

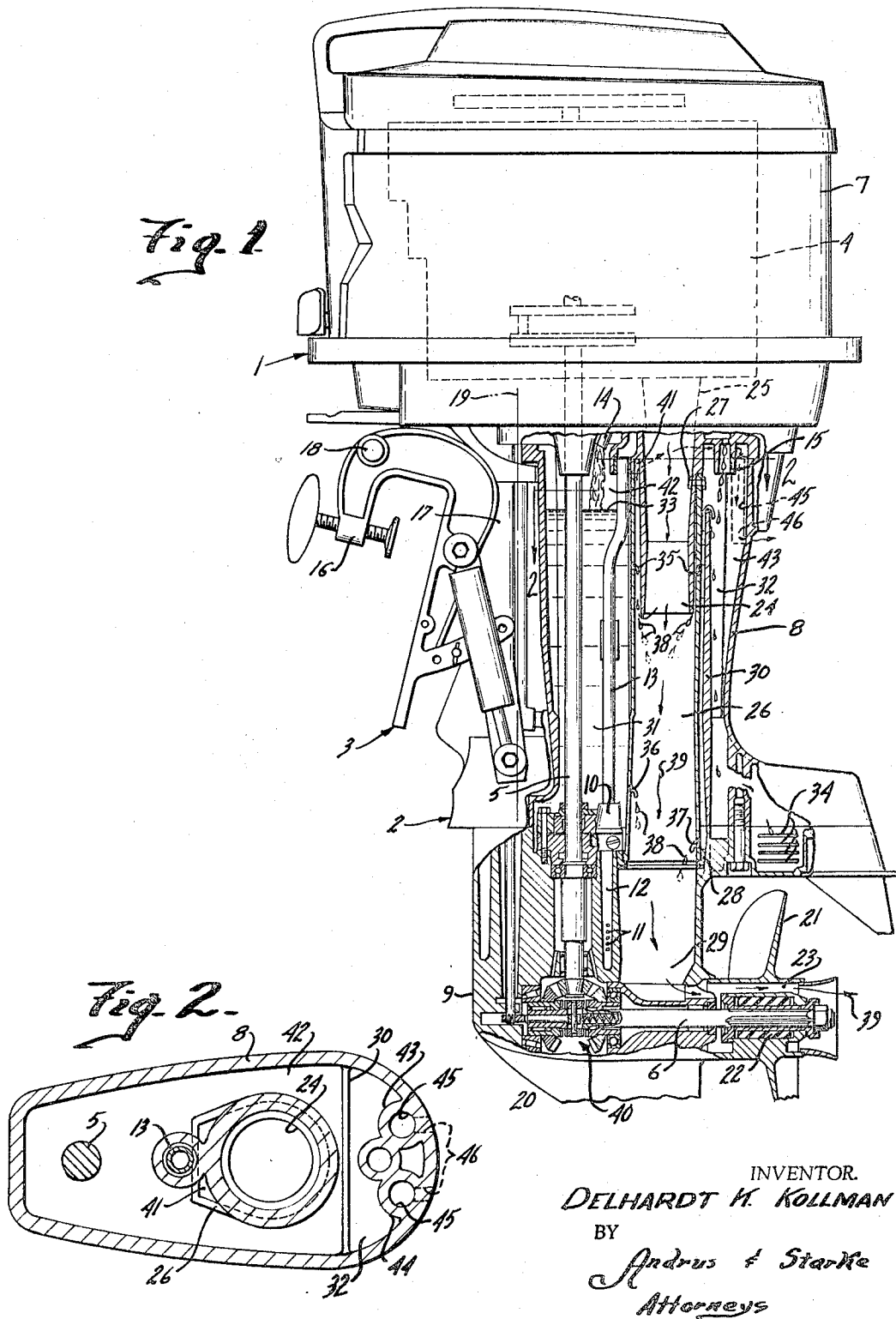
March 21, 1967

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3,310,022

EXHAUST SYSTEM FOR OUTBOARD MOTORS

Filed Aug. 23, 1965



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3,310,022

EXHAUST SYSTEM FOR OUTBOARD MOTORS
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Filed Aug. 23, 1965, Ser. No. 481,488
9 Claims. (Cl. 115—17)

This application is a continuation-in-part of application Ser. No. 393,602, filed Sept. 1, 1964, by Robert A. Boda and Delhardt K. Kollman, and assigned to a common assignee herewith.

This invention relates to certain improvements in exhaust systems for outboard motors.

In the foregoing application a water jacket encloses the exhaust passage which extends downwardly from the engine in the power head, through the drive shaft housing and into the lower unit from which the exhaust is discharged through the hub of the propeller. The jacket illustrated in the application comprises the major portion of the drive shaft housing except for a partition near the rear edge and which provides an overflow discharge for water from the jacket.

It has been discovered in operating the type of exhaust system shown in the foregoing application that difficulties arise in overheating the cushion material at the lower end of the exhaust tube, overheating the rubber mounting for the propeller on its shaft, in a tendency for carbon or coke to buildup in the exhaust tube reducing its capacity, and in a buildup of sediment at the bottom of the water jacket.

The present invention has the purpose of solving these difficulties without adding other difficulties detracting from engine performance.

In carrying out the invention applicant bleeds water directly into the exhaust tube from the surrounding jacket through one or more ports disposed at a desired height. Thus a small water bleed port is provided near the upper end of the tube to supply a limited amount of water directly into the stream of hot exhaust gases where the water is quickly converted to steam which effectively prevents the formation and/or gathering of carbon or coke within the tube. One or more small bleed ports are provided a short distance above the lower end of the tube and directs a restricted amount of water into the exhaust stream at this point where it is converted into steam and tends to cool the exhaust before it flows over the cushion mounting material supporting the tube.

The lowermost bleed port serves also as a drain which empties the jacket when the engine is stopped and thereby tends to flush out any sediment from the bottom of the jacket, and to protect the unit in case of freezing temperatures.

The addition of water to the exhaust stream tends to cool the latter and also prevents formation of carbon or coke on the interior surfaces of the exhaust tube. This water addition to the exhaust stream is kept at a minimum to prevent back pressures that would interfere with engine performance.

Another feature of the invention lies in the relationship of the jacket to the engine cooling system where water from the latter is used to supply water to the jacket. In general the amount of water employed in cooling the engine is greater than that necessary for the jacket around the exhaust tube and in that case only a part of the engine coolant water enters the exhaust jacket. This maintains the overflow level of water reasonably constant and prevents its rising into contact with the upper seal for the drive shaft and other parts.

The invention additionally provides for relief of the exhaust pressures when the boat is not moving forward, as when reversing the propeller or when idling the engine.

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For this purpose a limited port is provided from the exhaust tube at its upper end and which allows direct discharge of exhaust from the drive shaft housing. The port is insufficient in size to accommodate all of the exhaust at high engine speeds, and may be termed an auxiliary idle exhaust port or pressure relief.

The accompanying drawings illustrate the best mode presently contemplated by the inventor for carrying out the invention.

In the drawings:

FIGURE 1 is a side elevation of an outboard motor with parts broken away and sectioned to show the exhaust system; and

FIGURE 2 is an enlarged detail transverse section taken generally on line 2—2 of FIG. 1.

The outboard motor illustrated comprises, in general, a power head 1, a lower drive unit 2 and the usual mounting means 3.

The power head 1 generally comprises an internal combustion engine 4 having a crankshaft, coupled to the vertical drive shaft 5 which extends downwardly and is geared at its lower end to the horizontal propeller shaft 6 in the underwater portion of drive unit 2. A cowl 7 covers the engine 4 and is isolated therefrom by cushion mounting means, not shown, and which reduces the sound level of the engine.

The lower drive unit 2 generally comprises the vertical drive shaft housing 8 supporting the power head, and the underwater propulsion unit 9 depending therefrom. The drive shaft 5 is supported by suitable bearings in housing 8 and also drives the usual water pump 10 for supplying coolant water to engine 4. Pump 10 receives water from intake ports 11 in underwater unit 9 through passage 12 and forces the water upwardly through pipe 13 to the engine 4. After the water circulates through the cooling jacket of the engine 4, the water drops into housing 8 through ports 14 and 15.

The mounting means 3 generally comprises the clamp bracket 16 or other suitable transom fastening means, and the swivel bracket 17 which is pivoted to the bracket 16 on the horizontal axis 18 and to which the drive shaft housing 8 is pivoted on the vertical steering axis 19. Pivotal axes 18 and 19 provide the usual tilt and steering movements for the drive unit 2.

The underwater unit 9 generally comprises the torpedo-shaped housing 20 carrying the horizontal propeller shaft 6. The propeller 21 is mounted upon the rear end of shaft 6 to rotate therewith, and is more specifically supported on the shaft by a rubber cushion member 22 which yields upon impact of the propeller with any foreign object and may slip when necessary to avoid injury to the propeller.

The propeller 21 illustrated has a hollow hub providing passages 23 through which the exhaust of engine 4 is discharged into the slip stream of the propeller. The exhaust system of the present invention is adapted to transmit the exhaust from engine 4 to passages 23 or other suitable exhaust discharge means.

For this purpose the upper end of housing 8 which support engine 4 has a downwardly depending venturi-like tube 24 the upper end of which registers with the engine exhaust discharge port 25 to receive the engine exhaust and direct it downwardly into unit 2. An exhaust pipe 26, of larger diameter than tube 24 has its upper end receiving the telescoping lower free end of tube 24 and secured to the tube as by a tight fit, and if desired, one or more radial bolts 27. The lower end of pipe 26 is supported on the rubber cushion ring 28 at the juncture between housing 8 and unit 9, and registers with passage 29 in housing 20 which conducts the exhaust to discharge passages 23.

For the principal purpose of quieting the sound level of the engine the exhaust pipe 26 is surrounded by a water column which in the embodiment illustrated is provided by filling a portion of housing 8 to a suitable level with the engine coolant water discharged through port 14 from the engine.

A partition 30 extends across the housing 8 rearwardly of pipe 26 to divide the housing into a forward water jacket portion 31 surrounding shaft 5, pump 10, pipe 13 and exhaust pipe 26, and a rear open portion 32. The partition extends upwardly generally to the level desired for the water 33 surrounding pipe 26 in jacket 31.

Depending upon the design of the engine 4 and the speed at which maximum quieting effect is desired, a portion of the coolant water from the engine may be discharged through port 15 directly into portion 32 of housing 8 from which it is discharged through the slotted ports 34 on each side of housing 8 just above the juncture between housing 8 and underwater unit 9.

The major portion of coolant water, however, will enter the jacket 31 through port 14 from the engine. At most operating speeds the water 33 in jacket 31 will rise and overflow partition 30 into housing portion 32 from which it is also discharged through slotted ports 34.

In carrying out the present invention one or more small ports 35, 36 may be provided in pipe 26 and which bleed a part of the water 33 in jacket 31 directly into the exhaust stream flowing downwardly through pipe 26.

As illustrated ports 35 are near the upper end of pipe 26, but below the upper level of water 33, and they supply a limited flow of water into the both exhaust gases to form steam therein for keeping the inner surface of pipe 26 free of coke deposit.

One or more ports 36 are disposed somewhat above cushion ring 28 to reduce the temperature of the hot exhaust gases in the region of the rubber ring and thereby prevent damage to the latter from overheating.

One or more ports 37 are disposed at the bottom of pipe 26 principally for draining the jacket 31 when the engine is stopped. The water supplied the exhaust stream by ports 37 serves to further cool the gases as they pass through the passages 23 in the propeller hub, and thereby prevent damage to rubber member 22 supporting the propeller 21.

The ports 35, 36 and 37 are kept at a minimum since excess water in the exhaust stream would only serve to create a back pressure on the engine and would reduce its operating efficiency. Hence it is undesirable to have the entire water overflow from jacket 1 to be discharged into the pipe 26.

In the drawing the bleeding of water into the exhaust stream is indicated by droplets 38 leaving ports 35, 36 and 37. The exhaust flow is indicated by lines 39 containing arrows showing the direction of flow. The flow of water from ports 14 and 15 is also indicated, and the overflow of water at the top of partition 30 is shown.

When idling the engine without running the propeller, as by neutral positioning of the clutch 40 on propeller shaft 6, passages 23 fill with water and tend to block the escape of exhaust. This builds up a back pressure in pipe 26 that might kill the engine unless some form of relief is provided.

In the application referred to above a port is shown in the wall of the pipe just above the water level in the jacket, and exhaust is allowed to escape through this port directly to a discharge port in the rear wall of the housing.

In the embodiment illustrated in this application the front side of pipe 26 is formed outwardly of tube 24 at the top to provide a restricted upwardly facing port 41 for exhaust to escape into the chamber 42 at the upper end of housing 8 above the level of water 33. The rear wall of housing 8 has vertical strengthening ribs 43 and 44, each having a bore 45 extending downwardly from the top and discharging into the outside atmosphere through discharge ports 46.

The exhaust gases escaping through port 41 enter chamber 42 and from there are discharged through bores 45 and ports 46 in ribs 43 and 44.

Since the speed of pump 10 varies with the engine speed it is possible that under engine idling condition the volume of coolant water discharged through port 14 may not be sufficient to compensate the bleeding of water through ports 35, 36 and 37. Should this be the case, the upper ports 35 may become uncovered by dropping of the water level in jacket 31, in which event ports 35 will become auxiliary to the port 41 to relieve pressure in pipe 26.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propeller drive unit depending at the lower end thereof, an engine exhaust system comprising an exhaust pipe extending downwardly from the engine in said drive unit, exhaust discharge means communicating with the lower end of said pipe to discharge the exhaust therefrom, a water jacket for said pipe, inlet and outlet means including inlet and outlet ports to continually flow water through said jacket during operation of said engine, and port means substantially smaller than said water inlet port means to bleed a limited quantity of water from said jacket directly into the exhaust stream flowing through said pipe.

2. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propeller drive unit depending at the lower end thereof, an engine exhaust system comprising an exhaust pipe extending downwardly from the engine in said drive unit, exhaust discharge means communicating with the lower end of said pipe to discharge the exhaust therefrom, a water jacket for said pipe, inlet and outlet means to continually flow water through said jacket during operation of said engine, and restrictive port means substantially smaller than said water inlet port means in the wall of said pipe at the upper end thereof and below the water level in said jacket to bleed water directly into the pipe from said water jacket and thereby prevent carbon deposits on the inside of said pipe, the port means restricting the flow of water into the pipe to avoid buildup of back pressure against the exhaust of the engine.

3. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propeller drive unit depending at the lower end thereof, an engine exhaust system comprising an exhaust pipe extending downwardly from the engine in said drive unit, exhaust discharge means communicating with the lower end of said pipe to discharge the exhaust therefrom, a water jacket for said pipe, inlet and outlet means to continually flow water through said jacket during operation of said engine, and continuously open restrictive port means substantially smaller than said water inlet port means in the wall of said pipe at the bottom of said jacket to bleed water directly from the jacket into the pipe during operation of the engine and to drain the water from said jacket when engine operation is discontinued.

4. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propeller drive unit depending at the lower end thereof, an engine exhaust system comprising an exhaust pipe extending downwardly from the engine in said drive unit, exhaust discharge means communicating with the lower end of said pipe to discharge the exhaust therefrom, resilient cushion means supporting said pipe at its lower end in said drive unit, a water jacket for said pipe, inlet and outlet means to continually flow water through said jacket during operation of said engine, and restrictive port means substantially smaller than said

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water inlet port means in the wall of said pipe above said cushion support means to bleed water from said jacket into the exhaust stream and prevent injury to said cushion means from the hot exhaust gases.

5. In an outboard motor having a substantially vertical drive shaft housing supporting an internal combustion engine thereon with a drive shaft extending downwardly through said housing to an underwater propulsion unit, an engine exhaust system comprising an exhaust pipe extending downwardly from the engine in said housing, exhaust discharge means communicating with the lower end of said pipe to discharge the exhaust therefrom, means driven by said engine to substantially fill said housing surrounding said pipe with water and to maintain a continuous flow of water therethrough during operation of said engine, said means including an inlet port for filling said housing with water and an overflow outlet means, and port means substantially smaller than said inlet port to bleed a limited quantity of water from said housing into said pipe.

6. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propulsion unit depending at the lower end thereof, said propulsion unit having a propeller mounted upon a shaft by rubber cushion means constituting a safety slip drive for the propeller; an engine exhaust system comprising an exhaust pipe extending downwardly from said engine to said underwater propulsion unit, exhaust conduit means in said propulsion unit disposed to receive exhaust from said pipe and to discharge the same through passages in the hub of said propeller into the propeller slip stream, a water column surrounding said pipe, having inlet and outlet means and means substantially smaller than said inlet means to bleed water from said column into the exhaust stream ahead of said propeller passages to protect said cushion mounting from damage by reason of the hot exhaust gases.

7. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propulsion unit depending at the lower end thereof having a propeller driven by said engine with clutch means for selectively disconnecting the drive to the propeller and for reversing the latter; an engine exhaust system comprising an exhaust pipe extending downwardly from said engine through said drive unit to said underwater propulsion unit, cushion support means for said exhaust pipe at the lower end thereof and sealing the same in said drive unit, exhaust conduit means in said propulsion unit disposed to receive exhaust from said pipe and to discharge the same through passages in the hub of said propeller into the propeller slip stream, a rubber cushion mounting for said propeller exposed to heat from the exhaust gases flowing through the propeller hub, a water column surrounding said pipe and having overflow water discharge means at its upper end, means including a water inlet port to supply water to said column, port means through said pipe above the level of said water to relieve the exhaust pressure in the system when said propeller is not operating in a forward direction and the discharge through the propeller hub becomes blocked with water, and a series of ports in

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said pipe below the upper level of said water column and substantially smaller than said water inlet port to bleed limited amounts of water into the exhaust gases in said pipe at different levels, the uppermost bleeder port preventing carbon deposit in the pipe below and serving as additional exhaust pressure relief means, an intermediate bleeder port serving to protect said cushion support means from overheating, and the lowermost bleeder port protecting the cushion propeller mount from overheating and serving as a drain for the water column when the engine is stopped.

8. In an outboard motor having a substantially vertical drive shaft housing supporting an internal combustion engine thereon with a drive shaft extending downwardly through said housing to an underwater propulsion unit having a horizontal propeller shaft with clutch means for selectively driving the same in forward and reverse from said drive shaft; an engine exhaust system comprising an exhaust pipe extending downwardly from said engine through said drive shaft housing, exhaust conduit means in said underwater propulsion unit disposed to receive exhaust from said pipe and to discharge the same through passages in the hub of a propeller on said propeller shaft, means to fill said housing to a level near the top of said pipe with water leaving a substantial air chamber in the upper end of the housing, a restricted pressure relief port from said pipe into said chamber above the water in said housing, and restricted port means through said housing from said chamber to the outside atmosphere, said restricted ports and chamber providing a pressure relief for the exhaust in said pipe as when said propeller is not operated in a direction facilitating exhaust discharge through the propeller hub and constituting a sound filter tending to reduce engine noise, and said water column surrounding said exhaust pipe in said housing substantially reducing the sound level of the engine.

9. In an outboard motor having a drive unit with an internal combustion engine mounted thereon and an underwater propulsion unit depending therefrom, exhaust means extending downwardly through said drive unit from said engine, engine cooling means having a pump driven by said engine and supplying water to the cooling means during operation of the engine, water jacket means surrounding said exhaust means in said drive unit, and means to supply said water jacket means with a portion of the water discharged from said engine cooling means, said last named means including an overflow discharge from said engine cooling means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,310,022

March 21, 1967

Delhardt K. Kollman

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 61, for "support" read -- supports --;
column 3, line 26, after "36" insert -- and 37 --; line 31,
for "hoth" read -- hot --; column 4, line 25, strike out
"including inlet and outlet ports".

Signed and sealed this 7th day of November 1967.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents