May 12, 1936. S. S. COOK ET AL. 2,040,643

POWER INSTALLATION

Filed April 28, 1934 3 Sheets-Sheet 1

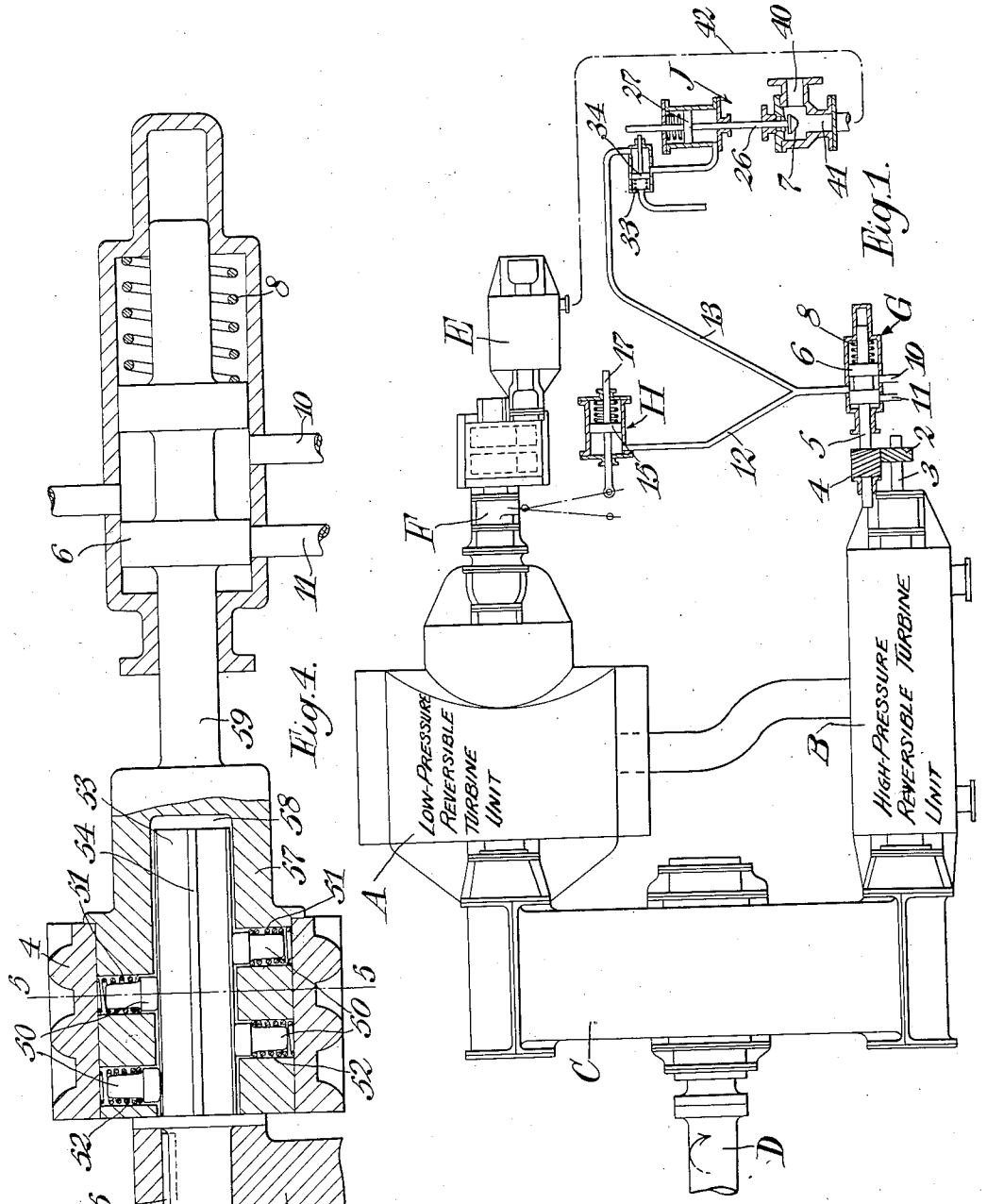


Fig. 1.

Fig. 4.

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POWER INSTALLATION

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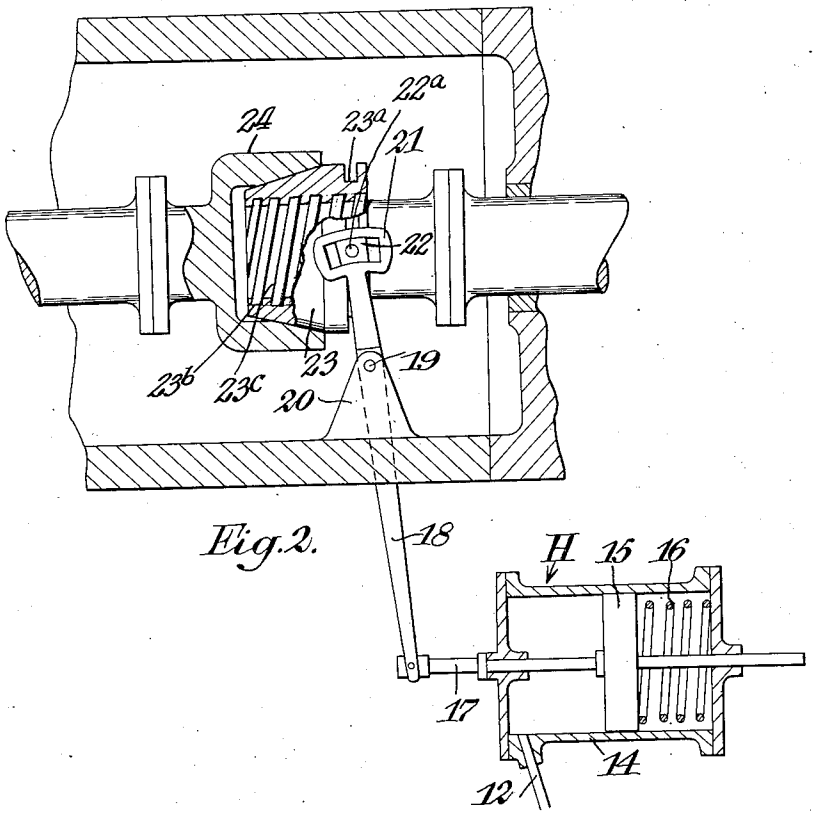


Fig. 2.

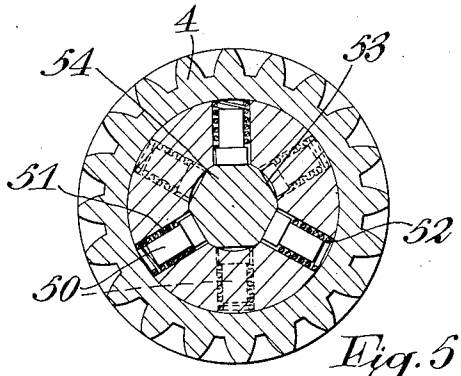


Fig. 5.

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POWER INSTALLATION

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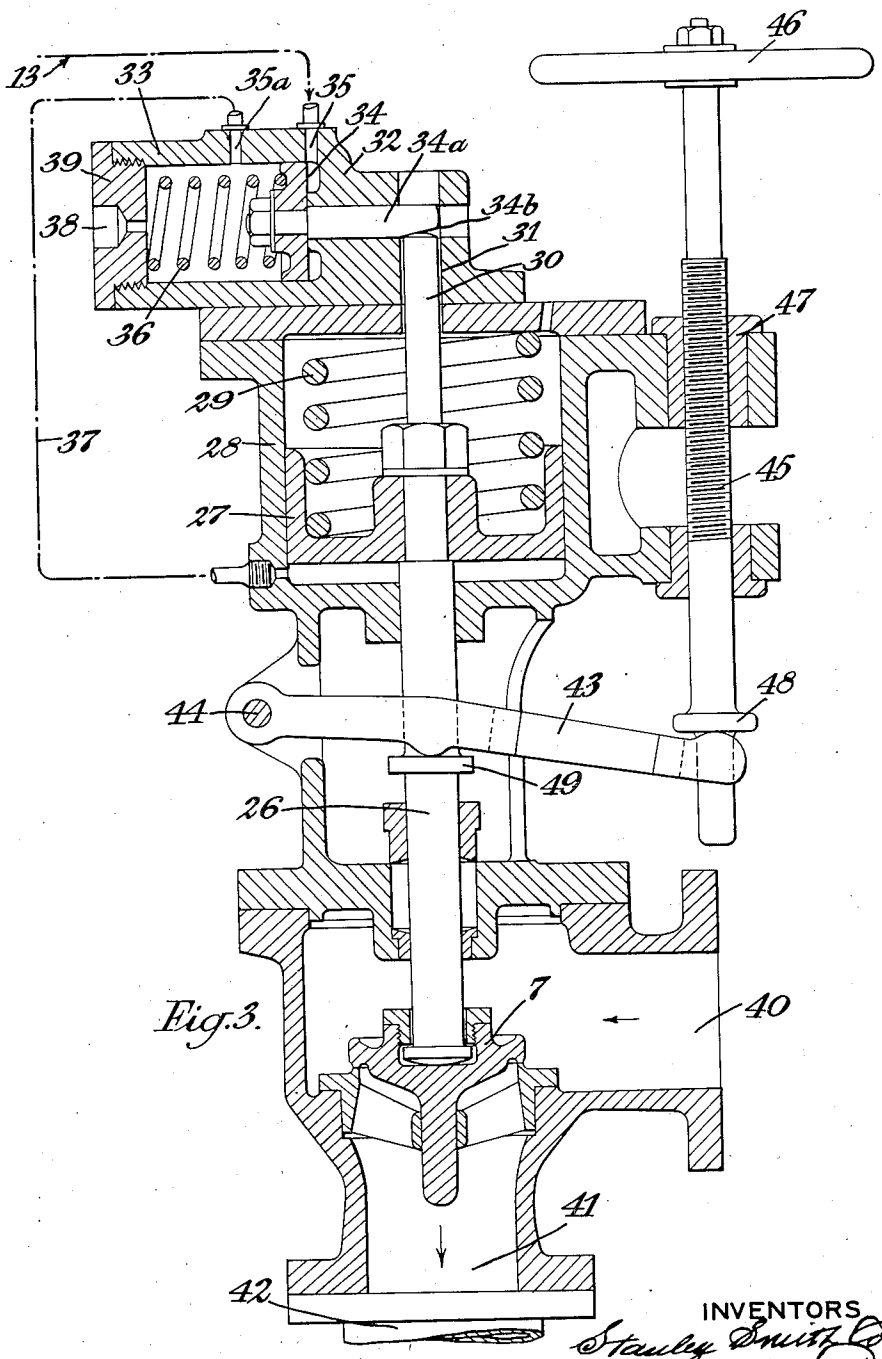


Fig. 3.

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UNITED STATES PATENT OFFICE

2,040,643

POWER INSTALLATION

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Application April 28, 1934, Serial No. 722,982
In Great Britain April 29, 1933

8 Claims. (Cl. 60—102)

This invention relates to power installations of the type embodying two or more prime movers driving the same power shaft, one (or more) of which prime movers drives through a unidirectional clutch commonly called a free-wheel clutch.

In a particular type of such installation, the main prime mover (or prime movers) is adapted to drive a power shaft in one direction at high powers, and the auxiliary prime mover to drive the power shaft in the same direction at low powers only; under normal conditions the free-wheel clutch device operates automatically, that is to say, it comes into operation if the auxiliary prime mover tends to run at a greater speed than that of the main prime mover or prime movers, torque then being transmitted through the clutch, whereas if the speed of the auxiliary prime mover falls below that of the main prime mover or prime movers, the clutch enables the main prime mover or prime movers to overrun the auxiliary prime mover.

The auxiliary prime mover is usually provided with an emergency trip governor in order to prevent it from attaining an excessive speed.

Should the main prime mover or prime movers, however, be reversed in direction, then the clutch would effect a rotation of the auxiliary prime mover in the reverse direction, and since this drive would be positive, it would be possible for the auxiliary prime mover to attain a speed corresponding to that of the main prime mover or prime movers and damage might be caused to the auxiliary prime mover.

The main object of the present invention is to provide means whereby this drawback is avoided, so that power installations of the type indicated above may thus be readily applied, for example, to marine steam turbine plants.

With such an object, the invention consists in the combinations of elements hereinafter described and particularly pointed out in the claims.

Referring to the accompanying diagrammatic drawings:—

Figure 1 shows a general view of the lay-out of one form of power installation according to the present invention, applied to a marine propulsion system indicating relay control, clutch-operating servo-motor and automatic lock for the inlet valve of the cruising turbine;

Figure 2 shows a view to a larger scale of the clutch-operating servo-motor and

Figure 3 a longitudinal elevation of a form of automatic locking valve for the cruising turbine;

Figure 4 shows a longitudinal elevation partly in section of a modified form of mechanism for actuating the relay control,

Figure 5 being a corresponding cross-section on the line 5—5 of Figure 4.

The same reference symbols are used in the different drawings to denote corresponding parts.

In carrying the invention into effect according to the form shown in Figure 1 as applied to a marine power installation having a low-pressure ahead and astern turbine within a common casing, A, and a high-pressure ahead and astern turbine within a common casing, B, these turbines being connected through gearing, C, to a propeller shaft, D; a cruising turbine, E, is connected to the low-pressure astern turbine by way of a free-wheel clutch device, F, and means operated by the high-pressure turbine are provided to render this clutch inoperative when the direction of rotation of the propeller shaft, D, is changed from ahead to astern.

The means for rendering the clutch inoperative comprise a single-helical pinion, **2**, rigidly mounted on the high-pressure turbine shaft, **3**, and meshing with a similarly toothed wheel, **4**, of greater width and axially movable with its shaft, **5**, parallel to the high-pressure turbine shaft, the shaft, **5**, being attached to the pilot valve, **6**, of a relay control, G, regulating the oil supply to or from a servo-motor, H, acting upon clutch-disconnecting means and also to or from a device, J, which closes and locks or unlocks the cruising turbine steam inlet valve, **7**.

A spring, **8**, is provided for urging the pilot valve in a direction opposite to that given it by the action of the helical wheel, **4**.

An inlet, **10**, is provided for a supply of oil or other pressure fluid and an outlet, **11**, for its escape, pipes, **12** and **13**, connecting the relay, G, respectively to the clutch-operating mechanism, H, and the cruising-turbine inlet valve, J, and its adjuncts.

The clutch-operating mechanism, H, (see Figure 2) according to one form comprises a cylinder, **14**, and piston, **15**, movable in one direction under the action of a spring, **16**, and in the other by pressure fluid admitted through the pipe, **12**, controlled by the relay, G.

The piston rod, **17**, is connected to one end of a lever, **18**, fulcrumed at the point, **19**, on a stationary bracket, **20**, the lever, **18**, being provided with a slotted head, **21**, in which is movable a block, **22**, having a pin, **22a**, entering an annular groove, **23a**, in the movable clutch cone, **23**, which is provided internally with a quick

thread, 23b, meshing with a corresponding thread, 23c on one of the shafts to be clutched together, the clutch cone, 23, itself engaging with an internally-coned member, 24, on the other of the two shafts. The thread, 23b, has such an angle that the cone, 23, can be moved axially by rotation on its axis, the arrangement being a known mechanical equivalent of a ratchet-and-pawl connection, so far as concerns overrunning and positive driving.

Referring now to Figure 3, for details of the valve operating mechanism, J, and adjuncts, the inlet valve, 7, controlling steam to the cruising turbine is mounted on a spindle, 26, carrying a piston, 27, slidable in a cylinder, 28, and forced in a direction to close the valve by a spring, 29, an extension, 30, of the spindle passing into a hole, 31, in the housing, 32, of the lock-operating device.

This device comprises a small cylinder, 33, with a piston, 34, having a piston-rod, 34a, provided with a bevel, 34b, at its free end, so that when the piston-rod, 34a, is protruded as far as possible from the cylinder, 33, by the spring, 36, its bevelled end engages with the end of the extension, 30, of the main valve spindle, 26, and holds the valve, 7, in its closed position.

The pipe, 13, from the relay is connected by way of a port, 35, to the end of the cylinder, 33, remote from the spring 36. A second port, 35a, is connected by a pipe, 37, to the interior of the cylinder, 28, on the side of the piston, 27, remote from the spring 29; while a leak-off, 38, is provided in the cover, 39, of cylinder, 33.

The steam inlet is indicated at 40, the outlet, 41, being connected by a pipe, 42, to the cruising turbine, E.

The action of the mechanism above described is as follows:—

With the main turbines running ahead, the pilot valve, 6, will be held under the joint influence of the spring, 8, and helical wheels, 2 and 4, at the left-hand end of its travel as seen in Figure 1, so that pressure oil can pass through the inlet, 10, and pipe, 12 to the servo-motor, H, (see Figure 2) thereby holding its piston, 15, to the right and keeping the clutch, 24, in gear.

At the same time pressure oil also passes through the pipe, 13, holding the piston, 34, to the left against its spring, 36, thereby withdrawing the lock, 34a, which prevents the inlet valve, 7, opening and uncovering the port, 35a, so that unless the inlet valve, 7, is held closed by the mechanism provided, it will automatically be opened by pressure oil passing through the pipe, 37, below the piston, 27.

Assuming that the steam to the ahead turbine is shut off and the astern turbine started, then by interaction of the helical wheels, 2 and 4, the pilot valve, 6, is forced against its spring, 8, to the right-hand end of its travel so that the pressure oil acting on the piston, 15, of the servo-motor, H, escapes by way of the pipe, 12, and leak-off, 11, the spring, 16, thereby withdrawing the clutch, F. At the same time the space on the right of the piston, 34, (see Figure 3) is likewise connected to the leak-off through the pipe, 13, and under the influence of the spring, 36, the piston, 34, moves to the right.

This action uncovers the port, 35a, and connects the space below the piston, 27, through the pipe, 37, and port, 35a, to the leak-off port, 38, thereby permitting the spring, 29, to close the inlet valve, 7, which is immediately locked in place by the bevel, 34b, on the end of the piston rod, 34a.

The valve, 7, may be additional to the ordinary shut-off or regulating valve, but the two may be combined as shown in Figure 3 by the addition of the lever, 43, pivoted at 44, screwed spindle, 45, and hand wheel, 46.

The spindle, 45, is screwed through a fixed bracket, 47, and is provided with a fixed collar, 48, which engages the free end of the lever, 43, the latter in turn engaging a collar, 49, on the valve spindle, 26, so that the extent to which the valve can open is regulated.

It will be seen that this mechanism cannot open the valve but can close it under any circumstances while permitting it to open under the influence of the control pilot valve, 6.

According to a modified form of the mechanism for operating the pilot valve, 6, (see Figures 4 and 5) the helical wheel, 4, is provided internally with a number of plungers, 50, forced inwardly in recesses, 51, by light springs, 52, the plungers when the turbines are stationary bearing on corresponding flats, 53, on a short length of fixed shaft, 54, held stationary, as by a key, 55, on a suitable bracket, 56.

The toothed wheel, 4, is rigidly associated with a boss or projection, 57, having therein an axial hollow, 58, to accommodate the shaft, 54, this boss, 57, being in turn connected by a spindle, 59, to the pilot valve, 6.

Supposing the main turbines are stationary, the pilot valve will be forced by its spring, 8, to the extreme position to the left as shown in Figure 1. As soon as the astern turbine begins to move, owing to the resistance to rotation of the wheel, 4, in view of the plungers, 50, and flats, 53, the helical wheel, 4, with its attachments, including the pilot valve, 6, will be immediately moved to the right (see Figure 1), and subsequent action being as above described.

As the speed increases the plungers, 50, will fly outwards against the action of their springs, 52, and by the interaction of the helical wheel, 4, and pinion, 2, the valve, 6, will be held against its spring, 8.

One convenient general arrangement has been described above by which the invention may be carried into effect, but it will be appreciated that other means may be employed for achieving a similar result and that variations in detail may be made without exceeding the scope of the present invention.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. In combination in a power installation, a driven element and means for driving said element, said driving means including a reversible power unit and a non-reversible supplementary power unit, said units having independent supplies of working medium, and including also a mechanical one-way-drive clutch associated with said supplementary unit, together with automatic means responsive to the starting movement of said reversible unit in the reverse direction for disengaging said clutch.

2. In combination in a marine propulsion system, a propeller shaft and means for driving said shaft, said driving means including a reversible power unit having ahead and astern turbine units and a non-reversible cruising turbine unit having a supply of working medium independent of that to said reversible power unit, and including also a mechanical one-way-drive clutch

associated with said cruising unit, together with automatic means responsive to the starting movement of said reversible unit in the reverse direction for disengaging said clutch.

3. In combination in a power installation, a driven element and means for driving said element, said driving means including a reversible power unit and a non-reversible supplementary power unit and including also a mechanical one-way-drive clutch associated with said supplementary unit, together with automatic means responsive to the starting movement of said reversible unit in the reverse direction for disengaging said clutch, said automatic means including a pair of helically-toothed wheels in operative association the one with the other, one of said wheels being in driven relation to said reversible unit to rotate therewith in both the ahead and reverse directions, and including also a guide on which the other of said wheels is axially slidable and a relay device operable by said slidable wheel.

4. In combination in a power installation, a driven element and means for driving said element, said driving means including a reversible power unit and a non-reversible supplementary power unit and including also a mechanical one-way-drive clutch associated with said supplementary unit, together with automatic means responsive to the starting movement of said reversible unit in the reverse direction for disengaging said clutch, said automatic means including a pair of helically-toothed wheels in operative association the one with the other, one of said wheels being in driven relation to said reversible unit to rotate therewith in both the ahead and reverse directions, and including also a guide with longitudinal flats on which the other of said wheels is axially slidable and a relay device operable by axial movement of said slidable wheel, said slidable wheel having radial recesses with spring-controlled members movable radially in said recesses and engaging with said flats to ensure axial movement of said slidable wheel at low speeds and automatically moving out of engagement therewith under the influence of centrifugal force as the speed rises.

5. The combination of elements claimed in claim 1, with the addition of means for shutting off said independent supply of working medium to said supplementary unit, said automatic means including a relay device and means operated therefrom for both disengaging said clutch and actuating said shutting-off means.

6. The combination of elements claimed in claim 1, with the addition of means for shutting off said independent supply of working medium to said supplementary unit, and means for locking said shutting off means in the shut-off position, said automatic means including a relay device and means operated therefrom for both actuating said shutting-off and locking means.

7. The combination of elements claimed in claim 1, with the addition of means for shutting off said independent supply of working medium to said supplementary unit, said automatic means including a relay device and means operated therefrom for both disengaging said clutch and actuating said shutting-off means, together with hand-operated means for actuating said shutting-off means independently of said relay device.

8. In combination in a power installation, a driven element and means for driving said element, said driving means including a reversible power unit and a non-reversible supplementary power unit, said units having independent supplies of working medium and including also a mechanical one-way-drive clutch associated with said supplementary unit, means for reversing said reversible unit, and means automatically responsive to operative movement of said reversing means for disengaging said clutch.

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