telescopes, levels, or the like, and which has the feature that it is self-locking as aforesaid.

With these and other objects in view the present invention comprises arms mounted to move angularly about a common axis, a radially movable member operatively related to the said arms in such manner that the radial distance of the said member from the said axis varies with variation of the angular relation of the said arms, and a stop for said member adjustable in its radial distance from the said axis. The stop may act to restrain movement of the said member either radially outwards or radially inwards, or both, and moreover the adjustment of the stop may be utilized, by forcing said member towards or from said axis, to vary the angular relation of the said arms. Thus the radially movable member may consist of a pin, stud or the like and the stop or operating member may consist of a rotatable member mounted for rotation at will about the said axis and comprising a cam race operating upon the said radially movable member to move it towards or away from the axis by rotation of said rotatable member.

A preferred device of this kind according to the present invention may comprise arms pivotally mounted about an axis, an operating disc, plate or the like or its equivalent mounted to be movable angularly about the same axis, a cam race such as a slot, groove or the like in or on said disc or the like which, or a part or parts of which lies or lie in a direction having both radial and circumferential components in relation to the axis, a cam race such as a groove, slot or the like formed in or on each arm or on a boss, disc, plate or the like formed on or carried by each arm, both said races lying in directions having radial components, and one or both in directions having both radial and circumferential components and being inclined one in relation to the other when superposed, and means such as a pin, stud or the like engaging the cam races of the operating disc or the like and of both the cam races of the arms. The invention comprises also the combinations of elements hereinafter delimitated in the appended claims and in part more fully described hereinafter with reference to the accompanying drawings. It is to be understood however that the invention is not limited to the constructional forms shown as various modifications may be made in the constructional details within the spirit of the invention as set forth in the claims.

In the drawings,

Figure 1, shows in perspective the separate parts of a hinge according to the present invention disassembled and spaced apart.

Figure 2, is a side view of the assembled hinge without the cover plate.

Figure 3, is a similar view with the arms in a different angular relationship.

Figure 4, is a side view of a display stand or tray mounted on a pedestal by means of a hinge according to the present invention.

Figure 5, is a front view of a motor car windscreen mounted by means of hinging devices according to the present invention, and Figure 6, a side view thereof.

The hinge illustrated in Figures 1 to 4 inclusive comprises two U-shaped arms 1, 2, the open ends 5 and 6 respectively thereof intermeshing or overlapping and a common spindle 16 being provided passing through holes 7, 8, in the arms so that they are capable of relative angular movement with the yokes 3, 4, of the arms remote from the spindle. Between the limbs of the U-shaped arms so assembled and rotatably mounted on the same spindle 16 is an operating disc having cut through it from face to face a spiral cam slot 12 and a central orifice 21. Extending through said cam slot is a metal pin 13 which projects beyond the faces of the disc on either side and engages in the curved slots 9, 10, formed in each limb of the arms, the slots 9 of one arm being reversed in their curvature or inclination in relation to the slots 10 of the other arm. These slots it will be observed lie in directions which have both radial and circumferential components. Cover plates 14, 15, are provided for the outer sides of the assembly, these being provided with central apertures 19 which are threaded upon the projecting ends of the spindle 16 and are secured by nuts 18 on to the ends 17 of the spindle the latter being screw-threaded for the purpose. The relation of the parts when assembled will be readily understood by considering how the dis-assembled parts shown in Figure 1 would be assembled from the positions shown. The arm 1 is moved in the direction of the operating disc 11 until the open ends 5 embrace the said disc 11 with the orifices 7 of said open ends coincident with the orifice 21 of the disc. In this position the outer end of the slots 9 will coincide with the spiral cam slot 12 about the position 9^a. The width between the open ends 5 of the arm 1 is such that they engage the faces of the operating disc 11 with sliding friction. The other arm 2 is then moved in the direction of the disc, and thus in a diametrically opposite direction to that in which the arm 1 was moved, until the open ends 6 thereof embrace the open ends 5 of the arm 1 with the orifices 8 of the arm 2 coincident with the orifices 7 of the arm 1 and the orifice 21 of the disk 11. In this position the outer ends of the slot 10 of arm 2 coincide with the outer ends of slots 9 of the arm 2 and with the aforesaid position 9^a of the cam slot 12 in the disc 11. The width between the open ends 6 of the arm 2 is such as to embrace the outer faces of the outer ends 5 of arm 1 with sliding friction. Assuming the lower end of spindle 16 to be engaged by a nut similar to 18 so that the lower cover plate 15 is fixed on the spindle, the plate and spindle is now raised and the latter threaded through the coinciding apertures 7, 8 and 21 until the plate 15 rests against the lower face of the lower limb 6 of the arm 2. The pin 13 is now dropped through the coinciding outer ends of the slots 9 and 10 and the portion 9^a of the cam slot 12 of disc 11 so that its lower end rests upon the lower cover plate 15, and the length of the pin 13 is such that in this position the upper end thereof is flush with the upper surface of the upper outer end 6 of the U-shaped arm 2. Figure 2 can now be taken as a view of the parts as so far assembled and before the upper cover plate 14 is applied. Finally the cover plate 14 is applied by passing the orifice 19 over the upper screw-threaded end 17 of the spindle 16 and thereafter applying the upper nut 18 thereto, the length of said spindle being such as to admit of this.

The operating disc 11 is of a diameter to project somewhat beyond the open ends of the U-shaped arms and the cover plates as clearly shown in Figures 2 and 3 so that it may be readily turned by the fingers and its edge may be milled or knurled to facilitate turning.

The action will be clearly understood from a consideration of Figures 2 and 3. Assuming (see Figure 2) the arm 2 to be fixed, the arm 1 free and the operating disc 11 to be turned in clockwise direction, the spiral cam slot will cause the pin 13 to move along the fixed slots 10 of fixed arm 2 towards the axis of the assembly, As the pin 13 is constrained to move in the fixed slots 10, and as said pin also engages the slots 9 in the free arm 1, the latter will be moved in clockwise direction about the axis as the actuting disc is so turned. Figure 3 shows the relation of the parts when the disc has been turned through rather more than 180 degrees. By further movement of the disc 11 the pin 13 will finally bring the inner ends of slots 9 into coincidence with the inner ends of slots 10 and this will be the limit of movement in that direction. With the cam slot 12 and slots 9 and 10 as shown a complete revolution of the disc effects rather less than 90 degrees of angular movement of the arm 1 in relation to the arm 2. If a cam slot sloped more steeply to the axis be chosen the angular movement of the disc 11 for given angular movements of the arm 1 would be reduced. A slow slope to the cam slot 12 however gives the self-locking feature. To secure the self-locking feature plainly for any position of the parts, for example the positions shown in Figures 2 or 3, the angle between the tangent to the slot 10 at the position of the pin, and the normal to the tangent to the wall of the slot at the point of contact with the pin, must be less than the "angle of friction", of the science of mechanics. Generally speaking to secure the self-locking feature the various slots are so chosen that the direction of pressure and reaction as determined by the slot 10 between the pin and the wall of the spiral cam slot is approximately normal to the tangent to the curve of the spiral slot at the point of contact.

The curvature of the slots 9 and 10 shown in the drawings is chosen to render the angular movement of the arm 1 proportional to the angular movement of the operating disc 11. Thus assuming the slots were straight between their terminal points shown, and assuming radial displacement of the spiral cam slot to be proportional to angular displacement, then on first operating the disc 11 to move the parts from the positions shown in Figure 2 a given angular movement of disc 11 would result in a certain angular displacement of the arm 1, but for successive equal angular displacements of the operating disc 11 the successive angular displacements of arm 1 would successively increase. By a simple geometrical construction the curves of slots 9 and 10 can be plotted to give the proportional displacement when desired or to give any other desired relationship between the two displacements.

It will be noted (see Figure 2) that when the pin 13 is at the outer extremity of the slots 9 and 10 and therefore restrained from any further movement away from the axis of the assembly, the end of the spiral cam slot 12 in the disc 11 is still a short distance from the said pin. This is to enable the parts to be jammed by forcibly turning the disc 11 in counterclockwise direction. This provides for elimination of any possible looseness or backlash in the position shown in Figures 2 and 4 which is frequently of advantage.

Figure 4 shows the application of the device to a pedestal display stand. The yoke 4 of the arm 2 is mounted on the top of a pedestal 22 and the yoke 3 of arm 1 carries a display tray 23. The arm with the tray 23 is shown in full lines in the position corresponding with Figure 2 and in dotted lines in the position corresponding with Figure 3.

Figures 5 and 6 show a pivoted windscreen for a motor road vehicle pivotally mounted and adapted for operation by similar devices and by similar methods to those just described. 24 is the glass windscreen in a frame 25. 26 are fixed uprights carried by the vehicle for the support of the windscreen. The said windscreen is mounted upon the uprights 26 by two hinging devices similar to those described, one on each side. The hinging device on the right is shown in section on the line 5—5 of Figure 6, but for simplicity of drawing the slots cut by this section are omitted. The two operating discs 11 instead of being mounted freely upon a spindle are mounted upon squared portion 29 of a shaft 27 which has circular portions 30, 31, freely rotatable within the central orifices of the ends 5, 6, of the arms 1, 2. The cover plates 14 and 15 are in the assembled device retained between a shoulder 33 formed on the shaft 27 and the nut 34. The shaft 27 has rigidly mounted upon it a knurled disc 28 so that by turning this the shaft 27 and with it both the operating discs 11 are turned thus operating the hinging devices in the manner described with reference to Figures 2 and 3. Referring to the side view, Figure 6, the arms 1, 2, are somewhat differently shaped from those shown in Figures 1 to 4 inclusive. 2 is the fixed arm the yoke 4 of which is mounted by screws 32 upon the upright 26, and 10 the slots of this arm indicated in dotted lines. 1 is the movable arm the yoke 3 of which is mounted by screws 32 upon the frame 25 of the windscreen, and 9 the slots of this arm indicated in dotted lines. The arms are so shaped that when the several slots 9, 10, 12, are in positions corresponding with Figure 2, the yokes 3, 4, are in alignment for the closed position of the windscreen. It will be readily understood from the foregoing description of the device shown in Figures 2 and 3 that if the disc 28 as seen in Figure 6 be turned in a counter-clockwise direction the arm 1 and with it the windscreen will be swung out to the right. Though the windscreen suspension just described is primarily intended to be operated by the disc 28 it may of course be operated by turning either of the discs 11 which will have the effect of simultaneously turning the other disc 11 through the medium of the shaft 27.

It will be understood that if the slots (9 or 10) of one arm lie in directions having both radial and circumferential components, the slots of the other arm may lie in a radial direction. This will give like action to that described with reference to the hinge having slots in each arm with both radial and circumferential components as shown in the drawings.

I claim—

1. A hinging device comprising arms mounted to move angularly about a common axis each arm having a slot therein the two slots intersecting at different points in their length and different radial distances from the common axis with variation of the angular relation of the arms, an intermediate member engaging in both said slots at their intersection, and operating means rotatable about the common axis for varying the radial distance of said intermediate member from the common axis thereby varying the angular relation of the arms.

2. A hinging device comprising arms mounted to move angularly about a common axis each arm having a slot therein which lies in a direction having both radial and circumferential components in relation to the common axis the two slots intersecting when superposed, and intermediate member engaging both said slots at their intersection, and an operating member rotatable about the common axis and having a cam surface engaging the intermediate member whereby on rotating the operating member the intermediate member is moved radially to vary the dis-

tance of the point of intersection of the two slots from the common axis and thus the relative angular position of the arms.

3. A hinging device comprising arms mounted to move about a common axis, each arm having a slot therein the two slots intersecting at different points in their length and at different radial distances from the common axis with variation of the angular relation of the arms, an intermediate member engaging in both said slots at their intersection, and a member rotatable about the common axis having a cam surface adapted to act as a stop for the intermediate member precluding movement thereof in a radial direction by force applied thereto.

4. A hinging device comprising arms mounted to move angularly about a common axis, each arm having a slot therein the two slots intersecting at different points in their length and at different radial distances from the common axis with variation of the angular relation of the arms, an intermediate member engaging in both said slots at their intersection, and a stop for the intermediate member precluding movement thereof in a radial direction by force applied thereto said stop being adjustable in its radial distance from said common axis.

5. A hinging device comprising arms mounted to move angularly about a common axis each arm having a slot therein the two slots intersecting at different points in their length and different radial distances from the common axis with variation of the angular relation of the two arms, an intermediate member engaging in both said slots at their intersection, and an operating member rotatable about the common axis and having a spiral groove engaging the intermediate member whereby on rotating the operating member in one direction or the other the intermediate member is moved radially in one direction or the other to vary the distance of the point of intersection of the two slots and increase or decrease the angle between the arms, the said spiral groove being adapted to act as a stop for the intermediate member precluding movement thereof in either radial direction by force applied thereto.

6. A hinging device comprising arms mounted to move angularly about a common axis, an intermediate member, means connecting said member with said arms to vary the angular relation of the latter by radial movement of said intermediate member in relation to the common axis, and operating means rotatable about the common axis for varying the radial distance of said intermediate member from the common axis.

7. A hinging device comprising arms mounted to move angularly about a common axis, an intermediate member, means connecting said member with said arms to vary the angular relation of the latter by radial movement of said intermediate member in relation to the common axis, and an operating member rotatable about the common axis and having a cam surface engaging the intermediate member whereby on rotating the operating member the intermediate member is moved radially in relation to the common axis.

8. A hinging device comprising arms mounted to move angularly about a common axis, an intermediate member, means connecting said member with said arms to vary the angular relation of the latter by radial movement of said intermediate member in relation to the common axis, and a member rotatable about the common axis and having a cam surface, said cam surface being adapted to act as a stop for the intermediate member precluding movement thereof in a radial direction by force applied thereto.

9. A hinging device comprising arms mounted to move angularly about a common axis, an intermediate member, means connecting said member with said arms to vary the angular relation of the latter by radial movement of said intermediate member in relation to the common axis, and an operating member rotatable about the common axis and having a spiral groove engaging the intermediate member whereby on rotating the operating member in one direction or the other the intermediate member is moved radially in one direction or the other to vary the radial distance of the intermediate member from the common axis and thereby increase or decrease the angle between the arms, the said spiral groove being adapted to act as a stop for the intermediate member precluding movement thereof in either radial direction by force applied thereto.

In witness whereof I have hereunto set my hand.

WILLIAM BERTRAM YOUNG.