HYDRAULIC PROPULSION MECHANISM FOR BOATS AND OTHER WATER VEHICLES

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During recent flood catastrophes in the Ohio River Valley, a great need was felt for a power driven boat which would be suitable for use as an emergency craft. This emergency boat must be capable of operation in shallow water as well as in water containing a large amount of floating debris. It would be necessary for the craft to be free from the danger of being disabled by submerged telephone wires, roof tops and other hidden objects. It also was found desirable to have a boat capable of movement forwardly, rearwardly and toward either side as well as one having the ability to remain stationary in the face of strong currents. Another feature desired in the emergency boat is the ability to turn sharply even when operating in swiftly moving waters. The primary object of the present invention therefore resides in providing a boat which will meet all of the above requirements and which will avoid serious objections to previously supplied crafts.

Another object of the invention resides in the provision of a boat having a motor driven water pump, the discharge of which is employed to propel the boat. By employing this method of propulsion, the need for conventional screw propellers is eliminated and the boat is rendered more flexible in its operation. An additional advantage resulting from the use of the water pump is the availability of an adequate supply of water with which to fight fires commonly resulting from floods.

A still further object of the invention is the provision of one or more screens in the suction line of the water pump to prevent the entrance of foreign matter which would injure the pump and disable the craft. The screens are made accessible from the interior of the boat in order that they may be cleaned without docking the boat. Means are also provided to effect the cleaning of the screens by power developed by the water pump.

An additional object resides in providing the suction line with a plurality of valved branches whereby the operation of the pump and the use of the boat will not be interrupted during the screen cleaning operations.

It is an object of the invention to employ a centrifugal water pump in order that a steady stream will be provided to propel the boat. When the propelling stream of water is free from pulsations, the boat will be free from vibration. To further eliminate objectionable vibration, the pipe lines leading to and from the pump are provided with flexible couplings to absorb any vibration incident to the operation of the driving motor.

For a further understanding of the invention and additional objects, reference is to be had to the following description and the accompanying drawings which disclose a preferred form of boat embodying the features of the present invention.

In the drawings:

Fig. 1 is a view in side elevation of a boat formed in accordance with the present invention, portions of the hull being broken away to show interior mechanism;

Fig. 2 is an enlarged plan view of the rear portion of the boat, the deck being omitted to show the piping system;

Fig. 4 is a similar view of the forward portion of the boat, the deck also being omitted in this view;

Fig. 5 is a vertical sectional view taken on a plane indicated by the line V—V of Fig. 3;

Fig. 6 is a similar view on a plane indicated by the line VI—VI of Fig. 3;

Fig. 7 is a vertical sectional view taken on a plane indicated by the line VII—VII of Fig. 3;

Fig. 8 is a vertical longitudinal sectional view taken through a flexible coupling used in the piping system of the boat to dampen vibrations;

Fig. 9 is a vertical sectional view on the plane indicated by the line IX—IX of Fig. 3 and shows a valve used to control fluid flow through one of the pipe lines;

Fig. 10 is a plan view of the wheel used in steering the boat and shows a link for transmitting motion to the rudder and other steering mechanism;

Fig. 11 is a vertical sectional view of the lower end of the steering column, the plane of the section being indicated by the line XI—XI of Fig. 10.

Fig. 12 is a diagrammatic view of mechanism employed to automatically effect the cleaning of the screens in the inlets extending to the pump.

Referring more particularly to the drawings, the numeral 1 designates the hull of a boat formed in accordance with the present invention. While the hull is shown as being formed from sheet material, it is within the scope of the invention to form the same from wood or other suitable and well known materials.

In the present instance, the bow 2 of the boat is provided with a modified prow since this is most desirable for an emergency boat. The conventional style of hull may be used, however, depending upon the use for which the boat is in-
tended. The hull is provided with a substantially flat bottom and at the rear is provided with an overhanging deck 3 which provides a place for a recess for the reception of the exterior of the steering mechanism 4. By reason of the pocket, the mechanism 4 may be arranged above the plane of the bottom of the hull and will therefore be less liable to become tanged in submerged debris, fences and telephone wires.

When forced in by pressure water, the blade or member to the framework of the boat is a prime mover 5. For purposes of illustration, the prime mover takes the form of an internal combustion engine and is provided with a cylinder block 6, a radiator 7 and a crank case 8. By the provision of the radiator, the engine may be cooled with clean water and will not be required to use the water in which the boat is operating since the latter usually contains so much foreign matter that its use is prohibitive. The driving shaft 9 of the engine is connected by means of a coupling 10 to the operating shaft 11 of a centrifugal fluid pump 12. The shaft 11 is journaled in bearings 13 provided in connection with the casing 14 of the pump and at its inner end is joined with the impeller 15 of the pump. A packed gland 16 is provided where the shaft passes through the casing 14 to prevent fluid seepage around the shaft and into the interior of the boat.

The pump impeller 15 includes spaced disks 16a and 16b between which are disposed the impeller blades 17. The disk 16b is positioned on the inlet side of the pump and is provided at its center with an opening through which the liquid passes. As the impeller rotates, the centrifugal action set up causes the water around the blades to move outward. Due to the shape of the casing, the water moves toward the tangentially disposed outlet 18. While pumps of various capacities may be employed, the one provided in the boat illustrated has a capacity of 800 gallons a minute which is sufficient for practical purposes.

When the boat is exhausted with the inlet of the pump is a feed or suction pipe line 19 which terminates in a pair of branches 20—20 leading by means of vertical fittings 21—21 to the exterior of the hull through the bottom thereof. A gate valve 22 is arranged in each of the branches 29 to stop fluid flow therethrough when it is not in use. Strainers 23 disposed in the fittings 21. The upper ends of the fittings are provided with cap members 24, these being removable to give access to the metallic screen strainers 23. The provision of the strainers is important because when the boat is operated in dirty streams or lakes foreign matter might become lodged in the pipe lines clogging the same and rendering the boat inoperative. In addition, such foreign matter, and in some instances fish, might readily reach the impeller and cause the same to jam and be rendered useless. By providing a plurality of fittings 21 and strainers 23, one may be cleaned while the other is being used and the operation of the boat uninterrupted. Small deflectors 25 are arranged at the leading edge of the inlet opening on the under side of the hull to assist in preventing foreign matter from entering the pipes.

To clean the screens of ordinary debris, the lines 20 have cleaning pipes 20a extending thereinto from the outlet of the pump. The inner ends of the pipes 20a are directed on the screens where the debris is most apt to collect.
flange is provided to form a swivel connection for an elbow-shaped member 32 terminating in a horizontally directed jet extension. By this construction, the member 32 is free to turn about a vertical axis so that when a stream of water is issuing from the jet to move the boat in a forward direction, angular positioning of the jet will result in changing the direction of travel of the boat.

To assist in steering the boat, there is also provided a small rudder member 33 which is secured at its lower forward end to the jet 32 in any suitable manner such as by welding. The upper portion of the rudder includes a forward extension 34 in which is formed a squared opening for the reception of the similarly shaped shank of a short vertically extending stub shaft 34. This shaft is journaled for movement in bearings carried by the overhanging deck 3, in vertical alignment with the axis of rotation of the jet 32.

The packing gland 33 surrounding the shaft 34 prevents the entrance of water around the rotatable shaft. The upper end of the shaft is also provided with a squared portion to join the shaft in non-rotatable relationship with a horizontally extending lever 35. A nut and washer are positioned on the upper end of the shaft to hold the lever in place thereon. The specific details of the jet, the rudder and the stub shaft are best illustrated in Fig. 7 of the drawings.

As illustrated in Figs. 10 and 11, the outer end of the lever 35 is connected by means of a drag link 36 with the free end of a steering arm 37, the opposite end of this arm being connected with a shaft 38 which is mounted for rotation in a housing 39. Within this housing, a second arm 40 is free to pivot to the shaft 38, the free end of the second arm being pivotally connected with a nut 41. Cooperating with this latter member is a worm 42 rigidly carried in connection with the lower end of a steering column 43. A steering wheel 44 is provided at the upper end of the column 43 for convenience in steering the boat.

It will be seen that rotary movement of the steering wheel will result in rotating the worm carrying with it the free end of the arm 41. This causes rotary movement of the shaft 38 and swinging movement of the steering arm 37 provided at the outer end thereof. The drag link transfers this movement to the rudder and the jet through the lever 35 and the stub shaft 34.

The boat is provided adjacent the steering wheel with a seat 44 for the pilot to sit on while operating the boat. Also arranged adjacent the seat is a transversely extending bar 46 by which is pivotally supported a plurality of control levers 47 and 48. In this instance, the group 47 is disposed at the operator’s right side within easy reach. The levers 47a and 47b in this group are employed to control the flow of water through the front and rear jets and consequently the forward and rearward movement of the boat. To do this, the lower ends of the levers 47a and 47b are connected by rods 49 and 50 with one of the arms of bell cranks 51 and 52 pivotally mounted at the front and rear portions of the boat. The other arms of the bell cranks are connected by means of links 53 with the sliding portions of gate valves 54 and 55 arranged adjacent the front and rear ends of the high pressure line.

The operator, by grasping either lever of group 47 and moving it rearwardly, will open one or the other of valves 54 and 55. In consequence, a stream of water will issue from the jet disposed beyond the valve opened and the reaction of this stream on the water will cause the boat to move. By selecting the lever to be operated, the direction of travel of the boat may be governed. It is important to note at this time that frequently in emergency operations of the boat, the same will run aground on mud or sand banks. The boat can be easily freed from these banks by opening the jet at whichever end the boat is stuck and undermining or wearing away the bank with the stream of water to such an extent that the boat will float free.

The second group of levers is disposed at the pilot’s left side and contains four individually operated levers numbered 56, 57, 58 and 59. These levers are employed to control the issuance of water from jets 60 disposed at the sides of the boat near the front and rear ends. The jets 60 are arranged at substantially ninety degrees to the longitudinal axis of the boat and are provided for the purpose of imparting sideward movement to the boat whenever such motion is necessary. One instance, for example, when the need for side motion would arise is when the boat is positioned alongside a dock with obstructions or other boats at each end. In such a case, the operator may, by the operation of the proper levers, cause a stream of water to issue from the jets on the side adjacent the dock. This will result in the boat moving away from the dock and when the obstructions are cleared, the side streams may be discontinued and lever 41a or 41b operated to impart longitudinal movement to the boat.

To conduct water to the side jets 60, the front and rear portions of the high pressure line are formed with branch lines 61, 62, 63 and 64. Of these branches, 61 extends to the left rear side, 62 to the right rear side, 63 to the left front and 64 to the right front side. Adjacent the points of connection with the high pressure line, the branch lines are provided with control valves 65 which, as illustrated in Fig. 9, contain pivoted gate members 65a. Externally disposed operating levers 66 are connected by shafts 67 with the members 65a, the free end of said levers being joined with the levers of group 48 by connecting rods 68. When any one of the levers of group 48 is swung rearwardly, the corresponding valve connected therewith will be opened and water will pass through the respective branch line to the jet at the outer end thereof. The levers 56 to 59 are made individually operated because at certain times it may be desired to open perhaps only one of the valves 65 or perhaps one on one side and one on the other. An example of this latter instance may be seen in the operation of turning the boat at right angles to the longitudinal axis of the boat. Simultaneously, the valves controlling the jet at the rear of the side to which the rudder is turned and the jet at the front of the opposite side are opened. The speed of the motor is then increased and the boat will be rotated or turned substantially within its own length. Regular steering is performed without increasing the engine speed or opening the valves in the branches leading to the side jets. The jets at the side are useful also in counter-
acting the force of a current when the boat is moving transversely thereof.

To minimize vibration resulting from the operation of the motor, the pump jet connected to the streams of water issuing from the jets, each of the pipe lines, including the branches, are provided with a semiflexible coupling. One of these couplings has been illustrated in vertical section in Fig. 8 of the drawings and includes the spaced pipe sections 74, a nut and clamp rings 71. The ends of the sleeve are beveled slightly to receive compressible packing rings 72. The rings 71 are perforated adjacent the outer edges to receive securing elements 73 by means of which compression forces are applied to the packing. By reason of this construction, metal to metal contact between the pipe ends is eliminated as is the transfer of vibrational forces.

As illustrated in Fig. 4, the high pressure line may be provided with added valve-controlled branch for the purpose of supplying water under pressure for any desired need such as indirect cooling of the motor or in the event the boat is used as a cruiser running water for washing and other uses. When the boat is built as an emergency flood or fire tug, standpipes such as that shown at 74 may be connected with the high pressure line. The standpipes 74 receive fire hoses or nozzles with which fires on floating or shore objects may be battled. When the fire streams are being used, the side jebs may be employed to counteract any recoil developed. In the event it is desired to hold the boat stationary, all the valves may be opened.

The inlet or suction line is provided with a capped branch 75 best shown in Fig. 6. A hose line may be connected with this branch and led into the hull of a disabled boat to remove water therefrom while the boat is being towed to port.

A boat formed in accordance with the present invention is characterized by its smoothness and flexibility of operation, its freedom from vibration, its usefulness and its economy of operation. The boat may also be provided with a radio to render it a complete emergency unit for river or lake shore communities. If desired, the boat may be mounted on a trailer and conveyed to land areas where the inlet side of the pump can be connected to a source of water in the same manner as an ordinary piece of fire fighting equipment.

To prevent the pump from becoming air locked, the inlet line 19 has a valve controlled vacuum operated filling device 80 connected therewith as disclosed in Fig. 8. The device 80 includes a tank 81 communicating with the line 19 and containing a pivoted bell crank lever 82 supporting a float 83 at the outer end of one arm. The other arm is provided with a needle valve 84 disposed for cooperation with the inlet of a pipe line 85 extending to the intake manifold of the boat engine. As long as the tank 81 has sufficient water to hold the float at a predetermined level, the valve 84 will hold the line 85 closed but when the water fails, by reason of the supply falling, the float will drop and a vacuum will be produced in the line 19 to cause it to become filled as soon as water is again supplied to the inlets.

What is claimed is:

1. In a boat having a hull and an internal combustion engine carried thereby, a centrifugal water pump operated by said engine, a feed line leading from the outlet of said pump to the exterior of said hull, a high pressure line extending from the bow to the stern of said hull, said high pressure line being connected intermediate of the ends thereof with the outlet of said pump, an outlet of said pump being connected with the rear end of said high pressure line, said jet being mounted for pivotal movement about a vertical axis, a rudder connected to said jet, a stub shaft rotatably mounted on the vertical pivotal axis of said jet, said rudder being keyed to one end of said stub shafts sleepers 76 and clamped in place by the other end of said shaft, a steering wheel rotatably mounted in said hull, a steering arm operatively connected with said steering wheel, a drag link connecting said steering arm and said crank arm, valve means provided adjacent the ends of said high pressure line, and operating mechanism for said valve means, said operating mechanism being disposed adjacent said steering wheel.

2. In a power operated boat having a hull and an internal combustion engine carried thereby, a central main pump connected with said hull, a branched pipe line extending from the inlet of said pump to the exterior of said hull below the water line, valve means disposed in the branches of said pipe line, water cleaning screen means disposed between the valve means and the inlets to connected with the high pressure line, the said branches for directing streams of water under pressure through said screen means in a reverse direction to effect cleaning thereof.

3. In a power operated boat of the type having a motor driven water pump, means for conducting water from the exterior of the boat hull to said pump comprising a supply line communicating with the inlet of said pump, a pair of tubular members communicating with the exterior of the boat hull, removable cap means carried by said members, branch lines establishing communication between the interior of said members and said supply line, valve means positioned in each of said branch lines, normally closed pipe lines connected with the outlet of the water pump and communications with the exterior of the boat hull, whereby removable cap means carried by said members, branch lines establishing communication between the interior of said members and said supply line, valve means disposed in said members, the closing of the valve in a branch and the introduction of water through the normally closed pipe line connected with the selected branch providing for reverse fluid flow through the screen in the tubular member to effect a cleaning thereof.

4. In a power operated boat of the type having a motor driven water pump, means for conducting water from the exterior of the boat hull to said pump comprising a supply line communicating with the inlet of said pump, a pair of tubular members communicating with the exterior of the boat hull, removable cap means carried by said members, branch lines establishing communication between the interior of said members and said supply line, valve means positioned in each of said branch lines, normally closed pipe lines connected with the outlet of the water pump and communications with the exterior of the boat hull, whereby removable cap means carried by said members, branch lines establishing communication between the interior of said members and said supply line, valve means disposed in said members, the closing of the valve in a branch and the introduction of water through the normally closed pipe line connected with the selected branch providing for reverse fluid flow through the screen in the tubular member to effect a cleaning thereof, and means actuated by the lack of water in said supply line for closing the valve.
in the branch line and opening the normally closed line connected with the particular branch.

5. In a power operated boat of the type having a motor driven water pump, means for conducting water from the exterior of the boat hull to said pump comprising a supply line communicating with the inlet of said pump, a pair of tubular members communicating with the exterior of the boat hull, removable cap means carried by said members, branch lines establishing communication between the interior of said members and said supply line, valve means positioned in each of said branch lines, screen means disposed in said members, normally closed high pressure fluid lines communicating with said branch lines between the valves therein and said tubular members, and means operated by the lack of water in said supply line for alternately opening and closing the valves in said branch lines and opening the high pressure line communicating with the branch containing the closed valve.

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