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(54) PROPULSION ARRANGEMENTS FOR AQUATIC TOYS

(71) I, LEE MAN KWAI, of 55—61 Kowloon City Road, 3rd to 8th Floors, Kowloon, Hong Kong, a British subject, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to propulsion arrangements for aquatic toys, for example toy or model boats.

According to the invention, a propulsion arrangement for an aquatic toy comprises a water-tight chamber having a water inlet and a water outlet, a fan rotatably mounted within the chamber such that on rotation it will draw water from the water inlet in the direction of the rotational axis of the fan and expel it from the water outlet in a direction substantially perpendicular to the rotational axis of the fan to propel the toy, a first gear fixed with respect to the fan, and an electric motor having a second gear mounted on an output shaft thereof, the shaft extending into the chamber through an opening therein such that the second gear meshes within the chamber with the first gear whereby the fan is rotated on energisation of the motor.

With an arrangement in accordance with the invention, rotation can be transmitted from the motor to the fan by means of two gears only. Furthermore, since the gears are accommodated within the chamber, it is a fairly simple matter to make the chamber water-tight.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view of a water-jet propulsion unit constituting part of a propulsion arrangement embodying the invention;

Figure 2 is a view of a cover part of the unit shown in Figure 1, taken in the direction of the arrow A in Figure 1;

Figure 3 is a plan view from below of a unitary plastics component of the propulsion unit shown in Figure 1;

Figure 4 is an exploded perspective view of an electric motor and associated components which, together with the propulsion unit shown in Figure 1, constitute the propulsion arrangement embodying the invention;

Figure 5 is a perspective view from above of the after end of a toy boat fitted with the propulsion arrangement embodying the invention; and

Figure 6 is a perspective view from below of the after end of the toy boat.

Figures 1 to 3 show a water-jet propulsion unit 10 that forms part of a propulsion arrangement for an aquatic toy. The propulsion unit 10 comprises a cover 12, a member 14 and a base 16, each of which may be a unitary plastics moulding. The cover 12 and base 16 fit together, by means of a lower side portion 18 of the cover 12 fitting within a correspondingly shaped peripheral wall 20 of the base 16, to define between them a chamber within which is received the member 14. Opposite ends of a spindle 22 forming part of the member 14 are received, respectively, within a recessed boss 26 inside an upper portion 28 of the cover 18 and a recess 30 within a hub 32 forming part of the base 16, whereby the member 14 is rotatable within the chamber about the axis of the spindle 22.

The member 14 comprises a disc 34 lying in a plane at right angles to the axis of the spindle 22. A crown gear 36 is formed on one face of the disc 34. Fan blades 38 are formed on the other face of the disc 34, namely the face confronting the base 16, the fan blades extending from the periphery of the disc 34 to a central hub 40.

When mounted between the cover 12 and base 16, the disc 34 of the member 14 divides the said chamber within the propulsion unit into two portions, namely an upper portion defined by the upper face of the disc 34 and the interior of the upper portion 28 of the cover 12, and a lower portion defined by the outer face of the disc 34, the interior of the remainder of the cover 12 and the interior of the base 16.

The above-described lower portion of the chamber within the propulsion unit is provided with a water inlet constituted by a circular opening 42 within the base 16. The water inlet 42 has a depending flange 44 around its periphery. The above-mentioned hub 32 having the recess 30 therein is supported centrally of the water inlet 42 by legs 46.

The lower portion of the chamber within the propulsion unit is also provided with a water outlet 48 defined by cooperating portions 50, 52 of the cover 12 and base 16, respectively, the water outlet 48 comprising a first portion 54 extending substantially tangentially of the lower portion of the chamber and a portion 56 in the form of a diverging nozzle substantially symmetrical about an axis perpendicular to that of the spindle 22 of the member 44.

As will be evident, the fan blades 38 are located within the lower portion of the chamber within the propulsion unit.

The upper portion of the chamber within the propulsion unit 10 houses the crown gear 36 on one face of the disc 34 of the member 14 and comprises an opening 60 formed in a portion 62 thereof, the opening 60 having a recess around its periphery.

As well as the water-jet propulsion unit 10 described above with reference to Figures 1-3, the present propulsion arrangement further comprises an electric motor 70 shown in Figure 4. The electric motor 70 has a pinion 72 fixed to the free end thereof. A ring-like sealing member 76 is mounted on the shaft 74 between the motor 70 and the pinion 72.

Figures 5 and 6 show the propulsion unit 10 and the electric motor 70 and associated components installed in a toy boat having a hull 78 and twin rudders 80. The propulsion unit 10 is fixed to the hull 78 such that the flange 44 around the water inlet 42 is secured within an opening in the bottom of the boat for the ingress of water, and such that the free end of the water outlet 48 is fixed within the transom 82 of the boat for the egress of water.

The electric motor 70 is secured in place by a clip 84 screwed into a pair of pillars, one of which is visible in Figure 5 and designated 86. In the illustrated condition, the motor 70 is mounted such that the shaft 74 extends through the opening 60 in the cover 12 of the propulsion unit 10 into the upper portion of the chamber therein, the shaft extending substantially at right angles to the axis of rotation of the member 14. The pinion 72 secured to the motor shaft 74 is in mesh with the crown gear 36 formed on one face of the disc 34 of the member 14. The sealing member 76 is urged against and into the opening 60 such that an annular surface portion 88 thereof engages the

bottom of the recess around the periphery of the opening 60, a cylindrical surface 90 thereof engages the side wall of said recess, and an annular surface portion 92 engages the face of the portion 62 of the cover 12 around said recess. A central, hub-like portion 93 of the sealing member 76 surrounds the shaft 74. In this way, the water-tight integrity of the chamber within the propulsion unit 10 is preserved in spite of connection thereto of the motor 70.

As can best be seen from Figure 5, wires 92 extend from the battery compartment 94 to terminals 96 of the motor 70.

The propulsion arrangement functions in the following manner. Upon energisation of the motor 70, the rotation of the output shaft 74 is transmitted by the pinion 72 to the crown gear 36, whereby the member 14 rotates. Water within the lower portion of the chamber within the propulsion unit 10 is forced out through the water outlet 48 due to the centrifugal effect produced by rotation of the fan blades 38, thereby creating a vacuum within the chamber, whereby water is then continuously sucked into the chamber through the water inlet 42 and forced out of the water outlet 48 by the fan blades. In this way, the propulsion unit creates a powerful water-jet stream which propels the boat, the water being drawn by the fan blades 38 from the water inlet 42 in the direction of the rotational axis of the fan and being expelled by the fan blades from the water outlet 48 in a direction substantially perpendicular to the rotational axis of the fan.

WHAT WE CLAIM IS:—

1. A propulsion arrangement for an aquatic toy, the arrangement comprising a water-tight chamber having a water inlet and a water outlet, a fan rotatably mounted within the chamber such that on rotation it will draw water from the water inlet in the direction of the rotational axis of the fan, and expel it from the water outlet in a direction substantially perpendicular to the rotational axis of the fan to propel the toy, a first gear fixed with respect to the fan, and an electric motor having a second gear mounted on an output shaft thereof, the shaft extending into the chamber through an opening therein such that the second gear meshes within the chamber with the first gear whereby the fan is rotated on energisation of the motor.

2. A propulsion arrangement according to claim 1, including a sealing member arranged on the output shaft of the motor between the motor and the second gear to seal said opening in the chamber.

3. A propulsion arrangement according to claim 1 or claim 2, wherein the output shaft of the motor extends into the chamber



5 The above-described lower portion of the chamber within the propulsion unit is provided with a water inlet constituted by a circular opening 42 within the base 16. The water inlet 42 has a depending flange 44 around its periphery. The above-mentioned hub 32 having the recess 30 therein is supported centrally of the water inlet 42 by legs 46.

10 The lower portion of the chamber within the propulsion unit is also provided with a water outlet 48 defined by cooperating portions 50, 52 of the cover 12 and base 16, respectively, the water outlet 48 comprising a first portion 54 extending substantially tangentially of the lower portion of the chamber and a portion 56 in the form of a diverging nozzle substantially symmetrical about an axis perpendicular to that of the spindle 22 of the member 44.

As will be evident, the fan blades 38 are located within the lower portion of the chamber within the propulsion unit.

25 The upper portion of the chamber within the propulsion unit 10 houses the crown gear 36 on one face of the disc 34 of the member 14 and comprises an opening 60 formed in a portion 62 thereof, the opening 60 having a recess around its periphery.

30 As well as the water-jet propulsion unit 10 described above with reference to Figures 1-3, the present propulsion arrangement further comprises an electric motor 70 shown in Figure 4. The electric motor 70 has a pinion 72 fixed to the free end thereof. A ring-like sealing member 76 is mounted on the shaft 74 between the motor 70 and the pinion 72.

40 Figures 5 and 6 show the propulsion unit 10 and the electric motor 70 and associated components installed in a toy boat having a hull 78 and twin rudders 80. The propulsion unit 10 is fixed to the hull 78 such that the flange 44 around the water inlet 42 is secured within an opening in the bottom of the boat for the ingress of water, and such that the free end of the water outlet 48 is fixed within the transom 82 of the boat for the egress of water.

50 The electric motor 70 is secured in place by a clip 84 screwed into a pair of pillars, one of which is visible in Figure 5 and designated 86. In the illustrated condition, the motor 70 is mounted such that the shaft 74 extends through the opening 60 in the cover 12 of the propulsion unit 10 into the upper portion of the chamber therein, the shaft extending substantially at right angles to the axis of rotation of the member 14.

60 The pinion 72 secured to the motor shaft 74 is in mesh with the crown gear 36 formed on one face of the disc 34 of the member 14. The sealing member 76 is urged against and into the opening 60 such that an annular surface portion 88 thereof engages the

bottom of the recess around the periphery of the opening 60, a cylindrical surface 90 thereof engages the side wall of said recess, and an annular surface portion 92 engages the face of the portion 62 of the cover 12 around said recess. A central, hub-like portion 93 of the sealing member 76 surrounds the shaft 74. In this way, the water-tight integrity of the chamber within the propulsion unit 10 is preserved in spite of connection thereto of the motor 70.

As can best be seen from Figure 5, wires 92 extend from the battery compartment 94 to terminals 96 of the motor 70.

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2. A propulsion arrangement according to claim 1, including a sealing member arranged on the output shaft of the motor between the motor and the second gear to seal said opening in the chamber.

3. A propulsion arrangement according to claim 1 or claim 2, wherein the output shaft of the motor extends into the chamber



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in a direction substantially at right angles to the axis of rotation of the fan.

4. A propulsion arrangement according to claim 3, wherein the first gear is a crown gear and the second gear is a pinion.

5. A propulsion arrangement according to claim 4, wherein the fan comprises a disc-like member having fan blades on one side thereof and the crown gear on the other side thereof.

6. A propulsion arrangement according to claim 5, wherein the disc-like member, the fan blades and the crown gear are formed integrally with one another.

7. A propulsion arrangement according to claim 6, wherein a spindle rotatably mounting the fan is formed integrally with the disc-like member, the fan blades and the crown gear.

8. A propulsion arrangement according to claim 6 or claim 7, wherein the disc-like member, the fan blades and the crown gear are constituted by a unitary plastics member.

9. A propulsion arrangement according to any one of claims 5 to 8, wherein the disc-like member divides the chamber into two portions, a first portion housing the fan blades and having the water inlet and water outlet and a second portion housing the first and second gears and having said opening.

10. A propulsion arrangement for an aquatic toy, substantially as herein described with reference to the accompanying drawings.

11. An aquatic toy having fitted thereto a propulsion arrangement according to any one of claims 1 to 10.

12. A toy boat having fitted thereto a propulsion arrangement according to any one of claims 1 to 10.

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