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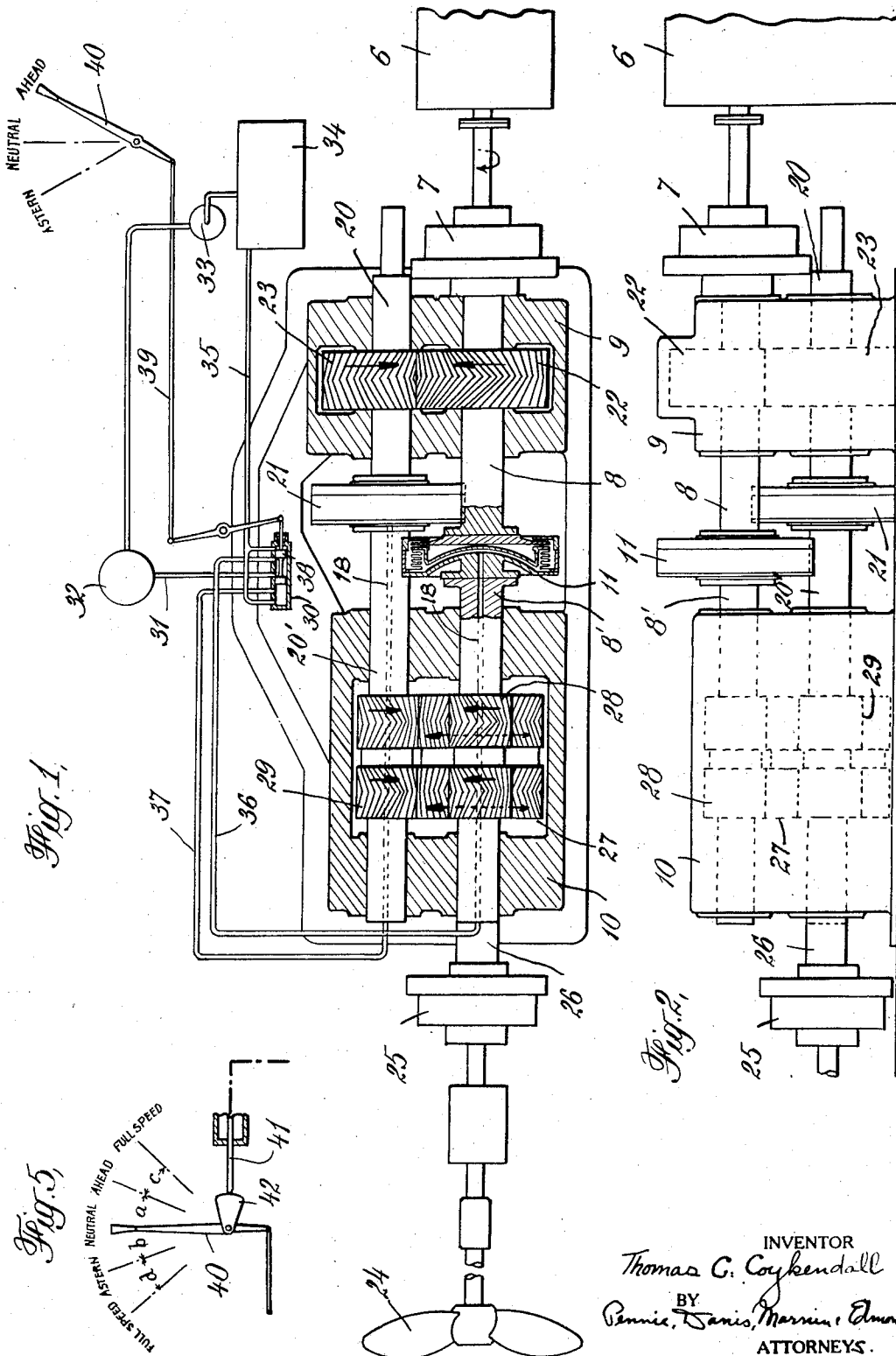
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1,701,403

SYSTEM OF MARINE PROPULSION

Filed Dec. 20, 1924

3 Sheets-Sheet 1



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SYSTEM OF MARINE PROPULSION

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Fig. 3,

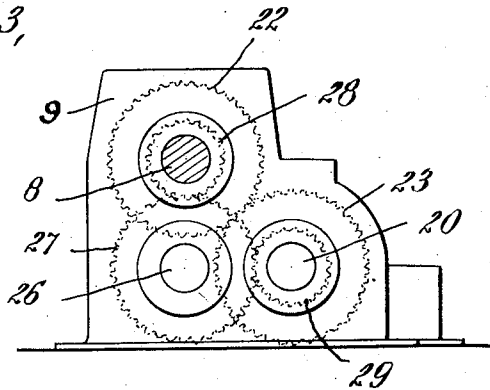
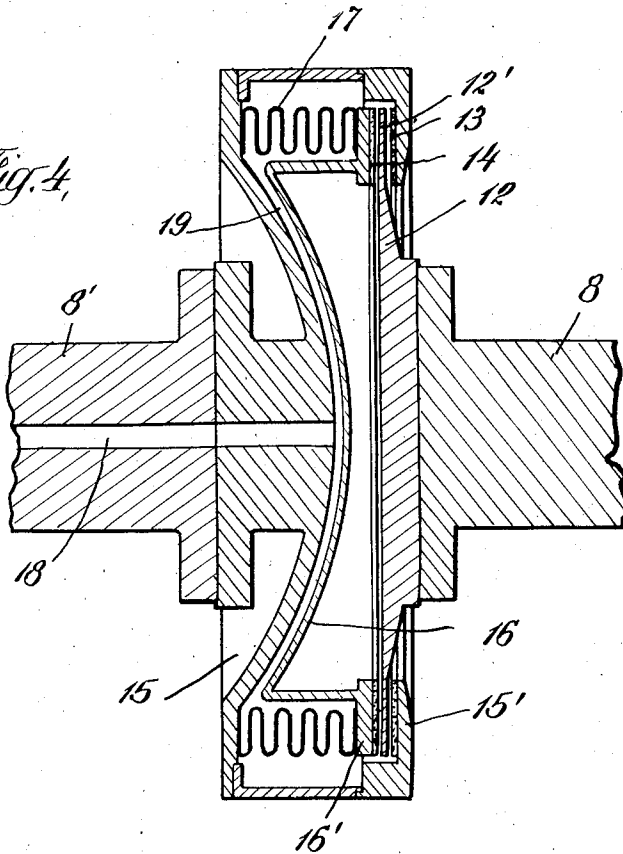


Fig. 4,



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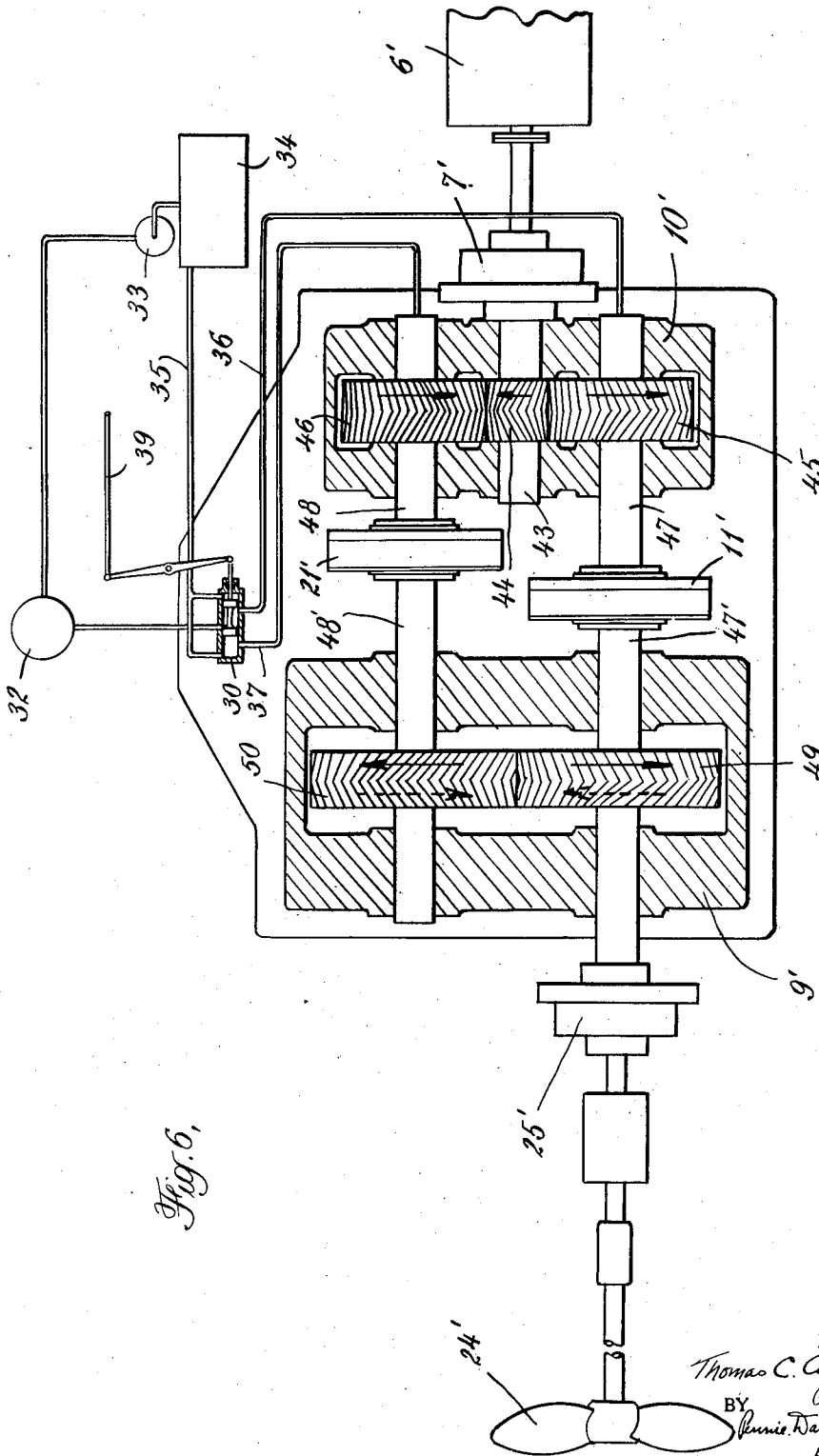
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SYSTEM OF MARINE PROPULSION

Filed Dec. 20, 1924

3 Sheets-Sheet 3



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SYSTEM OF MARINE PROPULSION.

Application filed December 20, 1924. Serial No. 457,227.

This invention relates to systems of marine propulsion and has for its object the provision of certain improvements in marine propulsion systems.

5 The invention particularly relates to systems of marine propulsion in which the propeller, or propellers, is operatively connected to the ship's engine or power source through appropriate reduction gearing. The efficient and economical speed of rotation of internal combustion engines, steam or other elastic fluid turbines, and like ship's engines, is ordinarily higher than the efficient and economical speed of rotation of the ship's propeller. It is therefore customary to connect the propeller to the ship's engine through appropriate speed-reducing agencies, such as reduction gearing. Satisfactory speed-reducing gearing has been developed for this purpose, but it has been found necessary in such gearing, both to avoid objectionable noise and to practically connect the relatively high speed and high power engine to the propeller, to maintain the gears permanently engaged or meshed. On this account, the provision of suitable means for obtaining astern-motion of the ship has presented a problem that has been given considerable attention by marine engineers. In general, it has heretofore been the usual practice to reverse the ship's engine or to provide an auxiliary reversing engine for astern-motion. Reversing a ship's engine is awkward and slow, particularly in cases of emergency, and the provision of an auxiliary reversing engine is costly and requires additional space.

The present invention aims to provide an efficient and simple system of marine propulsion in which ahead-motion and astern-motion are satisfactorily effected without reversing the ship's engine and without providing an auxiliary reversing engine. Thus, the improved system of the invention includes a speed-reducing gearing in which the gears thereof are permanently engaged or meshed, in combination with means for operatively connecting such gearing between the engine and the propeller so as to obtain ahead-motion and astern-motion. This result I am able to secure by the provision of two power clutches, preferably of the fluid pressure operated friction disk type, one of which clutches when actuated operates to connect the engine to the propeller through the

gearing for ahead-motion while the other clutch when actuated operates to connect the engine to the propeller through the gearing for astern-motion.

One embodiment of the invention includes a two-part main shaft (say connected to the engine) with a power clutch operatively associated therewith to connect or disengage the two parts of the shaft, and a two-part auxiliary shaft having a similar clutch operatively associated therewith. These shafts have one part thereof directly and permanently connected together by gearing whereby the shafts rotate in opposite directions, and the other parts of these shafts are connected to a third shaft (say the propeller shaft) through similar speed-reducing gearing. The clutches are preferably of the fluid pressure operated friction disk type, and the system then further includes fluid pressure control means for (1) actuating one of the clutches and simultaneously disengaging the other clutch to effect ahead-motion and for (2) actuating the latter clutch and simultaneously disengaging the other clutch to effect astern-motion and for (3) simultaneously disengaging both of the clutches.

It is frequently necessary in systems of marine propulsion to mount the ship's engine so that its shaft is at a higher level than the propeller shaft, for the reason that if the engine shaft is at a lower level than (or the same level as) the propeller shaft there is not sufficient room between the center of the engine shaft and the keelson of the ship for the bedplate of the engine. The improved system of the invention is admirably adapted to attain this end. Accordingly, in one embodiment of the system of the invention the engine or main driving shaft is arranged at a higher level than the propeller shaft. I have secured very excellent results with the engine and propeller shafts in substantially the same vertical plane, the engine shaft being at a higher level than the propeller shaft. With such an arrangement the auxiliary and propeller shafts may advantageously be arranged in substantially the same horizontal plane.

The improved marine propulsion system of the invention is simply operated and controlled by an appropriate control means for the two power clutches and the usual speed controlling means for the ship's engine. If

desired, the control means for the clutches may be operatively associated and combined with the speed controlling means for the ship's engine so that the manipulation of a single controller effects ahead-motion and astern-motion as well as variations in engine speed as desired in navigating and maneuvering the ship.

The novel features which I believe to be patentably characteristic of my invention are definitely pointed out in the claims appended hereto. The arrangement of the apparatus in and the mode of operation of the system of the invention, in what I now regard as the preferred embodiments thereof, will be best understood from the following description taken in conjunction with the accompanying drawings, in which

Fig. 1 is a diagrammatic plan partly in section of the system,

Fig. 2 is a side elevation of the system,

Fig. 3 is an end elevation of the system,

Fig. 4 is an enlarged cross-section of the power clutch employed in the system,

Fig. 5 is a detail view of a modified controlling means, and

Fig. 6 is a diagrammatic plan partly in section of a modified arrangement of the system.

Throughout this specification and the appended claims I have used the term engine to define any suitable power source for a ship. The system of the invention is especially applicable for use in conjunction with internal combustion engines, more particularly Diesel engines, steam or other elastic fluid turbines, and like relatively high speed and high power engines. By high power, I mean exceeding 100 horse power and usually several hundred horse power.

Referring now to Figs. 1, 2 and 3 of the accompanying drawings, there is diagrammatically illustrated a ship's engine 6, such, for example, as a Diesel engine. The engine shaft is operatively connected through a forward flexible coupling 7 to a main driving shaft 8-8'. The driving shaft comprises two parts 8 and 8' rotatably mounted in suitable bearings in gear casings 9 and 10, respectively.

The two parts 8 and 8' of the driving shaft are arranged to be operatively connected together or disengaged by a power clutch 11. The clutch illustrated in the drawings is of the fluid pressure operated friction disk type, such, for example, as a Metten oil clutch. This clutch (see Fig. 4) comprises a disk 12 secured to that part (8) of the driving shaft which is connected to the engine. The disk has an annular peripheral portion 12' preferably covered or lined with friction material, arranged between two relatively movable annular friction members 13 and 14. The annular friction member 13 is mounted on the inner face of the annular flange 15' of the clutch casing 15, the casing itself being se-

cured to the part 8' of the driving shaft. The annular friction member 14 is mounted on the face of the annular flange 16' of a convex-concave circular plate 16. The plate 16 is secured to the casing 15 by an annular expansible or bellows metal element 17. The concave face of the plate 16 is in juxtaposition with, but slightly spaced from, the inner convex face of the casing 15, and these faces in conjunction with the expansible element 17 form a chamber 19 adapted to be filled with oil supplied through the central hole 18 in the shaft 8'.

The operation of the clutch is as follows: So long as the oil in the chamber 19 is under no pressure, the normal resiliency of the expansible element 17 withholds the friction member 14 from engagement with the disk 12. The disk thus rotates freely in the space between the friction members 13 and 14. The two parts 8 and 8' of the driving shaft are accordingly operatively disengaged and free to rotate independently of one another. When the oil in the chamber 19 is placed under pressure, through means hereinafter more fully described, the friction member 14 is forced towards the friction member 13 with the result that the disk 12 is securely gripped between these members and the two parts 8 and 8' of the driving shaft are operatively connected to rotate as a unitary shaft.

An auxiliary two-part shaft 20-20' is rotatably mounted in suitable bearings in the gear casings 9 and 10. The two parts 20 and 20' of this shaft are arranged to be operatively connected together or disengaged by a power clutch 21, of the same construction as the clutch 11.

The main shaft (part 8) has secured thereto a gear 22 that permanently engages or meshes with a similar gear 23 secured to the auxiliary shaft (part 20). The shaft parts 8 and 20 thus always rotate in opposite directions. The gears 22 and 23 are preferably of the herring-bone type to reduce the noise of operation to a minimum. These gears are enclosed in a gear casing diagrammatically represented in the drawings by 9. It is to be understood that this casing is of suitable construction to house the gears and to provide convenient access to the gears for inspection and repair and that appropriate means may be employed for lubricating the gears.

The propeller 24 is operatively connected by a flexible coupling 25 to a propeller shaft 26 rotatably mounted in suitable bearing in the gear casing 10. A gear 27 is secured to the propeller shaft 26. A pinion 28 is secured to the part 8' of the main driving shaft and permanently engages or meshes with the gear 27 on the propeller shaft. A similar pinion 29 is secured to the part 20' of the auxiliary shaft and permanently engages or meshes with the propeller shaft gear 27. In the drawings, a pair of gears 27, and pairs of pinions 28

and 29 are illustrated, but it will be understood that each of these pairs functions as a single unit, the duplication being made for mechanical reasons.

5 The gears and pinions 27, 28 and 29 are of the herring-bone type and are enclosed in the gear casing 10 which is like the gear casing 9.

10 The main shaft 8—8' is at a higher level than the propeller shaft 26, and the two shafts are in substantially the same vertical plane (see Fig. 3), although the shafts are longitudinally somewhat displaced, that is not directly one above the other except for a short portion of the adjacent ends thereof.

15 The auxiliary shaft 20—20' and the propeller shaft 26 are in substantially the same horizontal plane (see Fig. 3) and similarly longitudinally somewhat displaced, that is, not directly side by side except for a short portion

20 of the adjacent ends thereof. Thus, the pinion 28 meshes with the top portion of the propeller shaft gear 27, and the pinion 29 meshes with one side (90 angular degrees removed from the point of engagement of pinion 28)

25 of the gear 27.

In the arrangement illustrated in the drawings the shaft 8—8' is the ahead-motion shaft and the shaft 20—20' is the reverse or astern-motion shaft. These two shafts are driven

30 by the engine at the same speeds but in opposite directions. The desired speed reduction is secured as a result of the pinions 28 and 29 meshing with the gear 27.

35 The clutches 11 and 21 are controlled by a clutch control valve 30. This valve has a central port communicating by a pipe 31 with a high pressure oil tank 32. The pressure of the oil in the tank 32 is established and maintained by an oil pump 33 connecting the tank

40 32 with a low pressure oil tank or sump 34. The valve 30 has a port at each end thereof communicating by a pipe 35 with the sump 34. Between the central port and each end port,

45 the valve 30 has intermediate ports communicating by pipes 36 and 37 and the central holes in shaft parts 8' and 20' with the oil chambers 19 of the clutches 11 and 21, respectively.

50 The valve 30 has a movable piston 38 connected by appropriate linkage 39 to a control lever or handle 40. When the piston 38 and the lever 40 are in their extreme right-hand positions, as shown in the drawings, the oil pipe 36 is in communication with the high

55 pressure oil tank 32 and clutch 11 is actuated and operatively connects together the two shaft parts 8 and 8'. At the same time the oil pipe 37 is in communication with the oil sump 34 and the clutch 21 is accordingly dis-

60 gaged, thereby permitting independent rotation of the two shaft parts 20 and 20'. When the piston 38 and control lever 40 occupy their extreme left-hand positions, as viewed in the drawings, the clutch 21 is actuated and the

65 clutch 11 is disengaged. When the piston 38

and the control lever 40 occupy their neutral or intermediate positions, both oil pipes 36 and 37 are in communication with the sump 34 and both clutches 11 and 21 are accordingly disengaged. It will be noted that the

70 control valve 30 provides insurance for the actuation at one time of only one clutch. In other words, when one clutch is actuated the other clutch is simultaneously and automatically disengaged, so that it is impossible for

75 the two clutches to be actuated or engaged at the same time.

The operation of the system illustrated in the drawings is as follows. By changing the position of lever 40 from its neutral position

80 to its ahead or astern position, the direction of the flow of oil (under pressure from tank 32) is changed in pipes 36 and 37 so that the propeller 24 is caused to rotate in either a right-hand or left-hand direction, causing

85 the ship or boat to move ahead (forward) or astern (backward). With the lever 40 in its neutral position and oil pipes 36 and 37 in communication with the sump 34, and engine

90 6 running counter-clockwise looking from the propeller, the gears 22 and 23 will be rotating in the direction indicated by the arrows in Fig. 1, the two clutches 11 and 21 will be

95 disengaged and the propeller will remain stationary. When the lever 40 is moved to its ahead position, the clutch 11 is actuated and clutch 21 disengaged, whereby power is

100 transmitted from the engine 6 through the clutch 11 to the pinion 28 to the propeller shaft gear 27, causing the propeller to rotate in a clockwise direction, and the boat to move ahead (forward).

To reverse the direction of rotation of the propeller, the lever 40 is moved to its astern position. The clutch 21 is thereby actuated

105 and the clutch 11 disengaged, whereupon power is transmitted from the engine 6 through gears 22 and 23, clutch 21 and pinion 29 to the propeller shaft gear 27, causing the propeller to rotate in a counter-clockwise direction and the boat to move astern (back-

110 ward).

In Fig. 5 of the drawings, I have diagrammatically illustrated an arrangement for effecting control of the direction of rotation

115 of the propeller and the speed of the ship's engine by a single means, which may be located in the pilot house or in the engine-room, or wherever convenient. A cam follower 41 actuates in any appropriate man-

120 ner the throttle or other speed controlling device of the ship's engine. Appropriate movement of the cam follower 41 for effecting the desired speed control of the engine is obtained by a cam 42 secured to the lever 40

125 to turn with the lever about its pivot point. Movement of the lever 40 through the angles *a* and *b* effects the actuation of the head-motion clutch or the astern-motion clutch, as the case may be. But this movement of the

130

lever does not alter the position of the cam follower 41 and the ship's engine operates at its minimum speed, say 100 R. P. M. Movement of the lever 40 through the angle c or d causes the cam follower 41 to move outward towards the pivot point of the lever and thereby the speed controlling devices of the ship's engine are operated to gradually increase the speed of the engine to its maximum or full speed, say 240 R. P. M. During the movement of the lever 40 through the angle c , the ahead-motion clutch remains energized and the astern-motion clutch remains disengaged, and similarly during the movement of the lever 40 through the angle d the astern-motion clutch remains energized and the ahead-motion clutch remains disengaged.

The marine propulsion system of the invention is of simple and rugged construction, easily and readily controlled and efficient in operation. The desired speed reduction between a single engine, running always in the same direction and the propeller is secured by an arrangement of permanently engaged gearing, relatively noiseless in operation. The system is of particular advantage in ships which in service must be continually maneuvered, such, for example, as tug-boats. The gearing and power clutches can be designed and constructed for the transmission of very high powers from engine to propeller, and the system of the invention is therefore applicable to equipments in which the power source is of several hundred horse power and higher.

The arrangement of apparatus illustrated in Figs. 1, 2 and 3 of the accompanying drawings is of particular advantage where it is necessary to mount the engine shaft at a higher level than the propeller shaft. It is also of advantage in ships having a single propeller. In ships having twin propellers, the modified arrangement illustrated in Fig. 6 has certain advantages, since it permits convenient mounting of the two ship's engines (one for each propeller) near the center of the ship together with proper arrangement of the reducing gearing and the two propeller shafts.

Referring now to Fig. 6 of the drawings, similar parts have been represented by the same reference character as in Figs. 1, 2 and 3. The arrangement illustrated is for a ship with twin propellers and it is to be understood that the apparatus shown is for the port propeller only; the apparatus for the starboard propeller being identical therewith.

The engine 6' is connected by a flexible coupling 7' to a shaft 43 rotatably mounted in the gear casing 10'. A pinion 44 is secured to the shaft 43 and permanently engages or meshes with gears 45 and 46 positioned on opposite sides thereof. The gears 45 and 46 are secured to the parts 47 and 48 of two-part

main and auxiliary shafts 47—47' and 48—48' respectively. The main and auxiliary shafts are appropriately mounted for rotation in the gear casings 9' and 10'. The three shafts 43, 47—47' and 48—48' are arranged in substantially the same horizontal plane.

The propeller 24' is secured to the main shaft part 47. Permanently engaged gears 49 and 50 are secured to the main shaft part 47' and the auxiliary shaft part 48' respectively. The pinion 44 and gears 45, 46, 49 and 50 are preferably of the herring-bone type. Power clutches 11' and 21' are operatively associated with the shafts 47—47' and 48—48', respectively. These power clutches are of the fluid pressure operated friction disk type illustrated in Fig. 4 of the drawings, and are controlled by instrumentalities of substantially the same construction as illustrated in Fig. 1 for the control of the clutches 11 and 21.

The operation of the system of Fig. 6 is substantially as follows. For ahead-motion, the power clutch 11' is actuated and energized and the power clutch 21' is disengaged. Power is transmitted from the engine 6' to the propeller 24' through the pinion 44, gear 45 and main shaft 47—47'. The gears in the system will rotate in the directions indicated by the full-line arrows and the propeller will be rotated to move the ship forward or ahead. For reversing or astern-motion, the power clutch 21' is actuated and energized and the power clutch 11' disengaged. Power is thereupon transmitted from the engine 6' to the propeller 24' through the pinion 44, gear 46, auxiliary shaft 48—48' and gears 50—49. The pinion 44 and gearing 46 will rotate in the same direction as for ahead-motion, but the gears 49 and 50 will rotate in the opposite direction, as indicated by the dotted line arrows. The propeller will accordingly rotate in a direction to move the ship astern or backward.

I claim:

1. A system of marine propulsion, comprising a propeller, an internal combustion engine, a two-part ahead-motion shaft, a power clutch of the fluid pressure operated friction type adapted to slip under excessive load and arranged to either operatively connect or disengage the two parts of said ahead-motion shaft, a two-part astern-motion shaft, a power clutch of the fluid pressure operated friction type adapted to slip under excessive load and arranged to either operatively connect or disengage the two parts of said astern-motion shaft, permanently engaged gearing for operatively connecting said engine to said propeller through said ahead-motion shaft to effect ahead propulsion when the clutch in that shaft is energized and the other clutch disengaged and for operatively connecting said engine to said propeller through said astern-motion shaft to effect astern propulsion when

the clutch in the latter shaft is energized and the other clutch disengaged, and control means for energizing at will one or the other of said clutches.

5 2. A system of marine propulsion comprising a propeller shaft, an internal combustion engine, a gear secured to said propeller shaft, a two-part main driving shaft having one
10 part thereof directly connected to said engine, a power clutch of the fluid pressure operated friction type adapted to slip under excessive load and arranged to either operative-
15 ly connect or disengage the two parts of said main driving shaft, a gear secured to that part of said main driving shaft between said clutch and said engine, a pinion secured to
20 the other part of said main driving shaft meshing with the gear on said propeller shaft, a two-part auxiliary driving shaft, a power
25 clutch of the fluid pressure operated friction type adapted to slip under excessive load and arranged to either operatively connect or dis-
engage the two parts of said auxiliary driving shaft, a gear secured to one part of said aux-
30 iliary driving shaft meshing with the gear on said main driving shaft, a pinion secured to the other part of said auxiliary driving shaft meshing with the gear on said propeller shaft, and control means for energizing at
will one or the other of said clutches.

3. A system of marine propulsion, comprising a propeller shaft, an engine, a two-part ahead-motion shaft, a two-part astern-motion shaft, a power clutch of the fluid pressure operated friction type adapted to slip
35 under excessive load and operatively associated with each of said ahead-motion and astern-motion shafts and arranged to either operatively connect or disengage the two
40 parts of the shaft, permanently engaged gearing for operatively connecting said engine to said propeller shaft through said ahead-motion shaft to effect ahead propulsion when the clutch in that shaft is energized and the other
45 clutch disengaged and for operatively connecting said engine to said propeller shaft through said astern-motion shaft to effect astern propulsion when the clutch in the latter shaft is energized and the other clutch dis-
50 engaged, and control means for energizing at will one or the other of said clutches.

4. A system of marine propulsion, comprising a propeller shaft, an engine, a two-part ahead-motion shaft having one part thereof
55 directly connected to the shaft of said engine, a two-part astern-motion shaft, a power clutch operatively associated with each of said ahead-motion and astern-motion shafts and arranged to either connect or disengage
60 the two parts of the shaft, permanently engaged gearing for operatively connecting said engine to said propeller shaft through said ahead-motion shaft to effect ahead propulsion and through said astern-motion shaft to
65 effect astern propulsion, and control means

for energizing at will one or the other of said clutches.

5. A system of marine propulsion, comprising a propeller, an engine, a two-part ahead motion shaft, a two-part astern-motion shaft, 70 a power clutch operatively associated with each of said shafts and arranged to either connect or disengage the two parts of the shaft, said ahead-motion shaft being mounted at a higher level than said astern-motion shaft, 75 permanently engaged gearing for operatively connecting said engine to said propeller through said ahead-motion shaft to effect ahead propulsion when the clutch in that shaft is actuated and the other clutch disen- 80 gaged and for operatively connecting said engine to said propeller through said astern-motion shaft to effect astern propulsion when the clutch in the latter shaft is actuated and the other clutch disengaged, and control 85 means for actuating one or the other of said clutches or simultaneously disengaging both of said clutches as desired.

6. A system of marine propulsion, comprising a propeller shaft, an engine, a two-part 90 ahead-motion shaft, a two-part astern motion shaft, a power clutch operatively associated with each of said ahead-motion and astern-motion shafts and arranged to either connect or disengage the two parts of the shaft, the axes of said propeller and astern- 95 motion shafts being in substantially the same horizontal plane and said ahead-motion-shaft being mounted at a higher level than said propeller and astern-motion shafts, permanently 100 engaged gearing for operatively connecting said engine to said propeller shaft through said ahead-motion shaft to effect ahead propulsion and through said astern-motion shaft to effect astern propulsion, and control means 105 for (1) actuating the clutch associated with said ahead-motion shaft and simultaneously disengaging the other clutch and for (2) actuating the clutch associated with said astern-motion shaft and simultaneously dis- 110 engaging the other clutch and for (3) simultaneously disengaging both of said clutches as desired.

7. A system of marine propulsion, comprising a propeller shaft, an engine, a two-part 115 ahead-motion shaft operatively connected to said engine, a two-part astern-motion shaft, a clutch operatively associated with each of said ahead-motion and astern-motion shafts and arranged to either connect or disengage 120 the two parts of the shaft, the axes of said propeller and astern-motion shafts being in substantially the same horizontal plane and the axes of said propeller and ahead-motion shafts being in substantially the same vertical 125 plane with the ahead-motion shaft at a higher level than the propeller shaft, permanently engaged gearing for operatively connecting said engine to said propeller shaft through said ahead-motion shaft to effect ahead pro- 130

pulsion and through said astern-motion shaft to effect astern propulsion, and control means for (1) actuating the clutch associated with said ahead-motion shaft and simultaneously disengaging the other clutch and for (2) actuating the clutch associated with said astern-motion shaft and simultaneously disengaging the other clutch and for (3) simultaneously disengaging both of said clutches as desired.

8. A system of marine propulsion, comprising a propeller shaft, an engine, a two-part ahead-motion shaft having one part thereof directly connected to the shaft of said engine, a two-part astern-motion shaft, a clutch operatively associated with each of said ahead-motion and astern-motion shafts and arranged to either connect or disengage the two parts of the shaft, said engine shaft being mounted at a higher level than said propeller shaft, permanently engaged gearing for operatively connecting said engine to said propeller shaft through said ahead-motion shaft to effect ahead propulsion and through said astern-motion shaft to effect astern propulsion, and control means for (1) actuating the clutch associated with said ahead-motion shaft and simultaneously disengaging the other clutch and for (2) actuating the clutch associated with said astern-motion shaft and simultaneously disengaging the other clutch and for (3) simultaneously disengaging both of said clutches as desired.

9. A system of marine propulsion, comprising a propeller shaft, an engine, a two-part ahead-motion shaft having one part thereof directly connected to the shaft of said engine, a power clutch of the fluid pressure operated friction type adapted to slip under excessive load and arranged to either operatively connect or disengage the two parts of said ahead-motion shaft, a two-part astern-motion shaft, a power clutch of the fluid pressure operated friction type adapted to slip under excessive load and arranged to either operatively connect or disengage the two parts of said astern-motion shaft, permanently engaged gearing for operatively connecting said engine to said propeller shaft through said ahead-motion shaft to effect ahead propulsion when the clutch in that shaft is energized and the other clutch disengaged, and for operatively connecting said engine to said propeller shaft through said astern-motion shaft to effect astern propulsion when the clutch in the latter shaft is energized and the other clutch disengaged, and control means for energizing at will one or the other of said clutches.

10. A system of marine propulsion, comprising a propeller shaft, a propeller operatively connected to said shaft, a gear secured to said propeller shaft, an engine, a two-part driving shaft operatively connected to said engine, a power clutch of the fluid pressure operated friction disk type opera-

tively associated with said shaft and arranged to either connect or disengage the two parts thereof, a gear on that part of said driving shaft between said clutch and said engine, a pinion on the other part of said driving shaft meshing with the gear on said propeller shaft, a two-part auxiliary shaft, a power clutch of the fluid pressure operated friction disk type operatively associated with said auxiliary shaft and arranged to either connect or disengage the two parts thereof, a gear on one part of said auxiliary shaft meshing with the gear on said driving shaft, a pinion on the other part of said auxiliary shaft meshing with the gear on said propeller shaft, and means for engaging one or the other of said clutches or simultaneously disengaging both of said clutches as desired.

11. A system of marine propulsion, comprising a propeller shaft, a propeller operatively connected to said shaft, a gear secured to said propeller shaft, an engine, a two-part driving shaft operatively connected to said engine, a clutch arranged to operatively connect or disengage the two parts of said driving shaft, a gear on that part of said driving shaft between said clutch and said engine, a pinion on the other part of said driving shaft meshing with the gear on said propeller shaft, a two-part auxiliary shaft, a clutch arranged to operatively connect or disengage the two parts of said auxiliary shaft, a gear on one part of said auxiliary shaft meshing with the gear on said driving shaft, a pinion on the other part of said auxiliary shaft meshing with the gear on said propeller shaft, said driving shaft being mounted at a higher level than said propeller shaft, and means for engaging one or the other of said clutches or simultaneously disengaging both of said clutches as desired.

12. A system of marine propulsion, comprising a propeller shaft, a propeller operatively connected to said shaft, a gear secured to said propeller shaft, an engine, a two-part driving shaft operatively connected to said engine, an ahead-motion power clutch arranged to either operatively connect or disengage the two parts of said driving shaft, a gear secured to that part of said driving shaft between said clutch and said engine, a pinion secured to the other part of said driving shaft meshing with the gear on said propeller shaft, a two-part reversing shaft, the axes of said propeller and reversing shafts being in substantially the same horizontal plane and the axes of said propeller and driving shafts being in substantially the same vertical plane with the driving shaft at a higher level than the propeller shaft, an astern-motion power clutch arranged to either operatively connect or disengage the two parts of said reversing shaft, a gear secured to one part of said reversing shaft meshing with

the gear on said driving shaft, a pinion secured to the other part of said reversing shaft meshing with the gear on said propeller shaft, and control means for (1) actuating
5 said ahead-motion clutch and simultaneously disengaging said astern-motion clutch to effect ahead propulsion and for (2) actuating said astern-motion clutch and simultaneously disengaging said ahead-motion clutch to effect astern propulsion and for (3) 10 simultaneously disengaging both of said clutches as desired.

In testimony whereof I affix my signature
THOMAS C. COYKENDALL.