

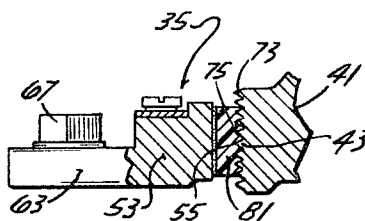
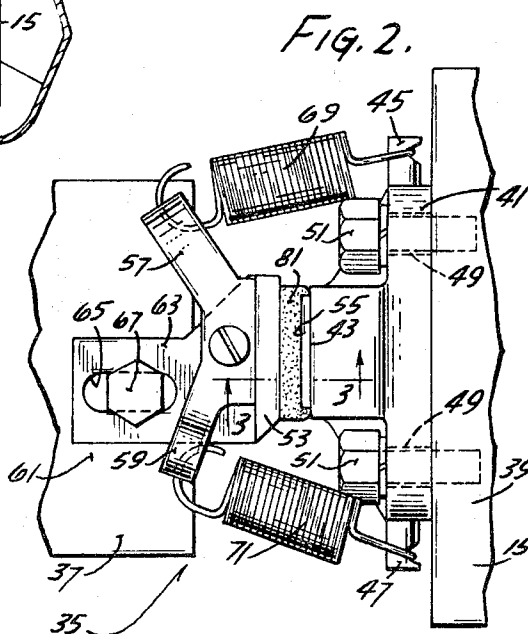
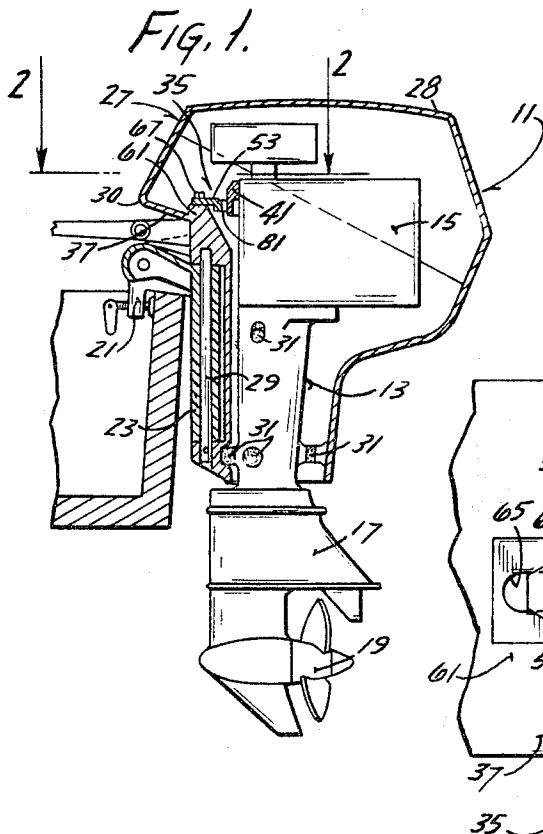
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The invention relates generally to outboard motors. More specifically, the invention relates to suspension arrangements for the dirigible propulsion unit of an outboard motor.

In outboard motor construction, it is common practice to floatingly suspend the dirigible lower unit and attached power head by resilient rubber mounts or the like interconnecting the lower unit and the supporting structure extending from a generally vertical king pin. The invention provides a connection between the structure extending from the king pin and the power head itself, which connection serves generally to resiliently frictionally restrain laterally operating torsional vibratory movement of the power head. However, in addition to the foregoing, the connection also serves to prevent significant vertical displacement of the connected parts of the power head and the supporting structure and to prevent separation of the connected parts of the power head and supporting structure in a direction normal to the direction of restrained vibratory movement. Such action serves to counteract any tendency toward undesired permanent set or drift of the rubber or other resilient mounts connecting the lower unit and the supporting structure.

In accordance with the invention, vibratory movement is primarily resiliently restrained by friction. Provision is provided, in the form of an adjustable mounting, for compensating for wear resulting from such frictional restraint. The invention also provides for frictional surfaces which are horizontally serrated to restrain vertical displacement while affording frictionally restrained lateral movement. Spring means are also included to establish a desired normal force between the friction surfaces and to prevent separation of the connected parts in a direction normal to the restrained lateral, torsional vibratory movement when the torsional vibration problem is at a maximum, i.e., generally when the engine speed is relatively low.

Other objects and advantages of the invention will become known by the following description and accompanying drawings in which:

FIG. 1 is a partially broken away side elevational view of an outboard motor embodying various of the features of the invention;

FIG. 2 is a plan view of the resilient restraining device embodied in the outboard motor shown in FIG. 1; and

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

The outboard motor 11 shown in the drawings includes a propulsion unit 13 comprising a power head 15 and a lower unit 17 which is connected to the power head 15 and which supports a propeller 19. In addition to the propulsion unit 13, the outboard motor 11 includes a transom bracket 21 adapted to be fixed to the transom of a boat, a swivel bracket 23 connected to the transom bracket by horizontal pivot means affording tilting of the swivel bracket 23, and a propulsion unit cover 27

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which is connected to the swivel bracket 23 for common vertical tilting movement and for dirigible movement relative to the swivel bracket by means of a vertical king pin 29. The propulsion unit cover 27 includes a top section 28 which is removably supported upon an upper portion 30 of the main part of the cover 27, which main part encloses the lower part of the power head and the upper part of the lower unit.

Connecting and supporting the propulsion unit 13 from the propulsion unit cover 27 are a series of rubber mounts 31 which can be as shown in the Watkins Patent No. 3,002,489. Specifically, the rubber mounts 31 connect the lower unit 17 with the main part of the propulsion unit cover 27. The specific arrangement and the location of the resilient mounts connecting the lower unit and the propulsion unit cover can be widely varied and still obtain the advantages of the invention. As thus described, the outboard motor 11 is conventional.

In accordance with the invention, and in addition to the rubber mounts 31 supporting the lower unit 17, and therefore also indirectly supporting the power head 15, there is also provided resilient damping means 35 connecting the power head 15 and the king pin 29. In the illustrated construction, this means extends between a part 37 of the main part of the propulsion unit cover 27 and an engine block 39 which forms a part of the power head 15.

The resilient damping means 35 connecting the power head 15 and the propulsion unit cover 27 serves to stabilize the power head 15 against lateral vibratory movement, particularly during low speed operation when torsional vibration has a maximum effect. Specifically, in this regard, the disclosed resilient damping means 35 affords relative lateral movement of the connected parts of the power head and the propulsion unit cover, subject to frictional restraint afforded by a pair of frictionally engaged members. Such frictional restraint is effective to sufficiently reduce vibratory power head movement to a level which does not adversely affect carburetor operation. In addition, the resilient damping means includes means establishing, between the connected parts of the power head and the propulsion unit cover, a normal force, which, in cooperation with the frictionally engaged members, produces the desired amount of frictional restraint.

In addition, the resilient damping means includes an adjustment arrangement affording compensation for wear between the engaged friction members.

The resilient damping means 35 also serves to reduce loading on the rubber mounts 31 to prevent sagging or permanent drift or set of the mounts under continually applied weight of the propulsion unit. Specifically in this regard, the resilient damping means is designed to effectively restrain any significant vertical displacement between the connected parts of the power head and the propulsion unit cover.

In the illustrated construction, the resilient damping means 35 includes a power head bracket 41 having a centrally located friction surface on member 43, a pair of ears or hooks 45, 47 extending respectively from the opposite sides of the friction surface 43, and means in the form of a pair of bolt holes 49 for cooperation with bolts 51 to assemble the bracket 41 to the engine block 39.

In addition to the power head bracket 41, the resilient damping means 35 also includes a propulsion unit cover

bracket 53 including a centrally located friction member or surface 55 and a pair of ears or tabs 57, 59 extending laterally from opposite sides of the friction surface 55. The ears 57, 59 can be integrally formed with the bracket 53 or can be formed on a piece which can be secured or otherwise fixed with respect to the bracket 53.

The propulsion unit cover bracket 53 is supported from the propulsion unit cover on a mounting lug 61 extending from the upper portion of the main cover part. Means are provided for adjustably locating the propulsion unit cover bracket 53 relative to the lug 61 so as to compensate for wear between the friction surfaces 43 and 55. This adjusting means comprises a leg part 63 on the bracket 53 and an elongated slot 65 located in the leg part 63 and extending generally perpendicularly to the friction surface 55. A clamping bolt 67 passes through the slot 65 to fix the bracket 53 to the cover 27 in adjusted position.

In order to maintain engagement of the brackets 41 and 53 with each other when the torsional vibrating effect is at a maximum, i.e., generally during low speed operation, and to establish a normal force between the engaged friction surfaces 43 and 55, there is provided, on each side of the friction surfaces, respective springs 69, 71 which are anchored between respective ears 45, 47 and tabs 57, 59. Thus, when the springs 69, 71 are assembled to the ears 45, 47 and tabs 57, 59, the bracket surfaces 43 and 55 are placed in pressure engagement with each other. When the engine is operating at relatively high speeds, and when the torsional vibration problem is therefore significantly reduced, the propelling thrust overpowers the springs 69 and 71, and separates the surfaces 43 and 55.

In order to limit vertical displacement of the brackets 41, 53 relative to each other when the surfaces 43 and 55 are engaged, the friction surfaces 43, 55 each includes a horizontally extending series of serrations, as indicated at 73 and 75 respectively. In order to afford abrasion resistance and to impart a degree of resilience to the connecting means 35 in a direction normal to the frictionally restrained movement, one of the friction surfaces is in the form of a block 81 of plastic material such as polyurethane. In the specifically disclosed construction, the block is anchored to the bracket 53 connected to the propulsion unit cover 27.

While the invention has thus far been disclosed in connection with an outboard motor in which the power head and at least a part of a lower unit are enclosed in the cover 27, the invention is also applicable to engines in which the power head is contained in an engine cover which is more or less rigidly connected to the power head and the lower unit, as shown for instance in the Irgens Patent No. 2,740,368. In this instance, the resilient damping means could be interconnected between a part extending rigidly from the upper end of the king pin and either of the power head or attached cover. Preferably however, the part or member extending from the king pin would extend into the engine cover and be connected to the power head by an arrangement such as that disclosed herein.

In addition to the advantages already mentioned, the invention also serves to eliminate any special assembly techniques otherwise required because of tolerance conditions between the supported mass of the propulsion unit and the supporting structure. Prevention of significant vertical displacement of the propulsion unit relative to the propulsion unit cover also serves to eliminate any problems with respect to maintaining connection between linkages extending through the cover to the propulsion unit. Finally, the resilient connecting means or dampener provides a desirable positive deflection stop.

Various of the features of the invention are set forth in the following claims.

What is claimed is:

1. The combination in an outboard motor of a sup-

porting member pivotal about a generally vertical axis when the outboard motor is in an operative position, a power head, a friction surface carried by said supporting member, a friction surface carried by said power head, and tension spring means interconnecting said supporting member and said power head to establish pressure engagement of said friction surfaces.

2. The combination in an outboard motor of a supporting member pivotal about a generally vertical axis when the outboard motor is in an operative position, a power head, a pair of friction surfaces, a first bracket mounted on one of said power head and said supporting member and carrying one of said friction surfaces, a second bracket carrying the other of said friction surfaces, spring means connecting said brackets to establish said friction surfaces in pressure engagement with each other, and means mounting said second bracket on the other of said power head and supporting member for adjustment in a direction normal to said engaged frictional surfaces.

3. The combination in an outboard motor of a supporting member pivotal about a generally vertical axis when the outboard motor is in an operative position, a power head, a pair of friction surfaces each including at least one serration, a first bracket mounted on one of said power heads and said supporting member and carrying one of said friction surfaces with said serration thereof in generally horizontal disposition, a second bracket carrying the other of said friction surfaces with said serration thereof in generally horizontal disposition, and spring means connecting said brackets to establish said friction surfaces in pressure engagement with each other and to engage said serrations with each other.

4. The combination in an outboard motor of a supporting member pivotal about a generally vertical axis when the outboard motor is in an operative position, a power head, a pair of friction surfaces each including at least one serration, a first bracket mounted on one of said power head and said supporting member and carrying one of said friction surfaces with said serration thereof in generally horizontal disposition, a second bracket carrying the other of said friction surfaces with said serration thereof in generally horizontal disposition, spring means connecting said brackets to establish said friction surfaces in pressure engagement with each other and to engage said serrations with each other, and means mounting said second bracket on the other of said power head and supporting member for adjustment in a direction normal to said engaged friction surfaces.

5. An outboard motor comprising a propulsion unit including a power head, and a lower unit connected to said power head, a transom bracket adapted to be mounted on the stern of a boat, a swivel bracket connected to said transom bracket for pivotal movement about a horizontal axis, a propulsion unit cover mounted on said swivel bracket for pivotal movement about an axis transverse to said horizontal axis, means resiliently connecting said lower unit and said propulsion unit cover, a first bracket mounted on said power head and including a centrally located friction surface with a generally horizontal serration, a second bracket including a centrally located friction surface with a generally horizontal serration, a pair of springs connecting said brackets on laterally opposed sides of said friction surfaces to establish said friction surfaces in pressure engagement with each other and to engage said serrations with each other, and means mounting said second bracket on said propulsion unit cover for adjustment in a direction normal to said engaged frictional surfaces.

6. A combination in accordance with claim 5 wherein one of said surfaces is provided by a plastic block.

7. An outboard motor comprising a propulsion unit including a power head, and a lower unit connected to said power head, a transom bracket adapted to be mounted on the stern of a boat, a swivel bracket connected to said transom bracket for pivotal movement

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about a horizontal axis, a king pin carried by said swivel bracket for pivotal movement about a vertical axis, means resiliently connecting said lower unit and said king pin, means on said power head and on said king pin in frictional engagement with each other to restrain lateral vibratory movement of said power head, and a tension spring extending transversely of said frictionally engaged means for maintaining a normal force between said frictionally engaged means.

8. The combination in an outboard motor of a supporting member pivotal about a generally vertical axis when the outboard motor is in an operative position, a power head, a friction surface carried by said supporting member, a friction surface carried by said power head, one of said surfaces constituting a plastic block, and

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spring means interconnecting said supporting member and said power head to hold said friction surfaces in frictional engagement.

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