April 15, 1952 J. F. MORSE 2,593,170

CONTROL MECHANISM FOR MARINE ENGINES

Filed Jan. 29, 1946 3 Sheets-Sheet 1

Fig. 1.

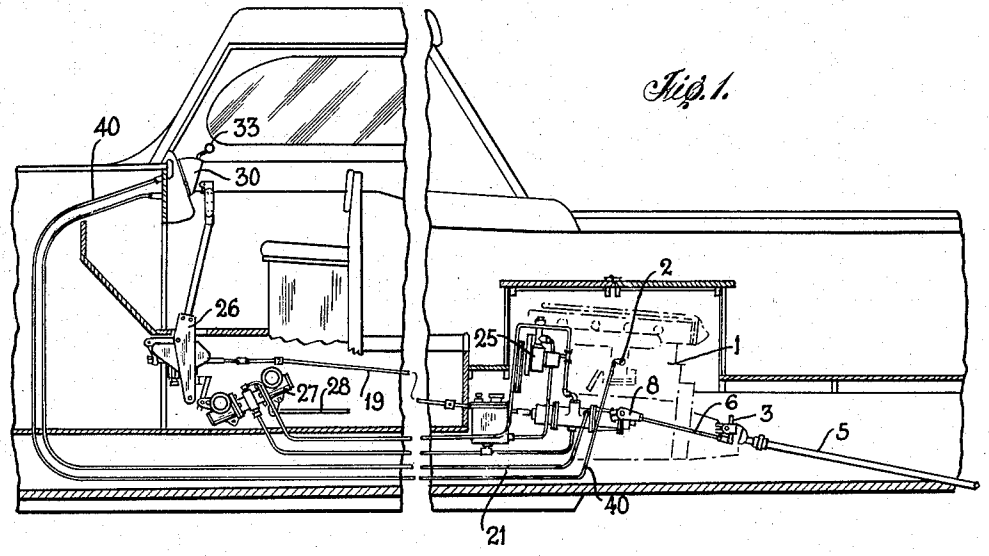



Fig. 2.

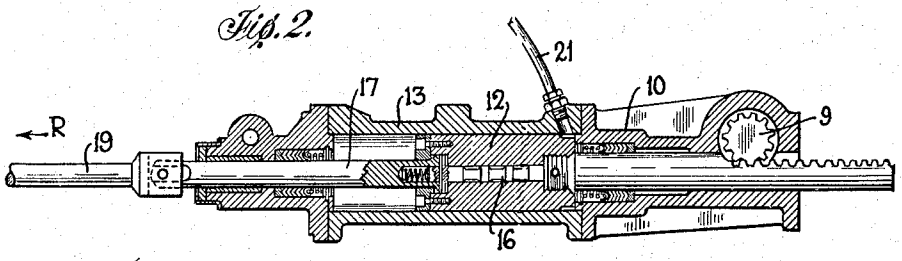
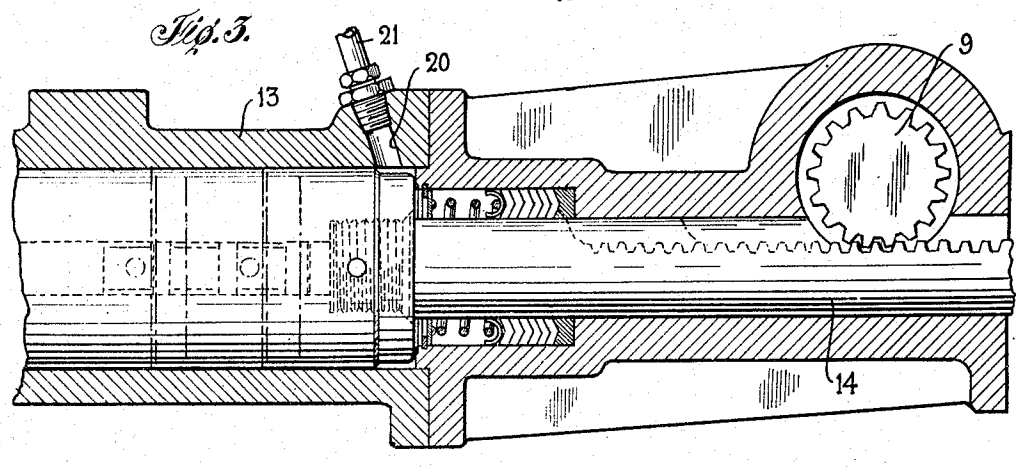



Fig. 3.




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CONTROL MECHANISM FOR MARINE ENGINES

Filed Jan. 29, 1946 3 Sheets-Sheet 2

Fig. 4.

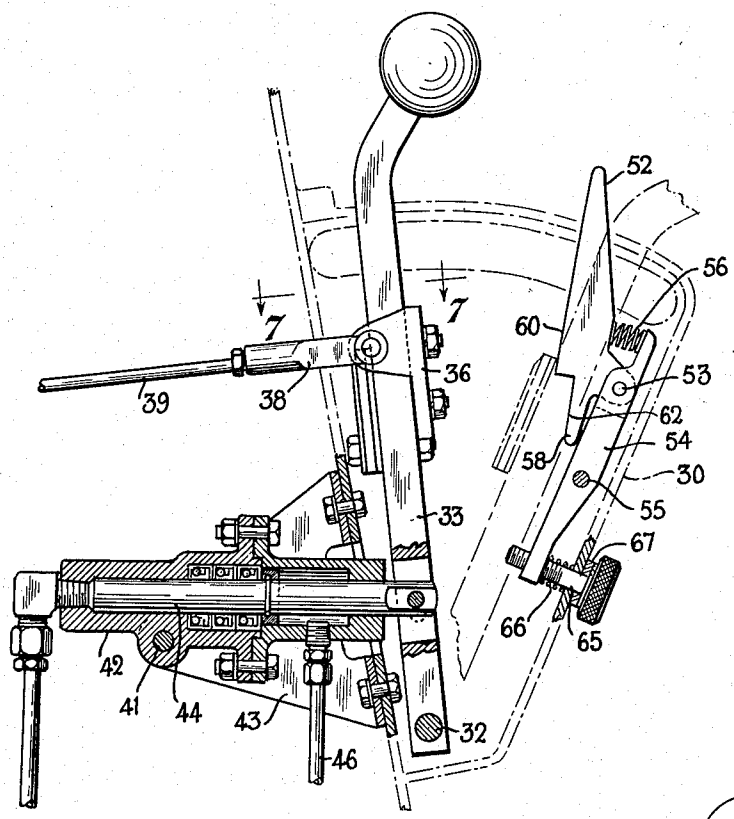
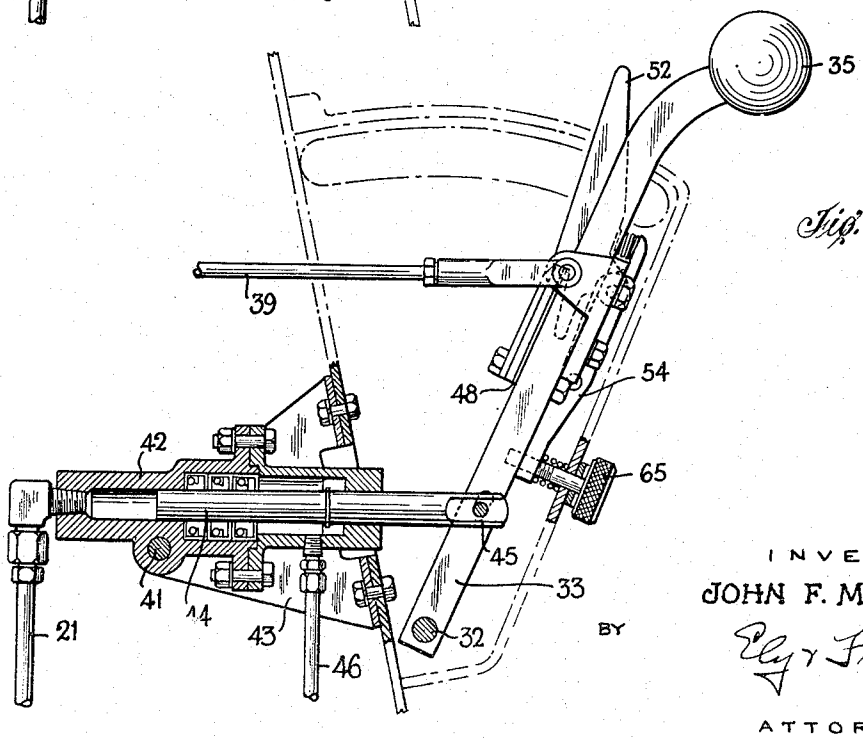



Fig. 5.



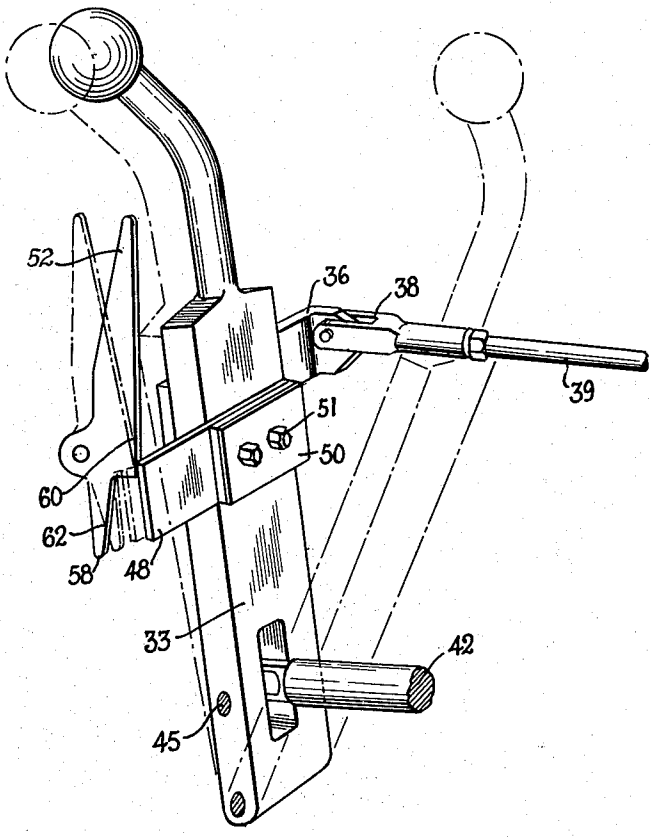

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CONTROL MECHANISM FOR MARINE ENGINES

Filed Jan. 29, 1946 3 Sheets-Sheet 3

Fig. 6.



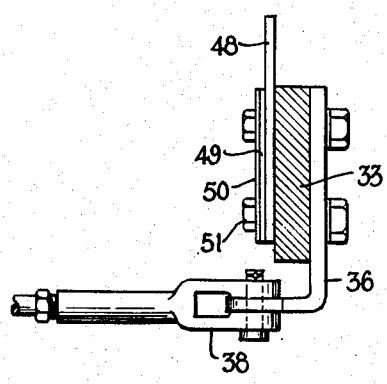




Fig. 7.

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## CONTROL MECHANISM FOR MARINE ENGINES

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14 Claims. (Cl. 74—472)

1

The present invention relates to the operation of engines and particularly to the marine engines such as used on power operated craft of various types.

In the operation of craft of the type specified when it is desired to place the engine in reverse from cruising speed, it is necessary to reduce the speed of the engine before shifting the transmission which in the ordinary craft requires the pilot to manipulate the control lever and the throttle in proper coordination to avoid injury to the transmission. If the throttle is moved to its extreme low during the operation of the transmission, there is danger of stalling the engine.

The present invention has as its object the provision of means which coordinates the movement of the control lever and the throttle so that when the transmission is to be thrown into reverse from high speed, a single movement of the control lever reduces the engine speed to the proper point so that the engine is slowed down to a safe idling speed which will permit the requisite change in the transmission without danger of stalling the engine.

It is also one of the objects of the invention to combine the throttle control within a single lever which has movement in two planes, one to control the transmission and the other to operate the rudder. With such a combination of elements, the pilot may operate the boat safely and surely with one hand in any situation in which he may suddenly find himself. These results are accomplished without in any manner interfering with the independent hand control of the throttle by which the speed of the craft is always under control of the operator.

In the application, the invention has been illustrated as applied to a particular type of craft with hydraulic control devices for operating the rudder and transmission, but it will be appreciated that this is the preferred arrangement and that the invention may be employed with less highly specialized and perfected devices.

In the drawings and description there is illustrated a control lever of the type shown in my prior Patents Nos. 2,321,098 of June 8, 1943, and 2,392,056 of January 1, 1946, in which the lever is moved forwardly and rearwardly to control the transmission and sideways to actuate the rudder.

It will be appreciated that the invention is shown and described in its present best known and preferred form, but this form is subject to change or revision within the scope of the invention as set forth in the appended claims. In the preferred form:

2

Fig. 1 is a vertical fore and aft section through a power boat equipped with the present invention in combination with the other features of marine control.

Fig. 2 is a longitudinal section through a particular type of hydraulic cylinder by means of which the transmission is actuated, this being the preferred method of controlling and operating the transmission, and this device is employed at times to operate the throttle in proper coordination with the transmission.

Fig. 3 is an enlarged view of the rear end of the power cylinder.

Fig. 4 is a side view of the throttle lever, the full lines showing the throttle at full speed and the dotted lines showing the position of the lever in what may be termed "high idling" speed, i. e., the speed at which the transmission may be shifted safely and without danger of stalling the engine.

Fig. 5 is a view showing the throttle lever at lowest speed.

Fig. 6 is a perspective view of the throttle lever at its "high idling" speed.

Fig. 7 is a section on the line 7—7 of Fig. 4.

Referring first to Fig. 1 in which portions of a power boat are shown, the numeral 1 indicates the location of a standard engine and 2 the butterfly valve at the carburetor. The transmission shifting lever is indicated at 3 and the power output shaft to the propeller at 5. A connecting rod 6 connects the lever 3 to a crank 8 which is operated from a gear 9 located in a power transmission unit 10 usually mounted on the side of the engine block.

The power transmission unit which is shown herein may be one of any of the well known devices of this character. In the form shown herein there is a piston 12 operating in a cylinder 13 and connected to a rack 14 which is in mesh with the gear 9. In the position shown in Figs. 2 and 3, the piston 12 is at the right-hand end of its stroke and the transmission will, in this position, be in forward. Located at the axis of the piston is a slide valve 16 which is carried by a rod 17 extending through the left-hand or forward end of the power unit where it is connected to an operating shaft 19 which extends toward the cabin of the boat.

When the shaft 19 is moved toward the left in the direction of the arrow R, ports in the piston are opened by the valve 16 to admit fluid under pressure behind the right-hand end of the piston and the piston, rack 14 and connecting rod 6 are moved to shift the transmission through neutral

to reverse. In the side of cylinder 13 and at the extreme right-hand end of the cylinder is a port 20 connected by a pipe 21 with the throttle control in a manner to be described.

It is sufficient to state at the present that when the pilot shifts the control lever to reverse so as to admit fluid under pressure behind the piston to move the transmission out of forward, the pressure fluid is conducted through the pipe 21 and actuates the throttle, and as the resistance to movement of the throttle is much less than the resistance to movement of the piston and its connections to the transmission, the throttle moves first so that the engine speed is automatically reduced before the transmission is shifted.

The position of the piston 12 when the transmission is in neutral and reverse is shown by the dotted lines in Fig. 3. The pressure medium employed is any one of the conventional hydraulic fluids which is maintained under adequate working pressure by a pump 25.

Referring now to the forward end of the boat: The pivoted and rocking control lever by which the transmission is shifted and the rudder operated is shown at 26. While a stick is shown, a wheel may be substituted as the manually operated control device. The specific form of control stick is shown in detail in my prior application Serial No. 587,887, filed April 12, 1945, now Patent No. 2,495,536 issued January 24, 1950. It is not necessary for the purposes of the present invention that this particular form of lever be employed. For the purposes of this application it is sufficient to state that when the manual control device, which is shown in forward, is moved to the rear, through requisite connections, the shaft 19 is moved in the direction of the arrow and the result of that action is first to move the throttle if it is in cruising or high speed to what has been termed the "high idle" speed. Immediately that this movement of the throttle has taken place, the transmission is shifted to neutral and then to reverse, depending upon the degree to which the lever is moved.

When the control device is moved to the right or left, corresponding movement is transmitted to the rudder (not shown) through a power unit 27 resembling the power unit 10 and connecting link 28. The power unit 27 receives its pressure fluid from the pump 25.

The throttle which is mounted in the cabin near the control device is shown in detail in Figs. 4 to 7 inclusive.

It comprises a generally triangular or sector shaped housing 30 in the lower part of which is located the shaft 32 on which is pivotally mounted the throttle lever 33, the upper end of which projects through a slot in the housing and is provided with a grip or knob 35. Near the upper end of the lever is secured a bracket 36 to the end of which is pivotally connected a yoke 38 which is, in turn, connected to a rod 39 and to a flexible cable 40 which extends to and operates the carburetor valve 2. When the throttle lever is in the position shown in full lines in Fig. 4, the engine is operating at maximum high, and when in the position shown in Fig. 5 at the lowest speed.

When in an intermediate position shown in dotted lines in Fig. 4 and in the position shown in Fig. 6, the engine is operating at the speed which may be selected as the proper idling speed to insure that the engine will not stall when the transmission is moved from forward into reverse. While any desired speed may be selected for "high idling" of the engine, a speed of from 200 to 300 R. P. M. above the lowest speed is desirable. This "high idle" speed is to prevent stalling of the engine on going into reverse with the boat still under headway. This assures a predetermined shifting speed for emergencies and not only eliminates stalling from too low an engine speed, but also prevents damage to the reverse gear from too much engine speed at the time that the transmission is shifted.

In order to accomplish the shifting of the throttle lever and the slowing of the engine to the selected high idling speed, the pipe 21 leading from the power unit 10 is connected at its other end to a cylinder 42 which is mounted on a pivot 41 located on a bracket 43 on housing 30. In this cylinder is located the piston 44 which extends through the end of the cylinder 42 and is pivotally connected at 45 to the throttle lever 33 near its lower end. The end of the cylinder near the throttle lever is provided with a drain 46.

It will be seen, therefore, that when the control lever is moved to shift the transmission from forward into reverse, the pressure fluid acting through the line 21 will move the piston 44 to the right in Figs. 4 and 5 and shift the throttle lever to close the carburetor valve. However, for the reasons set forth, it is not desirable to throttle the engine down completely, but only to a speed at which the transmission can be shifted safely.

For the last named purpose there is mounted on the throttle lever a stop plate 48 which projects laterally beyond the lever on the side opposite from the carburetor connection 36. In order to cushion the blow when the throttle lever is moved by the piston, the plate 48 is backed up by a cushion filler 49, usually of rubber, the assembly being held on the lever by a plate 50 and bolts 51.

Pivoted on the housing 30 so as to be in the path of the plate 48 is a stop lever 52. This lever or catch 52 is shown as pivoted at 53 on an arm 54 which is, in turn, pivoted at 55 in the housing 30. A spring 56 is located between the lever 52 and the arm 54 so that normally the lever 52 occupies the position shown in Fig. 4 with a tail portion 58 resting against the arm 54. In this position the surface 60 on the forward edge of the lever 52 is located so as to be struck by the stop plate 48 when the throttle lever is moved to the right by the piston as shown in Fig. 5 and in dotted lines in Fig. 4.

Immediately below the point of contact with the plate 48, the edge of the lever 52 is stepped back as shown at 62 so that the throttle lever may be moved by the operator to minimum idling speed. This is easily done by the operator who may with his little finger engage the upper end of the lever 52 and rock it about its pivot 53, permitting the plate 48 to pass beneath the shoulder as shown in Fig. 5.

The location of the contact surface 60 may be adjusted so that the optimum "high idling" speed may be attained by the threaded stud 65 which engages the lower end of the arm 54. A light spring 66 is located between the lower end of the arm 54 and the wall of the housing and a cushion washer 67 may be located between the head of the stud 65 and the wall of the housing.

It will be seen that the mechanism which has been described interferes in no way with the normal operation of the boat, the only difference being that if a speed below the selected high idle speed is desired, the operator is required to lift

the lever 52 so that the throttle lever may be moved to the extreme right.

It will also be understood that when the control lever is moved forwardly, the valve 16 admits pressure to the left-hand end of the cylinder 10 and the transmission is shifted accordingly, but this does not affect the throttle in any manner. The piston 44 in no manner interferes with the hand operation of the throttle.

The mechanism functions, however, when the throttle lever is moved beyond the high idling as in cruising. If an obstacle should suddenly appear ahead so that quick action is necessary with a reversal of the engine, the operator may in a single movement pull the control stick into reverse. This action through the valve 16 admits pressure fluid into the space at the end of the piston and the first reaction is to drive the piston 44 to the right, throwing the throttle into the selected high idling speed, and immediately thereafter the piston 12 in the power unit will shift the transmission into reverse without causing damage to the transmission or causing the engine to stall. The precise sequence of operations takes place because the pressure build-up in the power unit 10 carries back to the throttle cylinder 42, bringing the throttle to its proper idling position before the clutch in the transmission is disengaged. However, the interval is so short that the shift in the transmission is almost instantaneous.

With the improved control stick, the reversal of the transmission and the steering of the boat is all done in a single operation and the pilot can use both hands to bring the boat about and avoid whatever obstacle may have loomed up.

What is claimed is:

1. In a marine control system, for use with an engine having a reversible transmission, a throttle lever for controlling the speed of the engine, a control lever for shifting the transmission, a stop in the path of the throttle lever and adapted to arrest the movement of the throttle lever at a point intermediate the limits of its movement, and means acting concurrently with the movement of the control lever when the transmission is shifted from forward into reverse to move the throttle lever against the stop.

2. In a marine control system, for use with an engine having a reversible transmission, a throttle lever for controlling the speed of the engine, a control lever for shifting the transmission, a shiftable stop which in one position is adapted to arrest the movement of the throttle lever when moving toward low speed at a point short of the extreme low, means acting concurrently with the movement of the control lever when the latter is shifted from forward into reverse to move the throttle lever against the stop, and means to shift the stop to permit the throttle lever to pass beyond it.

3. In a marine control system, for use with an engine having a reversible transmission, a throttle lever for controlling the speed of the engine, a control device for shifting the transmission, a stop in the path of the throttle lever to arrest its movement toward low speed, and means acting upon the movement of the control device when the latter is shifted from forward to reverse to move the throttle lever against the stop and then to shift the transmission into reverse.

4. In a marine control system, for use with an engine having a reversible transmission, a throttle lever for controlling the speed of the engine, a control device for shifting the transmission, a shiftable stop in the path of the throttle lever to arrest its movement toward low speed at a point short of extreme low, means to move the stop to permit the throttle lever to be moved to extreme low, and means acting upon the movement of the control device when the latter is shifted from forward to reverse to move the throttle lever against the stop and then to shift the transmission into reverse.

5. In a marine control system, the combination of an engine, a reversible transmission for the engine, a throttle lever for controlling the speed of the engine, a transmission control mechanism comprising a manually operated device, a cylinder and a fluid operated piston in the cylinder, said piston being connected to the transmission, means actuated by the manually operated device for admitting fluid under pressure against the piston, a second cylinder, a second fluid operated piston in the second cylinder and connected to the throttle lever, a conduit leading from the first cylinder to the second cylinder, and a stop in the path of the throttle lever for arresting its movement toward low speed.

6. In a marine control system, the combination of an engine, a reversible transmission for the engine, a throttle lever for controlling the speed of the engine, a transmission control mechanism comprising a manually operated device, a cylinder and a fluid operated piston in the cylinder, said piston being connected to the transmission, means actuated by the manually operated device for admitting fluid under pressure against the piston to shift the transmission into reverse, a second cylinder, a second fluid operated piston in the second cylinder and connected to the throttle lever, a conduit leading from the first named cylinder to the second cylinder and operable to move the throttle lever toward low speed, a shiftable stop in the path of the throttle lever for arresting its movement by the second piston at a point short of lowest speed, and means to shift the stop out of the path of the throttle lever.

7. In a marine control system, the combination of an engine, a reversible transmission for the engine, a throttle and throttle control means for regulating the speed of the engine, a transmission control mechanism, and a device connected with said control mechanism and having a connection to the throttle control means and a second connection to the transmission, said device being so constructed and arranged that it first moves the throttle control means to reduce the engine speed and then actuates the transmission control means to shift the transmission into reverse.

8. In a marine control system, for use with an engine having a reversible transmission, a throttle for controlling the speed of the engine, a cylinder, a piston in the cylinder, a valve for controlling the admission of fluid pressure into the cylinder behind the piston, a manually operated control device, connections from the said device to the valve, means to connect the piston with the reversible transmission, a second cylinder, a conduit connecting the said cylinders, a piston in the second cylinder, and connections between the second piston and the throttle.

9. In a marine control system, for use with an engine having a reversible transmission, a throttle lever for controlling the speed of the engine, a pressure cylinder and piston for operating the

reversible transmission, a second cylinder and piston for moving the throttle lever to reduce the speed of the engine, and a connection between the cylinders which permits pressure fluid acting to shift the transmission into reverse to enter the second cylinder and move the throttle.

10. In a marine control system, for use with an engine having a reversible transmission, a throttle lever for controlling the speed of the engine, a pressure cylinder and piston for operating the reversible transmission, a second cylinder and piston for moving the throttle lever to reduce the speed of the engine, a shiftable stop in the path of the throttle lever to arrest the lever before the engine reaches its minimum speed, and a connection between the cylinders which permits pressure fluid acting to shift the transmission into reverse to enter the second cylinder and move the throttle.

11. In a marine control system for use with an engine having a reversible transmission, a throttle and a throttle control means for regulating the speed of the engine, a stop projecting in the path of the throttle control means at a point to arrest movement of the throttle control means short of minimum engine speed, a transmission control mechanism, a manually operated device, and means actuated by the said manually operated device which in one movement in shifting the transmission from forward to reverse, first moves the throttle control means against the stop and then actuates the transmission control mechanism to shift the transmission into reverse.

12. A marine control system in accordance with claim 11, in which means are provided to release



the throttle control means for movement past the stop to reduce the speed of the engine to its minimum.

13. In a marine control system for use with an engine having a reversible transmission, a throttle operating device for controlling the speed of the engine, fluid pressure means for operating the throttle operating device, and fluid pressure means for operating the transmission, a source of fluid under pressure, a manual control device, a single valve actuated by said manual control device for simultaneously releasing the pressure fluid to both said fluid pressure means, and a stop projecting into the path of the throttle operating device to arrest its movement at a point short of extreme low engine speed.

14. A system in accordance with claim 13 in which the operation of the fluid pressure means for the throttle occurs before the operation of the fluid pressure means for the transmission.

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