United States Patent

[11] **3,579,900**

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[33] **Great Britain**
[31] **461/68 and 22272/68**

[54] **TOY WATERCRAFT**
13 Claims, 9 Drawing Figs.

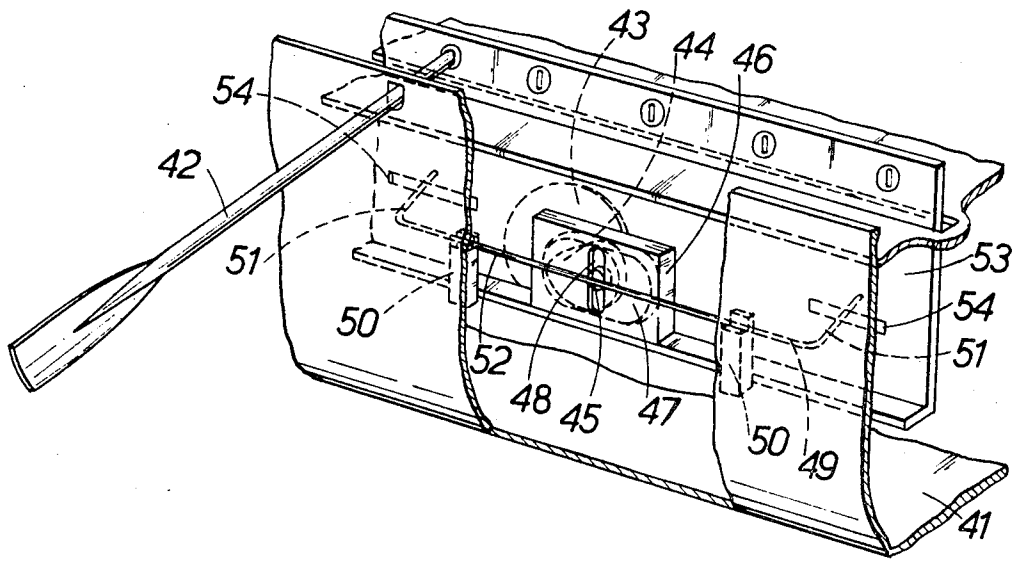
[52] **U.S. Cl.** **46/93**
[51] **Int. Cl.** **A63h 23/02**
[50] **Field of Search** 46/91, 93, 243, 92, 245

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Assistant Examiner—D. L. Weinhold
Attorney—Burns, Doane, Benedict, Swecker and Mathis

ABSTRACT: A toy watercraft propelled by a rowing action, The cars are driven by a motor through a double cam device which imparts reciprocating horizontal and vertical components of motion to the oars so that they move in oblong paths, the longest axis of the oblong being parallel to the water surface.



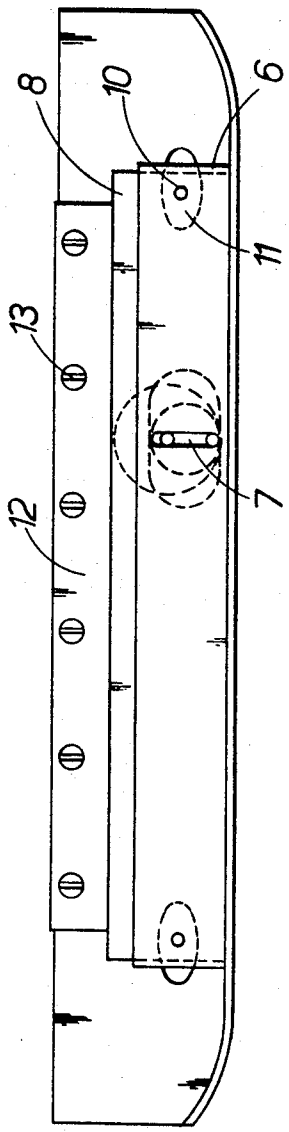


Fig.1.

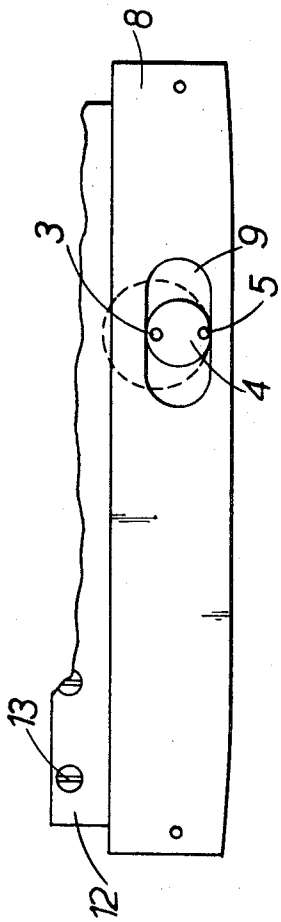


Fig.2.

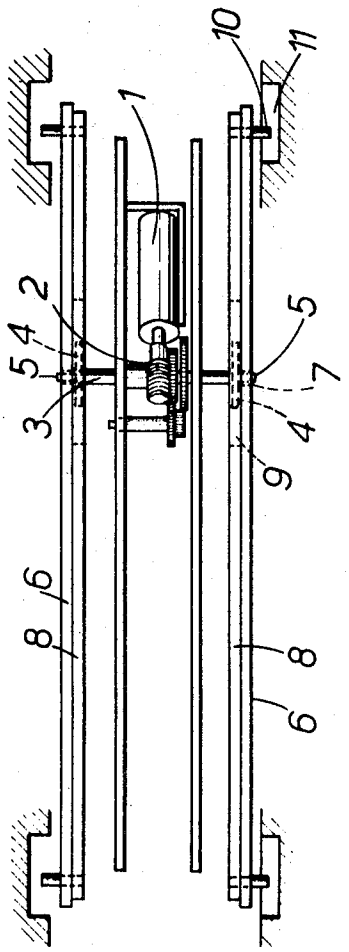


Fig.3.

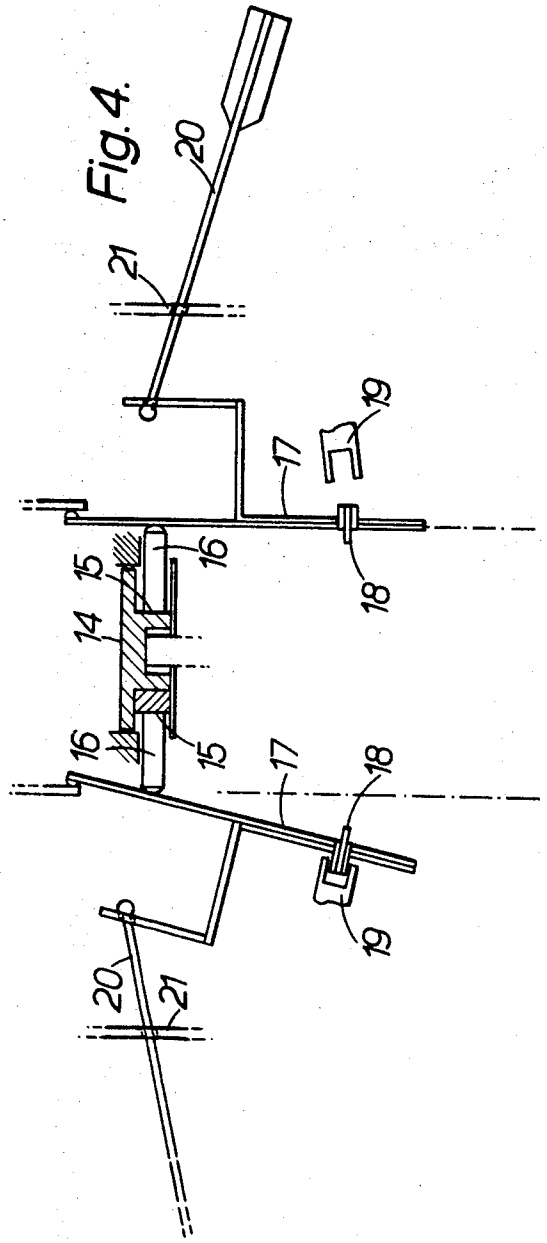

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Fig.4.

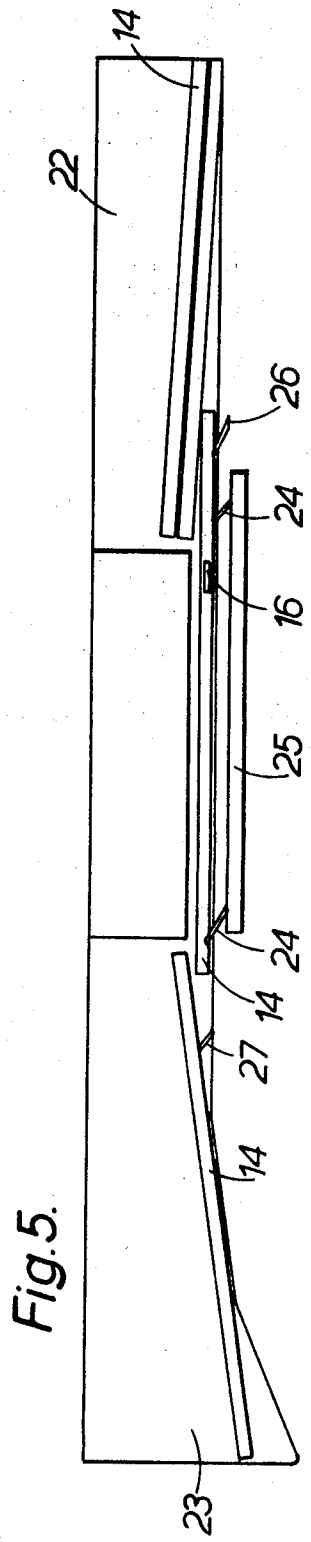

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Fig.5.

Fig.6.

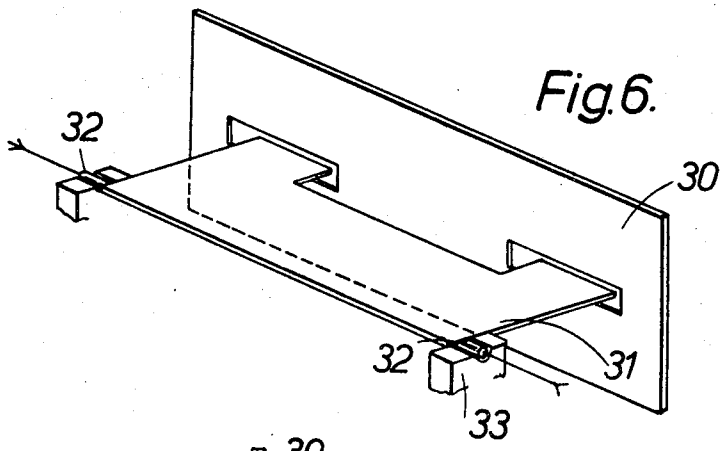
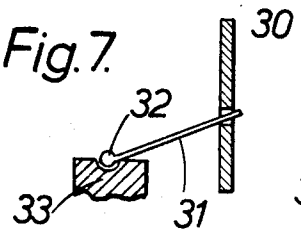


Fig.7.



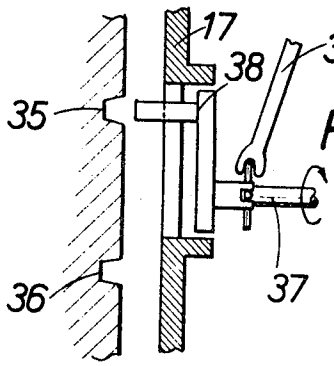
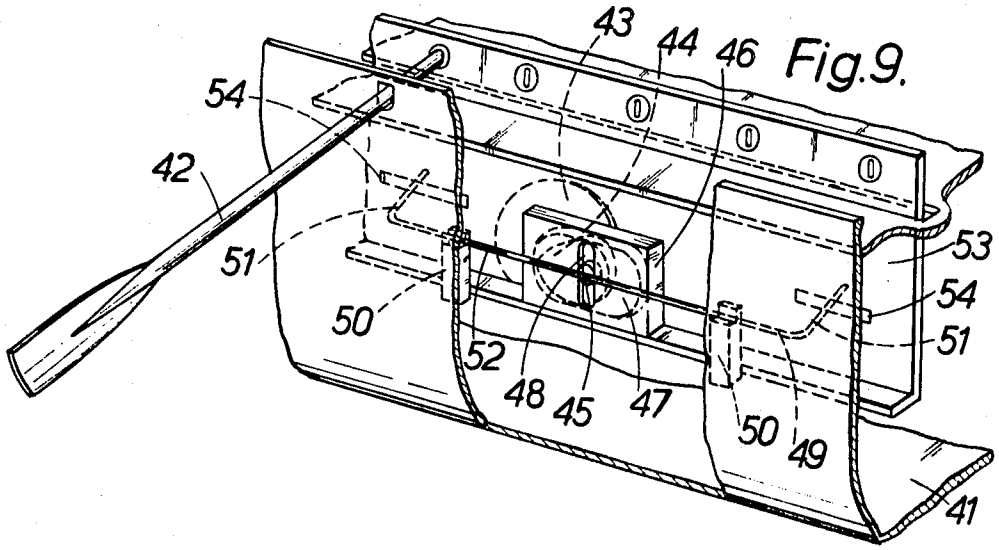


Fig.8.

Fig.9.



TOY WATERCRAFT

FIELD OF THE INVENTION

This invention relates to toy watercraft propelled by a rowing or sculling action, and also to methods and apparatus for steering or otherwise controlling such craft.

DESCRIPTION OF PRIOR ART

Toy watercraft propelled by a rowing or sculling action are known, but in these prior art craft the rowing actions are not realistic as the oar blades describe circular paths.

One object of the present invention is to provide a toy watercraft in which the oar blades describe realistic oblong paths in which each oar is inserted into the water, pulled backwards relative to the craft to drive the craft forwards through the water, lifted out from the water or returned to its original position relative to the craft so that the cycle may be repeated, the longest axes of the oblong paths being parallel to the water surface.

SUMMARY OF THE INVENTION

According to the invention I provide a toy watercraft comprising a double cam device driven by a rotatable shaft which in turn drives an oar or paddle blade by imparting to the oar or paddle two reciprocating linear perpendicular components of motion which are unequal in amplitude and sufficiently out of phase to combine to produce a resultant motion of the oar or paddle blade along an oblong path.

In more detail I provide a toy watercraft propelled by a mechanism which drives one, two or more oars with a rowing, sculling or paddling motion, comprising a motor, two cams mounted upon a rotatable drive shaft, two cam followers each of which cooperates with one cam and which are rigidly locked together, and one or more oars or paddles coupled to the cam followers, wherein in operation the motor rotates the drive shaft so that the cams rotate and impart to their respective followers a reciprocating linear component of motion, the two components being perpendicular, of unequal amplitude, and approximately 90° out of phase for both cam followers to move together over an oblong path which is the resultant of the perpendicular components, the oar or paddle blade or blades coupled thereto moving over s similar path.

In another preferred embodiment, one of the cam followers acts as an oar mounting to which is attached a plurality of oars extending on both sides of the craft so that the oars are driven in unison. Alternatively, two linked oar mountings may be provided, each of which is coupled to the oars on one side of the craft. Thus the cam followers can act as oar mountings, or separate oar mountings may be provided.

Each oar is preferably detachably connectable to its mounting at the end remote from the blade by a linkage which allows the oar blade to move about but not to rotate. The oars may be pivoted between their mountings and their blades in rowlocks so that when the mountings are moved in one direction, the blades move in the opposite direction. Alternatively, the oars may be prevented from rotating by the shape of the rowlocks. The cross section of the oars and rowlocks may be shaped so that the oars are feathered during the return stroke out of the water.

The ends of the cam followers may be constrained to move only along the desired path so that they are prevented from rocking. This may be accomplished by locating pins attached to the ends of the cam followers in grooves or depressions provided in a fixed part of the craft. Where separate oar mountings are provided, their movements may be similarly constrained.

The drive shaft may be driven by an electric or a clockwork motor, and a reduction gear may be employed so that the oars are driven at a realistic speed, say 20 to 35 strokes per minute.

The toy may take the form of any type of craft propelled by rowing or paddling, for example a canoe having only a single paddle, a simple rowing boat having two oars, a racing shell having eight oars, or a Roman Galley having several banks of oars. The hull of the craft may be detachable from the mechanism so that the same mechanism may be used in turn to propel several different hulls.

Various methods of steering the toy may be used, for example a simple rudder at the stern of the craft which may be set at the required angle by the operator before use, or by radio control during use. Steering may also be effected by a shifting weight within the hull of the craft which tilts the craft from one side to the other so that the oars on one side dip further into the water than the oars on the other side. The craft may also be steered by stopping the oars on one side of the hull while the oars on the other side continue to row. If one set of oars is stopped while immersed in the water the craft will turn more quickly than if the set is stopped while the oars are out of the water. The oars may be stopped and restarted by a signal, for example a radio signal.

A more sophisticated embodiment of the invention may take the form of a toy which is steered automatically by selectively stopping and restarting the oars on each side of the hull according to a predetermined programme.

Such a device may comprise a programmed member which may for example be a disc, a drum or a strip having two separate information-carrying contoured surfaces. The programmed member may be driven, for example by a ratchet mechanism, so that each contoured surface moves past a sensor sprung into contact with it whereby the sensors move back and forth to follow the shape of the contours. Each sensor may be linked to an oar mounting in such a way that the movements of the sensors may stop and restart the oars connected to the respective mountings. Each mounting is preferably coupled to the oars on one side of the hull, so that the mechanism allows the sets of oars on each side of the hull to be stopped and restarted independently. The programmed member is preferably interchangeable with the other programmed members so that different programmes may be used in the same toy. The toy may include a mechanism for changing the programme automatically so that several programmes may be stored in the hull and moved past the sensor in sequence.

Additional commands may be incorporated into the programmed members so that with appropriate cooperating mechanism, for example, the speed of the craft may be varied, its direction of travel reversed, a sail automatically raised or lowered, or a rudder automatically operated.

The toy watercraft may have two motors each with a cooperating gearbox, each motor driving the same ratchet mechanism but a separate bank of oars, so that each motor drives the oars on one side of the hull. Thus each motor may be stopped independently to effect a turn while the other motor continues to drive both its own bank of oars and the ratchet mechanism.

This embodiment allows the speeds of the two banks of oars to be varied independently, and the banks to be driven simultaneously in opposite directions. Both oar banks could be synchronized when driven simultaneously at the same speed by the interaction of magnets placed on the two oar-mounting members.

The toy performs particularly effectively if the oblong shape of the path of each oar blade is such that the blades move substantially parallel to the water surface for a large proportion of the path. This provides better propulsion as each blade may be in the water for a greater proportion of the path. It also reduces any tendency of the oars to "catch a crab," and gives a particularly realistic impression of a real rowing action.

Thus each oar blade in operation preferably moves along a path which comprises two straight parallel sides which are the longer two sides of a rectangle, joined at each end by curved portions, the straight sides being substantially parallel to the water surface.

The curved portions may be segments of a circle or of an ellipse, in which case they may together consist of two halves of an ellipse having its major axis perpendicular to the water surface.

A path of the desired shape is more readily obtained if one of the cam followers with its cooperating cam produces the vertical component of motion of the blades while the other cam follower with its cooperating cam produces the horizontal component of the motion.

Another means for limiting the movement of the cam followers or oar-mounting members to their oblong paths comprises a restraining member in the form of a plate which cooperates with one or more slots in an oar-mounting member or cam follower, one edge of which is pivoted so that it can turn only about an axis parallel with the slot(s). In operation, the plate limits the motion of the cam follower or oar-mounting member and prevents it from rocking while allowing it to move along its oval path.

A variation of this antirock mechanism which is equally effective and easier to manufacture, comprises a restraining member in the form of a U-shaped rod or wire, in place of the plate, the end portions of the rod or wire cooperate with the slots in the oar-mounting member or cam follower, and the middle portion of the rod or wire is pivoted so that it can turn only about an axis parallel to the slot(s).

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments of the invention will now be described by way of example and with reference to the drawings of which:

FIG. 1 is a side elevation of a rowing mechanism of a watercraft according to the invention;

FIG. 2 is a side elevation, partly broken away, of part of the same rowing mechanism;

FIG. 3 is a top plan of the same rowing mechanism;

FIG. 4 is a schematic front elevation of a programming mechanism of a watercraft according to the invention;

FIG. 5 is a schematic side elevation of part of a ratchet mechanism adapted to operate the programming mechanism;

FIG. 6 is a schematic perspective view of a mechanism for limiting the cam follower or oar-mounting member to its desired oblong path;

FIG. 7 is a schematic end elevation of the mechanism shown in FIG. 6;

FIG. 8 is a schematic front elevation of a device whereby the programming device may engage and disengage the cam follower or oar-mounting member with the fixed hull of the craft;

FIG. 9 is a partially cutaway perspective view of part of the hull of a watercraft showing the rowing mechanism.

DESCRIPTION OF PREFERRED EMBODIMENTS

The rowing mechanism of FIGS. 1, 2 and 3 is incorporated into a hollow hull which, for simplicity, is not shown.

The mechanism comprises an electric motor 1 driven by batteries (not shown) which are distributed about the hull so that its center of gravity is not upset. The motor drives a reduction gear 2 which in turn drives a drive shaft 3 at a rate of about 30 r.p.m. At each end of the drive shaft is rigidly mounted a double cam comprising a disc 4, eccentrically mounted upon the drive shaft, and a pin 5, perpendicularly projecting from the flat face of the disc and parallel to the drive shaft. Each double cam cooperates with a pair of cam followers. The pin 5 of each double cam cooperates with a follower 6 formed as a strip having a vertical slot 7 with which the pin engages. The disc 4 of each double cam cooperates with a follower 8 which is provided with a horizontally elongated slot 9, with which the disc engages. Each pair of cam followers 6 and 8 are locked together by pins 10 so that each pair of followers may move only together.

In operation, when each double cam rotates, each pin 5 imparts to its follower 6 in a horizontal reciprocating component of motion, while each disc 4 imparts to its follower 8 a vertical reciprocating component of motion 90° out of phase with the motion of the cooperating follower 6. The result is that both followers of each pair move together over a path which is the resultant of the two components, and this path is elliptical in shape. The pins 10 are located in elliptical slots 11 of the same shape as the path to ensure that the followers move over the elliptical path without rocking. An oar-mounting member 12 is fixed to each of the cam followers 6, and each oar-mounting member is provided with a number of slots 13 into each of which an oar may be fitted. The slots allow the oars to move about but not to rotate. Each oar is pivoted in a rowlock (not shown) provided in the hull of the craft so that in operation as the oar-mounting members move along their elliptical paths, the oar blades move along similar paths but in the opposite direction to provide a realistic rowing action.

FIG. 4 is a schematic cross section through the programming mechanism. This comprises a programmed strip 14 having two surfaces which carry programmed instructions as varying contours 15. Each surface 15 is sprung into contact with one end of a cooperating sensor which is in the form of a finger 16. The other end of each finger 16 is sprung into contact with an oar-mounting member 17. Each oar-mounting member may be locked to a drive plate (not shown) by a pin 18 which engages a socket in the drive plate. The drive plate is driven with an elliptical motion by a cam device (not shown). Each oar-mounting 142 member may also move out of engagement with the drive plate and instead engage a fixed socket 19 which holds it motionless relative to the craft as a whole. Each oar-mounting member is coupled to a plurality of oars, 20, each of which is pivoted in a rowlock 21.

In operation, the strip 14 is driven by a ratchet mechanism (not shown) past the fingers 16 which move to and fro to follow the varying contours of the surfaces 15. When one of the fingers moves outwards from the axis of the strip, as shown in the left-hand side of FIG. 4, it deflects the oar-mounting member 17 so that this moves out of engagement with the drive plate and into engagement with the fixed socket 19. Thus the oar-mounting member, and consequently the oars, are held motionless. When the finger 16 moves back towards the axis of the strip 14 to follow the contours of the surface 15, the oar-mounting member is allowed to move back into engagement with the drive plate. The oar-mounting member now moves over an elliptical path with the drive plate, and the oars therefor perform a rowing action.

The strips 14 are interchangeable so that by using an appropriate strip, the oars on either side of the boat may be stopped and restarted according to a predetermined programme.

A variation of this programming device is shown in FIG. 8, and allows the oars to be selectively stopped either in a raised or in a lowered position.

In this variation the double cam 38 is slidably mounted on the drive shaft 37 so that by sliding in one direction it moves into engagement with the shaft 37 and by sliding in the opposite direction it moves out of engagement with the shaft 37. The double cam 38 is of sufficient depth always to be engaged with the cam followers 17, whether the double cam is engaged or disengaged from the drive shaft.

Two indentations 35 and 36 are provided in a fixed part of the hull of the craft to receive part of the double cam 38 when this is out of engagement with the drive shaft 17 to hold the cam assembly motionless. When the cam 38 engages one of these indentations 36 the oars which it drives are held motionless in a raised position out of the water and when it engages the other indentation 35 the oars are held motionless in a lowered position in the water.

In operation, the double cam 38 is moved into or out of engagement with the drive shaft 37 by a movable fork 34 which is operated by a programming device (not shown). When the cam 38 is engaged with the drive shaft 37 the cam rotates with it and drives the oars. When the cam is not engaged with the drive shaft it engages one of the indentations 35 and 36 in the hull so that the oars are held either in a raised or in a lowered position depending upon the programmed instructions.

One form of ratchet mechanism will now be described with reference to FIG. 5 of the drawing, which shows a side eleva-

tion of part of the mechanism. The mechanism comprises an inlet hopper 22 for storing strips 14 prior to use, and an outlet hopper 23 for storing them after use. Between these hoppers is situated two sensors in the form of fingers 16 which transmit programmed instructions from each strip in turn to the oars. Two ratchet teeth 24 are attached to a ratchet plate 25 which is driven to and from by a crank mechanism (not shown) so that in operation as the teeth move to the left they engage one or more of the strips which is also moved to the left, but as they move to the right they also move downwards and out of engagement with the strip or strips. A keeper 26 is provided to hold the strip motionless while the ratchet teeth move back to the right. The outlet hopper 23 slopes downwards part of the way along its length so that as each strip is discharged into the outlet hopper it moves under any strips already positioned in the hopper. A keeper 27 is provided to hold the strips once they have been discharged into the outlet hopper.

In operation, the bottom strip from the inlet hopper 22 is engaged by the first ratchet tooth and driven by it in steps past the fingers 16, each step corresponding to one cycle of the oars of the craft. The strip moves to the left until it also engages the second ratchet tooth and continues until it is discharged into the outlet hopper 23 where it is held by the keeper 27. Meanwhile, the next strip in the inlet hopper has been engaged by the first ratchet tooth and this strip in turn is driven in steps past the fingers 16, until it in turn is discharged into the outlet hopper, sliding beneath the strip which has already been deposited there. The sequence continues until all the strips in the inlet hopper have been used.

A mechanism for preventing the cam followers or oar-mounting members from rocking while moving along their oblong paths is shown in FIGS. 6 and 7. The mechanism comprises a plate 31 which cooperates with two slots in an oar-mounting member or cam follower 30 and which is pivoted at 32 on mounting 33 so that it can turn only about an axis parallel with the slots. In operation, the plate 31 limits the motion of the cam follower or oar-mounting member 30 and prevents it from rocking while allowing it to move along its oval path.

FIG. 9 is a cutaway perspective view, partly in section, of part of a watercraft according to the invention. The watercraft shown comprises a hull, part of which is shown at 41, which houses the oar-driving mechanism. This mechanism comprises a double cam device which consists of a disc 43 pivoted at its center and connected to the driven shaft of an electric motor (not shown). Upon this disc is mounted a three-cornered cam 44, and upon the cam 44 is mounted a smaller cylindrical cam 45. The two cams 44 and 45 cooperate with a cam follower 46, which is attached to an oar-mounting member 53, upon which are mounted several oars, one of which is shown at 42. The three-cornered cam 44 cooperates with an oval indentation 47 in the cam follower. The oval indentation 47 is formed of two straight parallel sides of equal length joined by curved ends, the parallel sides in operation being parallel to the water surface and to the longest axis of the oval. The cylindrical cam 45 cooperates with a slot 48 having its longest axis perpendicular to the water surface.

A U-shaped wire 49 consisting of two end portions 51 joined by a center portion 52 is mounted on two pivots 50 in such a manner that the wire may turn freely about the axis of the center portion 52, but is otherwise restrained. The two slots 54 are provided in the oar-mounting member 53, and these slots engage the end portions 51 of the wire 49.

In operation, the disc 43 is rotated by the electric motor with the result that each of the cams 4 and 5 imparts to its follower 47 and 48 respectively, a linear component of motion. The two linear components are perpendicular and out of phase, and these combine so that the cam follower moves with the resultant motion along an oval path. The oval path has two straight sides of equal length parallel to the water surface and joined by curved sides, the longest axis of the oval being parallel to the straight sides. As the oar-mounting member 53 is fixed to the cam follower 46, the oar-mounting member also moves over the oval path so that the oars in turn perform a similar motion. The wire 49 allows the oar-mounting member 53 to move along the oval path, but prevents it from rocking.

In embodiments where a programmed strip driven by a ratchet mechanism is used to control the action of the oars, a simple counter wheel may be incorporated which would allow the strip to stop advancing while the wheel revolved instead. This would allow the programming available from each strip to be greatly expanded.

Apart from programmed strips, other information carrying means may be employed for controlling the oars, for example a punched tape.

In a simple embodiment of the invention which does not incorporate a programming device, the double cam assembly may be replaced by a small spur gear cooperating with a toothed cavity in an oar-mounting member so that as the gear rotates it rolls around the periphery of the cavity. Alternatively, the gear may rotate about a fixed axis so that the oar mounting moves about it in a similar manner.

The expression "oars" used herein is intended to include paddles and sculls as used, for example, to propel canoes and boats.

I claim:

1. A toy watercraft comprising:
a hull;
at least one oar movably mounted on said hull;
movable follower assembly means, including a pair of cam followers fixed to one another for movement together, for moving said at least one oar along a path similar to a path of movement of said follower assembly means;
rotatable double cam means for imparting to each of said cam followers a reciprocating and substantially pure linear component of motion, the component of each of said cam followers being perpendicular, unequal in amplitude and approximately 90° out of phase so that said follower assembly means is moved in an oblong path through translation;
motor means for rotating said double cam means; and,
means for constraining said follower assembly means against rocking during movement along said oblong path.

2. A toy watercraft according to claim 1 wherein:
said cam means cooperates with said cam followers to move said follower assembly such that said oblong path comprises the two longer sides of a rectangle joined at each end by curved portions, said sides being substantially parallel to the surface of the water upon which the toy is floating.

3. A toy watercraft according to claim 1 including:
oar mounting means for mounting each said oar, said oar mounting means being fixed to at least one of said cam followers to form a portion of said movable follower assembly means.

4. A toy watercraft according to claim 1 wherein:
each said oar is jointed directly to one of said cam followers.

5. A toy watercraft according to claim 1 including:
oar mounting means for detachably supporting each said oar remotely from the blade while permitting each said oar to move about freely without rotation; and,
a rowlock for pivotally supporting each said oar between said blade and said oar mounting means.

6. A toy watercraft according to claim 1 wherein:
said means for constraining said follower assembly means against rocking comprises spaced pins attached to said follower assembly means adjacent opposite ends thereof and cooperating with oblong shaped depressions in said hull.

7. A toy watercraft according to claim 1 wherein: constraining said follower assembly means against rocking comprises a retaining member attached to said hull and pivoted about an axis, said restraining member cooperating with means defining at least one slot in said follower assembly means.

8. A toy watercraft according to claim 1 and including:
means for selectively stopping and restarting the movement of at least one oar by rendering movement of said at least

one oar independent of the operation of said motor means.

9. A toy watercraft according to claim 8 wherein said means for selectively stopping and restarting the motion of said at least one oar comprises:

a programmed member having at least one contoured information carrying surface;

movable sensor means abutting against said surface and operatively engaging at least one of said follower assembly means and said oars for selectively coupling and uncoupling at least one of

a. said oars from said follower assembly means, and

b. said cam means from said motor means; and

driving means for moving said programmed member so that said surface moves relatively to said sensor means with the sensor means following the contour of said surface.

10. A toy watercraft according to claim 9 wherein said at least one oar comprises a bank of oars mounted on one side of said hull and including:

a second bank of oars mounted on the opposite side of said hull, a second movable follower assembly means, a second double cam means, and a second

means for constraining said second follower assembly means against rocking, respectively identical to the first mentioned bank of oars, follower assembly means, double cam means, and means for constraining said follower assembly means;

said programmed member comprising a strip of rectangular cross section having two contoured information-carrying surfaces on opposite surfaces of said strip;

said first mentioned sensor means cooperating with one of said strip surfaces;

a second movable sensor means identical to said first-mentioned sensor means and cooperating with the other of said strip surfaces.

11. A toy watercraft according to claim 9 and including:

lever means engaged by said sensor means for selectively coupling and uncoupling said cam means from said motor means; and,

two stations provided in said hull, one above the other, for engaging and holding said cam means when said cam means is uncoupled from said motor means, one station engaging and holding said cam means with said at least one oar in a raised position and the other station engaging and holding said cam means with said at least one oar in a lowered position.

12. A toy watercraft according to claim 10 and including:

magazine means for storing a stack of said programmed members;

ratchet means for extracting said members one by one from said magazine means and for moving said members past each of said sensor means; and,

container means for storing said strips once moved past said sensor means.

13. A toy watercraft according to claim 1 wherein said at least one oar comprises a bank of oars mounted on one side of said hull and including:

a second bank of oars mounted on the opposite side of said hull, a second movable follower assembly means, a second double cam means, and a second means for constraining said second follower assembly means against rocking, respectively identical to the first mentioned bank of oars, follower assembly means, double cam means, and means for constraining said follower assembly means;

said oar banks being driven simultaneously in opposite directions.