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Flip-type Cover Assembly

Field of the Invention

This present invention relates to a flip-type cover assembly, more particularly but not exclusively, for audio and/or video equipment.

Background of the Invention

A cover is commonly arranged over an opening of a housing to act as a partition between the interior of the housing and the external environment. This ensures that the interior of the housing is free from dirt which often accumulates if the same is exposed to the external environment over time.

A cover assembly is typically used in audio-video equipment to prevent one or more ports of the equipment from being permanently exposed to the external environment. A first known design of a cover assembly comprises a cover which rotates about a fixed axis so as to cover or expose an opening of the housing. A second known design of a cover assembly comprises a sliding cover which translates along a straight path to cover or expose an opening of the housing in a linear fashion.

A problem arising from the first known design of cover assembly is that more material is needed between both sides of the cover and their centre of curvature so that the surface of the cover flushes with the surface of the housing. Thus, this results in a higher cost of constructing the cover assembly. Additionally, a large radius of curvature of the cover assembly will also invariably take up unnecessary space within the housing. However, if the radius of curvature of the cover assembly is small, the surface of the cover will protrude above the surface of the housing. This may be undesirable for at least two reasons: firstly, because it does not appeal to the eye; and secondly because the sharp corners of the cover may cause injuries to a user.

Likewise, the second known design of the cover assembly is also accompanied with its various disadvantages. Firstly, a force must be applied about the centre of a closed cover so as to expose the opening of the housing. If the force is applied at either side of the cover, the cover may be easily jammed because the applied force cannot be sufficiently translated to the opposite side of the cover.

One design which attempts to overcome the disadvantages of the foregoing cover assemblies is illustrated in Figures 1(a) to 1(c), which shows a side view of a flip-type cover assembly 101 from a closed position to an opened position. Both sides of the cover 102 have side walls (one of which is shown as 107), a housing 103, two separate cam paths 104,105 and two pins 106a, 106b. The side walls 107 of the cover 102 are movably coupled to the housing 103 by the two pins 106a, 106b, and rotational movement of the cover 102 is guided by the two cam paths 104, 105 along which the two pins 106a, 106b move.

Rotational movement of the cover 102 is divided into two stages: The first stage begins from the position of the cover 102 illustrated in Figure 1(a) and ends at the position of the cover 102 illustrated in Figure 1(b); the second stage begins from the position of the cover 102 as illustrated in Figure 1(b) and ends at the position of the cover 102 illustrated in Figure 1(c).

During the first stage of the rotational movement of the cover 102, the cam paths 104, 105 are designed to ensure that the cover 102 does not hit the edges of the housing 103. During the second stage of the rotational movement of the cover 102, the cover 102 rotates about a fixed position as illustrated in Figure 1(c) by the position of pin 106a in cam path 104 until the opening of the housing 103 is fully exposed.

A first disadvantage of the flip-type cover assembly 101 of Figure 1 is that the position of the fixed rotational axis of the cover 102 must be close to the opening of the housing 103 during the second stage of the rotational movement. This means that the cover 102 does not stay close to the edges of the housing

103. A consequence of this is that additional internal space of the housing 103 is taken up to accommodate the movement of the cover 102. Hence, such flip-type cover assemblies 101 are usually of a considerable size. A second disadvantage is that there is a large gap between the cover 102 and the housing 103, and this may make the cover 102 more difficult to operate since a user's finger could be jammed therein when opening the cover 102. A final disadvantage is that when the cover 102 is opened, the underside of the cover 102 is clearly seen from the outside. As such, the underside of the cover 102 may have to be nicely sprayed in colour so as to enhance its aesthetic appearance.

Summary of the Invention

In a first specific expression of the invention, there is provided a flip-type cover assembly for audio and/or video equipment, the assembly comprising

a support frame defining an opening,

a cover for the opening, the cover movably mounted to the support frame at two pivoting axes, each pivoting axis being guided for movement by a corresponding pair of cam paths, each pair of cam paths having first and second movement axes defining different movement paths, each pivoting axis being arranged to move along the first and second movement axis of the corresponding pair of cam paths to move the cover between open and close positions.

By using two different movement axes to define each pair of cam paths, this enables better control of the movement of the cover since effectively, two different movement axes are combined into one cam path. The cover assembly can also be designed with a reduced gap between the cover and the edges of the support frame which defines the opening. Also, depending on application with a second movement axes for each pair of cam paths, the cover may be received entirely within the frame so that the cover does not protrude out of the frame.

Preferably, the first movement axis of first said pair of cam paths forms an angle of at least 20° with the first movement axis of second said pair of cam paths. Even more preferably, the second movement axis of first said pair of cam paths also forms an angle of at least 20° with the second movement axis of second said pair of cam paths. The minimum angle of 20° has been found to reduce jamming during the opening or closing of the cover resulting in a smoother operation.

The first movement axis and second movement axis of both cam paths may be arcuate in shape or generally curved. If this is the case, then the first movement axis of first said pair of cam paths and the first movement axis of second said pair of cam paths may have a first common center of curvature. The second movement axis of first said pair of cam paths and the second movement axis of second said pair of cam paths may also have a second common center of curvature that is at a different position from the first common center of curvature. In other words, two rotation axes are incorporated in the same cam path which allows finer movement control of the cover.

The first movement axis of first said pair of cam paths may have a radius of curvature that is greater than the radius of curvature of the first movement axis of second pair of cam paths. The second movement axis of first pair of cam paths may also have a radius of curvature that is greater than the radius of curvature of the second movement axis of second pair of cam paths.

Advantageously, as each pivotal axis is arranged to move along the second movement axis of corresponding pair of cam paths, both pivotal axis, in relation to the common center of curvature, forms an angle of at least 20° with each other. The minimum angle of 20° has been found to reduce jamming during the opening or closing of the cover resulting in a smoother operation.

Further, in embodiments of the invention, a gap between each of the plurality of pins and the corresponding cam path is preferably 0.15mm or less.

The cam paths may be formed on the support frame. Also, the cover assembly may have biasing means arranged to bias the cover to the open position.

Brief Description of the Drawings

A preferred embodiment will now be described by way of example, with reference to the accompanying drawings, of which:

Figures 1(a) to 1(c) are side views of a known flip-type cover assembly;

Figures 2(a) and 2(b) illustrate a flip-type cover assembly having a cover according to a preferred embodiment of the invention;

Figures 3(a) to 3(c) are views from one side of the flip-type cover assembly of Figures 2(a) and 2(b) illustrating operation of the cover;

Figure 4 illustrates a close-up view of one of the cam paths of Figures 3(a) to 3(c); and

Figure 5 illustrates an alternative method of measuring angles X and Y of Figure 3(c) from the movement axes of respective cam paths.

Detailed Description of the Preferred Embodiment

Figures 2(a) and 2(b) illustrate a flip-type cover assembly 301 comprising a cover 302 and a support frame in the form of a housing 303 according to the preferred embodiment of the invention. The housing 303 has four side walls 206 for enclosing an audio jack 207 and which defines an opening 210 which is covered by the cover 302.

Figure 2(a) illustrates the flip-type cover assembly 301 in a close position, whilst Figure 2(b) illustrates the cover assembly in an open position. Referring to Figure 2(a), a force 304 is applied on any part of the cover 302 to move the cover 302 to the open position of Figure 2(b).

The structure of the flip-type cover assembly 301 will now be described by referring to Figures 3(a) to 3(c) which are side views of the cover assembly 301. It should be apparent that the other side of the cover assembly 301 is identical and thus, only one side is shown in the drawings.

The cover 302 has two side members (one side member is shown as dotted lines in Figures 3(a) to 3(b)) with each side member having two sets of pivoting pins 307a, 307b and 310a, 310b (pins 307b and 310b are not shown) protruding outwards. The pivoting pins 307a, 307b and 310a, 310b are aligned along respective pivoting axes (from Figures 3(a) to 3(c), the pivoting axes are the centre axis of each pin 307a, 310a). One of the side walls 206 (shown as 206a in Figure 3(a)) includes two cam paths 306a, 312a. The cam path 306b (not shown and which corresponds with the cam path 306a) and the cam path 312b (not shown which corresponds with the cam path 312a) which are arranged on the side wall 206 opposite to the side wall 206a are identical to the respective cam paths 306a, 312a. In Figure 3(a), only cam paths 306a, 312a arranged on the side wall 206a are shown and it should be apparent that the pivoting pins 307a, 307b, 310a, 310b are located within the respective cam paths 306a, 306b, 312a, 312b so that the cover 302 is movably coupled to the housing 303.

The cover assembly 301 also includes biasing means in the form of a spring 311 (one on each side of the side members of the cover 302) arranged to bias the cover 302 to the open position.

For ease of describing the different parts, reference is made in the description below to the view from one side of the cover assembly 301 as illustrated in the drawings but it would be apparent that the same description/operation applies to the parts of the other side view.

Each of the cam paths 306a, 312a has two movement axes 320a, 320b (for cam path 306a) and 321a, 321b (for cam path 312a) which defines two different directions of movements of the pivoting pins (307a, 310a) (more specifically, distinct arcuate movements) when the cover 302 moves from the close position

to the open position. As shown in Figure 3(a), the movement axes are represented by centre lines 320a, 320b which adjoins to form the cam path 306a. The cam path 312a is similarly formed by the adjointment of the two movement axes 321a, 321b.

Each of the portions that defines the movement axes 320a, 320b, 321a, 321b, is a partial arc defined by a respective common centre of curvature 308, 309 but have different radii. To elaborate, the movement axes 320a, 321a of the first and second cam paths 306a, 312a are defined by the common centre of curvature 308 but the movement axis 320a of the first cam path 306a has a greater radius of curvature to the centre of curvature 308 than the radius of curvature of the movement axis 321a of the second cam path 312a.

When the cover 302 is in the close position illustrated in Figure 2(a), the pivoting pins 307a, 310a are positioned at the initial positions of the respective cam paths 306a, 312a as shown in Figure 3(a). When the force 304 is applied to open the cover 302, and assisted by the spring 311, the cam paths 306a, 312a guide the pivoting pins 307a, 310a along their respective first movement axes 320a, 321a so as to move the cover 302 to an intermediate position as illustrated by the dotted lines of Figure 3b). At this stage, instead of rotating one of the pivoting pins 307a. 310a about the pivoting axis, the pivoting pins 307a, 310a are guided along respective second movement axes 320b, 321b of the respective cam paths 306a, 312a so that the cover 302 gradually slides to the open position illustrated in Figure 3(c). Movement of the cover 302 along the second movement axes 320b, 321b is defined by the centre of curvature 309.

As would be appreciated from the above description and as illustrated in Figures 3(a) and 3(b), the first centre of curvature 308 that defines the first movement axes 320a, 321a of the first and second cam paths 306a, 312a is arranged near to the opening 210. In this way, the cover 302 is rotated easily by applying a nominal force at any area of the cover 302. In addition, this also ensures that the rear side 322 of the cover 302 does not hit the edges of the housing 303.

As the movement of the cover 302 transits from the first movement axes 320a, 321a to the second movement axes 321a, 321b of the cam paths 306a, 312a, the movement of the pivoting pins 307a, 310a along the second movement axes 321a, 321b are defined by the second common centre of curvature 309, which is arranged further away from the opening 210 as compared with the first centre of curvature 308. This ensures that the rear side 322 of cover 302 stays close to the edges of the housing 303 with only a small constant gap between the two. Accordingly, this minimises the chance of a user's finger being trapped between the gap, or a foreign object being introduced into the flip-type cover assembly 301. Thus, the combination of the profiles of the first and second movement axes 320a, 320b, 321a, 321b that forms the cam paths 306a, 312a defines a smooth cam path profile and provides better control to guide the movement of the cover 302.

It should be noted that as both pivoting pins 307a, 310a move along the first movement axes 320a, 321a of the respective cam paths 306a, 312a (i.e. pin 307a moving along axis 320a of the first cam path 306a, and pin 310a moving along axis 321a of the second cam path 312a), the pivoting pins 307a, 310a forms an angle X with each other in relation to the common centre of curvature 308. Similarly, as the pivoting pins 307a, 310a moves along the second movement axes 320b, 321b of the respective cam paths 306a, 312a, the pivoting pins 307a, 310a forms an angle Y with each other in relation to the second common centre of curvature 309. It has been found that if the angles X and Y are at least 20°, this prevents jamming during the opening or closing of the cover 302 and enables smoother opening and closing. This is particularly useful if the flip-type cover assembly 301 is produced from plastic material.

In addition, the position of the cover 302 in relation to the opening 210 when the cover 302 is in the open position can also be configured such that spraying of the underside of the cover 302 is unnecessary because it is not visible. Accordingly, significant spraying cost can be saved.

The angle of 20 degrees or more also generally works best for flip-type cover assemblies 301 having a maximum gap between a pin and its corresponding cam path width of 0.15mm illustrated by Figure 4.

It should be apparent that if the angles X and/or Y is less than 20 degrees, the force 304 may have to be applied near the centre of the cover 302 so that rotational torque is evenly applied along the entire edge of the cover 302. Otherwise, undesirably jamming may occur on one side of the cover 302. Further, the cover 302 when pushed may also experience undesirable sliding which is not part of the cover movement as defined by the cam path profile.

Various modifications to the preferred embodiment described above can be made. For example, the preferred embodiment illustrates that the pivoting pins 307a, 310a are attached to the side walls of the cover 302 so that the pivoting pins 307a, 310a can engage with the respective cam paths 306a, 312a arranged at the side walls 206a of the housing 303. However, the coupling of the cover 302 with the housing 303 is also possible if the cam paths 306a, 312a are arranged on the side walls of the cover 302 instead, with the corresponding pivoting pins 307a, 310a being arranged at the side wall 206a of the housing 303.

The first movement axes 320a, 321a of the first and second cam paths 306a, 312a have different radii of curvature, and similarly for the second movement axes 320b, 321b. However, it is envisaged that the first movement axes 320a, 321a of the first and second cam paths 306a, 312a may have the same radius of curvature, and similarly the second movement axes 320b, 321b may also share the same radius of curvature. However, it is preferred that the first and second cam paths 306a, 312a should be separated from each other so as to avoid the pivot pin 310a moving along the second cam path 312a to engage with the first cam path 312a and vice versa, which might cause jamming of the

cover 302 as the cover is moved from the closed to the opened position (and vice versa).

The cam paths 306a, 312a are shown as being formed by two partial arcs to define two different movement axes but it is envisaged that the cam paths 306a, 312a may be formed by two straight paths similarly defining two different movement axes, or a series of straight paths defining a generally curved or arcuate movement profile to move the cover 302 from the closed to the open position (and vice versa).

Further, the profile of the cam paths 306a, 312a is dependent on the type of material used for the cover assembly 301. Thus, the angles X and Y should be adapted accordingly, and it has been found that angles in the range between 20° and 160° work well.

Also, the angles X and Y may be measured from a different direction. Instead of measuring the angles X and Y from their respective common centre of curvature 308, 309, corresponding tangential lines can be drawn along first and second movement axes and measuring the angle defined between those tangential lines.

Figure 5 illustrates the pivot pin 307a arranged along the second movement axis 320b of the cam path 306a, and pivot pin 310a arranged along the second movement axis 321b of the cam path 312a. At these positions of pivot pins 307a, 310a, two lines 330, 331 which are tangential to the respective movement axes 320b, 321b can be drawn. Accordingly, the angle Y can be measured by the angle that defines the tangential lines 330, 331. All the angles defined between the corresponding tangential lines along the first movement axes 320a, 312a and second movement axes 320b, 321b can thus be defined in the same way.

It should therefore be appreciated that if all the angles between corresponding tangential lines along first and second movement axes 320a, 320b, 321a, 321b of the cam paths 306a, 312a are at least 20 degrees, a smooth cam path profile will be formed and this provides better control to guide the movement of the cover 302 of the flip-type cover assembly 301.

If the cam paths 306a, 312a are linear or straight and not curved, then the angles X and Y would be between the respective movement axes.

The cover assembly 301 may find applications in audio-video products, computing, storage products and other home appliance.

Thus, although the invention has been described using a preferred embodiment, many variations are possible within the scope of the claims, as will be clear to the skilled reader, without departing from the invention as claimed.

CLAIMS

1. A flip-type cover assembly, the assembly comprising
a support frame defining an opening,
a cover for the opening, the cover movably mounted to the support frame at two pivoting axes, each pivoting axis being guided for movement by a corresponding pair of cam paths, each pair of cam paths having first and second movement axes defining different movement paths, each pivoting axis being arranged to move along the first and second movement axis of the corresponding pair of cam paths to move the cover between open and close positions.

2. A flip-type cover assembly according to claim 1, wherein the first movement axis of first said pair of cam paths forms an angle of at least 20° with the first movement axis of second said pair of cam paths.

3. A flip-type cover assembly according to claim 1 or 2, wherein the second movement axis of first said pair of cam paths forms an angle of at least 20° with the second movement axis of second said pair of cam paths.

4. A flip-type cover assembly according to claim 1, wherein the first movement axis of first said pair of cam paths and the first movement axis of second said pair of cam paths have a first common center of curvature, and
wherein the second movement axis of first said pair of cam paths and the second movement axis of second said pair of cam paths have a second common center of curvature that is at a different position from the first common center of curvature.

5. A flip-type cover assembly according to claim 4, wherein the first movement axis of first said pair of cam paths has a radius of curvature

that is greater than the radius of curvature of the first movement axis of second pair of cam paths.

6. A flip-type cover assembly according to claim 4 or 5, wherein the second movement axis of first pair of cam paths has a radius of curvature that is greater than the radius of curvature of the second movement axis of second pair of cam paths.

7. A flip-type cover assembly according to claim 6, wherein as each pivoting axis moves along the second movement axis of corresponding pair of cam paths, both pivoting axes, in relation to the common center of curvature, form an angle of at least 20° with each other.

8. A flip-type cover assembly according to any preceding claim, wherein the cam paths are formed on the support frame.

9. A flip-type cover assembly according to any preceding claim, further comprising biasing means arranged to bias the cover to the open position.

10. A flip-type cover assembly according to claim 2, 3 or 7, wherein the angle is in the range between 20° and 160°.

11. An audio/video product comprising a flip-type cover assembly of any preceding claim.