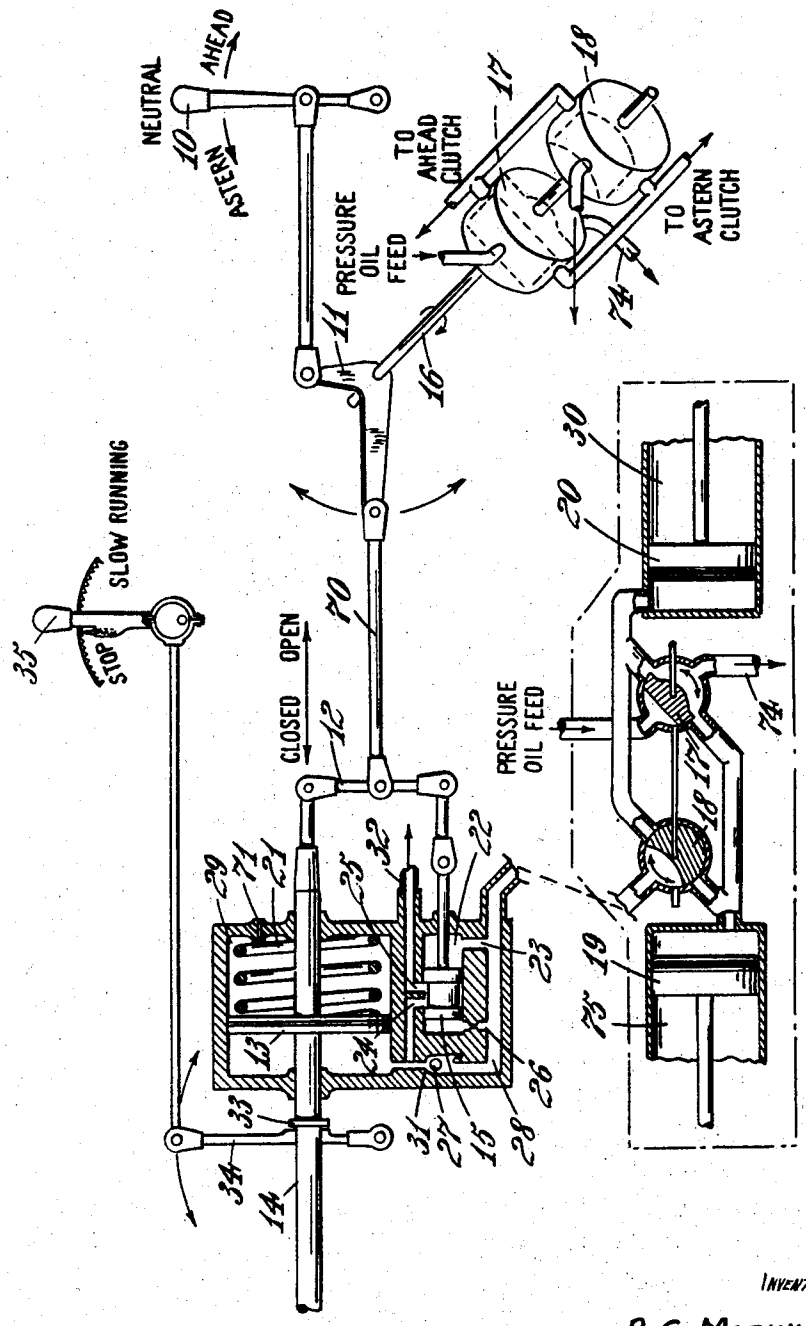
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THROTTLE CONTROL SYSTEMS FOR ENGINES DRIVING FORWARD AND REVERSE GEARS

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THROTTLE CONTROL SYSTEMS FOR ENGINES DRIVING FORWARD AND REVERSE GEARS

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This invention relates to a throttle control system for engines driving forward and reverse gears and concerns such engines driving forward and reverse gears including forward and reverse clutches.

The main object of the invention is to provide such engines with safety means, whereby the throttle of the engine cannot respond to a manual throttle control until the forward or the reverse clutch has been engaged or made effective.

According to the invention, there is provided for an engine driving forward and reverse gears including forward and reverse clutches, a throttle control system comprising a manual control for the throttle, means for actuating the forward and reverse clutches, and means for delaying the opening of the throttle in response to movement of the manual throttle control to open the throttle until the said acuating means has caused either one of said clutches to become engaged. The manual throttle control may be arranged to control said actuating means so that movement of said manual throttle control to open the throttle in an ahead range first causes the forward clutch to become engaged, and movement of said manual throttle control to open the throttle in an astern range first causes the reverse clutch to become engaged. This may be done either by interlocking the throttle control and the gear control, or by providing a single lever to control both throttle and gear.

The control system is especially, but not exclusively, applicable to a reverse reduction gear of the epicyclic type and by way of example the invention is hereinafter described with reference to the accompanying drawing which shows in diagrammatic form a hydraulic power-operated control system for a marine engine.

The marine engine is adapted to drive a screw propeller shaft through an epicyclic reverse-reduction gear-box. From the neutral position of the gears, ahead or astern is selected by the hydraulic application of a clutch or brake band to the appropriate annulus or drum of the epicyclic gear-boxes. Referring to the components shown in the drawing, the throttle control **10** is connected by mechanical linkage, including a bell crank lever **11**, and a connecting rod **70** to a rocking arm **12**, one end of which is attached to a servo piston **13** controlling the throttle linkage **14** and the other end is attached to a servo-valve **15** controlling the supply of oil to one side of the servo-piston **13**. The bell crank lever **11** is secured to a shaft **16** on which are mounted two supply valves **17** and **18**, the former valve **17** being arranged to control the supply of oil to either of the operating pistons **19**, **20** for actuating the astern or ahead clutches, and the latter valve **18** being arranged to permit oil to reach the servo mechanism for the throttle. The servo cylinder **29** houses a servo piston **13** connected to the throttle linkage **14** and controlled by a spring **21** which moves the piston to cause the throttle linkage to close the throttle, the spring **21** being housed in the cylinder **29** on one side of the piston **13** on a space vented to atmosphere by means of a vent **71**. A servo valve **15**

slides in a chamber **22** provided with a pressure equalising duct **23**, two ports **24**, **25** and a restrictor or passage **26** which restricts flow. The servo valve **15** controls the supply of oil through the restrictor **26** and port **24** to the servo cylinder **29**, and also controls the passage of oil escaping from the servo cylinder through ports **24** and **25** when the throttle setting is reduced. A non-return ball valve **27** permits the oil to drain from the servo cylinder **29** when the oil pressure in the passage **28** drops.

The connecting rod **70** which connects the bellcrank lever **11** to the rocking arm **12** is arranged to be in line with the arm of the bellcrank lever to which it is connected when the throttle control **10** is in its neutral position. In this manner it is ensured that when the throttle control **10** is moved from its neutral position to select either ahead or astern the rocking arm is pivoted about its connection with the servo piston **13** to displace the valve **15** to the right in the drawing.

In operation, the throttle control **10**, which may be located on the ship's bridge, may be moved from neutral to ahead. This movement is transmitted to the bell crank lever **11** causing it to rock and rotate the shaft **16** in one direction. Rotation of the shaft in this direction causes the valve **17** to open and permit oil under pressure to flow to the operating chamber of the piston **20** for actuating the ahead clutch and also causes the valve **18** to open and permit oil to flow to the restrictor **26**. Further movement of the throttle control **10** to pre-select a definite throttle setting is transmitted through the rocking arm **12** to cause the servo valve **15** to move to the right in the drawing and permit passage of oil from the restrictor **26** to the port **24** and thence into the servo cylinder **29**.

The oil pressure in the operating chamber **30** builds up rapidly and displaces the operating piston **20** so as to engage the clutch. As soon as this pressure has been achieved, the oil forcing past the delaying restrictor **26** and into the servo cylinder **29** is able to build up and displace the servo piston **13** to the right in the drawing. Displacement of the servo piston **13** pivots the rocking arm **12** about its connection with the connecting rod **70** and consequently the valve **15** is moved to the left in the drawing. Movement of the servo piston **13** ceases as soon as the valve **15** reaches its equilibrium position in which it closes the port **24** and it will be seen therefore that the extent of movement of the servo piston brought about by adjustment of the throttle control **10** depends on the amount by which the throttle control **10** is moved. The displacement of the servo piston **13** actuates the throttle linkage **14** to open the throttle to the amount pre-selected by the setting of the throttle control **10**. The spring **21** is of such strength as to ensure that the throttle will not open until the oil pressure is sufficient to engage the clutch. It will be noted that the restrictor **26** also controls the rate of opening of the throttle so as to avoid the stalling of the engine, particularly a gas turbine engine.

If now the throttle setting is reduced, that is to say, if the throttle control **10** is moved back towards its neutral position in the ahead range the valve **15** is displaced to the left in the drawing thus uncovering the port **24** to the port **25** and placing the cylinder **29** in communication with the drain. The servo piston is then moved to the left in the drawing by the spring **21**, and the throttle opening is reduced by an amount corresponding to the movement of the throttle control **10**, the movement of the servo piston to the left in the drawing ceasing when the valve **15** again reaches its neutral position in which it covers the port **24**. When the throttle control is moved right back to its neutral position the valve **15** is again displaced to the left in the drawing

uncovering the port 24 to drain, and the servo piston is displaced to the left in the drawing by the spring 21, the movement of the servo piston closing the throttle, whereupon the movement of the piston ceases. In this case the valve 15 follows up the movement of the servo piston but does not return completely to its equilibrium position but to the position shown in the drawing.

When the throttle control 10 is moved to astern and then to a pre-selected setting, the valve 17 is opened so as to permit the oil to flow to and displace the operating piston 19 of the astern clutch, the valve 17 at the same time placing the operating chamber 30 in communication with a drain passage 74, the valve 18 is opened to permit oil to flow to the restrictor 26, and the servo valve 15 is moved to permit passage of oil from the restrictor 26 to the port 24 and thence into the servo cylinder 29. As soon as the operating chamber 30 is placed in communication with the drain passage 74 the oil pressure in the chamber 30 is relieved and the forward clutch is disengaged. At the same time oil pressure is built up in the operating chamber 75 of the piston 19, and the astern clutch engaged. After the oil pressure has been built up in the operating chamber 75 and the astern clutch engaged the oil is able to displace the servo piston 13 and cause the throttle to be opened to the amount pre-selected by the setting of the throttle control 10.

In the neutral position of the throttle control 10 the valve 17 places each of the operating chambers 30 and 75 in communication with the drain passage 74.

If when either clutch is engaged, the oil pressure should drop and permit the clutch to become disengaged, the reduction in oil pressure will allow the ball valve 27 to be forced off its seating 31 by the oil under a higher pressure in the servo cylinder, and the oil will escape from the servo cylinder 29 past the ball valve 27, thus releasing the spring 21 to cause the servo piston 13 to return and close the throttle. The invention therefore prevents the engine from overspeeding when a clutch becomes disengaged due to a failure in the oil pressure. The system according to the invention also makes it impossible to overspeed the engine by opening the throttle with the gear in neutral.

In the example being described, the throttle linkage is provided with a limited control for slow-running and stopping which is independent of the servo control mechanism and normal throttle control. This limited control comprises a collar 33 or stop on the throttle linkage 14 which is engageable by a pivoted control arm 34 operated by a control lever 35 in the engine room control station. By this means the throttle may be opened to a limited extent, without previously engaging either clutch, for inspection and testing purposes.

I claim:

1. A throttle and transmission control system comprising in combination; a source of hydraulic power; a first hydraulic clutch motor; a second hydraulic clutch motor, which clutch motors are independently connected to said source to be operated by a predetermined hydraulic pressure, selector valve means for connecting one of said clutch motors selectively to said source, a hydraulic throttle motor for operating a throttle and comprising a piston and cylinder; conduit means connecting said source and said cylinder so that the piston tends to move in one direction on increase of hydraulic pressure, said conduit means also connecting said cylinder to the said one of the clutch motors and a preloaded spring between said piston and said cylinder and opposing relative movement between said piston and said cylinder in said one direction, said spring being preloaded to an extent such that said piston moves relative to said cylinder only after said predetermined hydraulic pressure has been exceeded.

2. A throttle and transmission control system comprising in combination a source of hydraulic power; a first hydraulic clutch motor; a second hydraulic clutch motor; a hydraulic throttle motor for opening a throttle and comprising a piston and cylinder; a conduit leading to said cylinder on one side of said piston; spring means acting on the other side of said piston and being preloaded to an extent such that the piston moves relative to the cylinder only after a predetermined pressure has been exceeded; progressively operable servo-valve means in said conduit; control valve means operable to selectively connect said source to one of said clutch motors and to connect said conduit to said one of said clutch motors; a manually operable member; and a mechanical linkage connecting said manually operable member to both said servo-valve means and said control valve means.

3. A throttle and transmission control system as claimed in claim 2 in which the manually operable member is pivotable in a clockwise and an anti-clockwise direction from an initial position and said control valve means comprises a rotary valve rotatable by said manually operable member to connect said first hydraulic clutch motor to said source when the said manually operable member is pivoted in a clockwise direction from the initial position, and to connect said second hydraulic clutch motor to said source when said manually operable member is pivoted in an anti-clockwise direction from the initial position.

4. A throttle and transmission control system as claimed in claim 3 in which the linkage comprises a bell crank lever having two mutually inclined arms radiating from a central part and being mounted to pivot about a first axis, first link means pivoted to one arm of said bell crank lever connecting said one arm to said manually operable member, second link means connected to said control valve means and a connecting link connected at one end thereof to the other arm of said bell-crank lever to pivot about a second axis and at its other end to said second link means to pivot about a third axis, the first, second and third axes lying in a common plane when said manually operable member is in its initial position.

5. A throttle and transmission control system comprising in combination a source of hydraulic power; a first hydraulic clutch motor; a second hydraulic clutch motor; a hydraulic throttle motor for opening a throttle and comprising a piston and cylinder; a first conduit leading to said cylinder on one side of said piston; spring means acting on the other side of said piston and being preloaded to an extent such that the piston moves relative to the cylinder only after a predetermined pressure has been exceeded; a vent leading from said cylinder on said one side of said piston; a second conduit leading from said vent; pressure release valve means operable to connect said vent to said second conduit when the pressure in said second conduit falls below said predetermined pressure; and control valve means operable selectively to connect said source with one of said hydraulic clutch motors to connect said first conduit to said one of said clutch motors and to connect said second conduit directly to said source and to said one of said clutch motors.

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