HYDRAULIC STEERING GEAR FOR SHIPS


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This invention relates to hydraulic ship's steering gear of the type where a hydraulic pump operates to deliver liquid under pressure to rams which actuate the rudder. In the specification of British Letters Patent No. 365,952 there is described a hydraulic ship's steering gear of this general character where the pump operating the ram movement is driven normally by an electric motor but can be driven alternatively by means of an auxiliary compressed air or steam engine, the compressed air or steam supply to this alternative or auxiliary engine being controlled by the automatic gear that controls the hydraulic pump.

The object of the present invention is to provide a hydraulic steering gear wherein the hydraulic pump is driven by a steam engine which constitutes the main or sole prime mover, which will be reliable in its action and economical in the use of steam. The invention consists of a particular arrangement the characteristic of which is that the steam engine has two supplies of steam, one for ensuring its continuous operation under light or no load, and another for ensuring an increased supply to effect the steering operation. In the preferred arrangement the engine is controlled both by a hand control valve to ensure its proper and desired regulation and operation for running light when the ship's rudder is stationary, and a main steam valve, which is controlled automatically and simultaneously with the hydraulic pump control. That is to say, the main steam valve is normally completely shut, but is opened by the operation of the telemotor or other mechanism which controls the hydraulic pump.

Where the pump employed is a variable stroke pump, the telemotor whose operation imparts stroke to the pump simultaneously opens the main steam valve and when the hunting gear brings the pump stroke back to zero the main steam valve is simultaneously closed and the steam engine runs light until it is again required to operate the rudder.

By reason of the foregoing arrangement the steam engine, although always running, so that no inertia effects have to be suddenly overcome, consumes very little steam until power is required but immediately the pump is set to operate the rams of the steering gear a full supply of steam is instantly available for the engine.

A manner of carrying out the invention is illustrated by the accompanying drawings in which Figure 1 is a diagrammatic plan of a system of steam hydraulic gear, Figure 2 is an end view of the hydraulic pump unit, Figure 3 is a radial section through a steam valve suitable for the accomplishment of the invention, and Figure 4 is a section on the line 4—4 of Figure 3 looking in the direction of the arrows.

In the drawings, A is the tiller fixed to the rudder stock, B1, B2, B3 and B4, are hydraulic cylinders and rams, and C is a variable stroke pump driven by the steam engine D, which is preferably of the double cylinder, double acting, forced lubrication type.

The operation of the pump is controlled by spindles E1, E2. When the spindles E1, E2, are pulled out from the pump, oil can be drawn from the cylinders B3, and B4, through the pipes P1, and P2, and discharged through pipes G1, and G2, to cylinders B2, and B1. When the control spindles are pushed in, oil is drawn through pipes G1 and G2, from the cylinders B2, and B1, and is discharged through pipes P1, and P2 to cylinders B3, and B4.

The stroke varying spindles E1, E2 of the pump C are secured to a bridge J, which is connected to the lower end of a rocking lever O by the pivot P (see Figure 2). The upper end of the lever O and also the main steam control valve R of the steam engine D are connected at Q to one end of a link S, whose other end is connected to approximately the middle point of a floating lever H.

A form of steam valve suitable for the accomplishment of the invention is shown in Figures 3 and 4. It will be seen on reference to these figures that the valve consists of a fixed barrel I supported in a suitable frame 2. This fixed barrel is provided with ports 3 and 4 and a rotary valve 5 is located within the fixed barrel and has members 5a and 5b which open and close the ports and the valve is actuated by a lever 5c attached to the shaft 5d which at its other end is keyed by the block 4e to the valve 5. In the position shown in the drawings, the valve is in its closed position. Steam is always supplied to the barrel I and some of the steam passes by way of the by-pass pipe P1, the precise quantity required for maintaining the engine turning over being adjusted by the valve P. The lever 5c is connected for actuation to the actuating rod S of the gear. One end K of the lever H is connected to a telemotor Y, which works in sympathy with the ship's steering wheel in the usual way; this end of the lever H is also connected to a hand wheel W which permits local control of the steering. The other end L of the 55
lever \( H \) is connected through a spring link \( M \) to a pin \( N \) on the tiller \( A \). When the end \( K \) of the lever \( H \) is moved by the telemotor \( Y \) or the hand wheel \( W \), the link \( S \) opens the valve \( R \) so as to admit steam to the engine and also moves the spindles \( B1 \) \( B2 \) so as to place the pump \( C \) on stroke. It will be seen that whatever be the direction in which the valve is actuated from its closed position steam will pass to the engine by way of the passage \( a \) to augment the by-pass supply, and the valve will open fully even though the movement of the steering wheel is only such as is required for the smallest practical degree of steering, the combined movement of the valve, consequent upon a larger degree of steering being required, having no further effect. Oil is then withdrawn from one pair of cylinders \( B1 \) \( B2 \) or \( B3 \) \( B4 \) and discharged to the other pair of cylinders, thus operating the tiller \( A \). The movement of the tiller moves the end \( L \) of the lever \( H \), so that the link \( S \) is returned to its original position, thus closing the steam valve \( R \) and bringing the pump stroke back to zero. The rudder is thus held in the position determined by the setting of the telemotor \( Y \) or hand wheel \( W \), until those controls are again moved.

In order to keep the engine \( D \) running when the main supply of steam is cut off by closing the valve \( R \), this valve is by-passed by a pipe \( P1 \) which admits a small supply of steam to the engine even when the valve \( R \) is closed. The flow through the pipe \( P1 \) can be adjusted by a hand-operated valve \( P \).

In order to allow the rudder to give way when subjected to a severe shock from a heavy sea or other cause, opposite pairs of cylinders \( B1 \) \( B4 \) and \( B2 \) \( B3 \) are connected by pipe lines. These pipe lines are provided with double spring loaded valves \( T1 \) and \( T2 \) which can be adjusted by hand. A shock on the rudder forces open the valves \( T1 \) and \( T2 \) (which are ordinary shock valves commonly used in hydraulic steering gear), allowing oil to pass between the cylinders \( B1 \) \( B4 \) and \( B2 \) \( B3 \) and thus allowing the rudder to move. This movement of the rudder moves the end \( L \) of the lever \( H \), which puts the pump \( C \) on stroke and opens the steam valve \( R \), so that the rudder is automatically returned to position when the excessive strain has been relieved.

The hydraulic cylinders are provided with air cocks \( U1 \), \( U2 \), \( U3 \), and \( U4 \), and \( V \) is an oil replenishing tank containing suction valves which are connected to the pump by pipes, permitting compensation for any loss of oil.

It will be seen that we have by our invention provided two independently adjusted or adjust able supplies of steam to the steam engine driven by the pump, one a small, preferably hand controlled, continuous supply which can be arranged to keep the engine always running, and the other a main supply for causing the engine to deliver sufficient power to effect the steering during which operation both supplies are employed.

Although we have throughout the foregoing description referred only to a steam engine, that term is to be taken to include any elastic fluid engine such, for example, as a compressed air motor.

What I claim and desire to secure by Letters Patent is:

1. A steam-hydraulic steering gear for vessels comprising in combination rams for effecting movement of the vessel's rudder, a variable stroke hydraulic pump for delivering pressure liquid to operate the rams, a steam engine for driving the pump, means for continuously supplying a sufficient quantity of steam to the engine to maintain its operation under light load, a main steam supply for said engine, a main, normally closed, steam valve for controlling the main steam supply to the engine, control means associated with the steering wheel for simultaneously applying stroke to the variable stroke pump and opening the main steam valve of the engine when the steering wheel is operated, and a hunting gear operative to close the main steam valve and reduce the pump stroke to zero simultaneously when the rudder of the steering gear reaches the desired position.

2. A steam-hydraulic steering gear for vessels comprising hydraulic rams operating to effect movement of the vessel's rudder, a hydraulic pump, a steam engine for driving the pump, a continuous minimum steam supply for maintaining the steam engine running at all times, a main steam valve which when open insures maximum supply of steam to the engine, means controlled by the steering wheel of the vessel for setting the pump in effective operation and simultaneously opening the main steam valve each time the steering wheel is moved to effect steering, the main steam valve remaining open irrespective of the pressure in the hydraulic system until the rudder of the steering gear has reached the desired position, and means for simultaneously closing the main steam valve and rendering the pump ineffective immediately the rudder has reached the desired position.

3. A steam-hydraulic steering gear for vessels comprising rams operating to effect movement of the rudder, a variable stroke hydraulic pump operating to deliver pressure liquid to operate the rams, a steam engine for driving the pump, a continuous steam supply to the steam engine, a hand control for setting said continuous steam supply at the minimum necessary to maintain the steam engine running continuously under light load, a main steam supply for said engine, a main, normally completely closed, steam valve controlling the main steam supply to the steam engine and control means associated with the steering wheel for simultaneously applying stroke to the variable stroke pump and opening the main steam valve of the engine when the steering wheel is operated, and a hunting gear operating to close the main steam valve and reduce the pump stroke to zero simultaneously when the rudder of the steering gear reaches the desired position.

WILLIAM GEORGE RIDDELL.