

May 29, 1928.

1,671,480

J. F. METTEN

SHIP PROPULSION SYSTEM

Filed Aug. 12, 1925

2 Sheets-Sheet 1

Fig. 1.

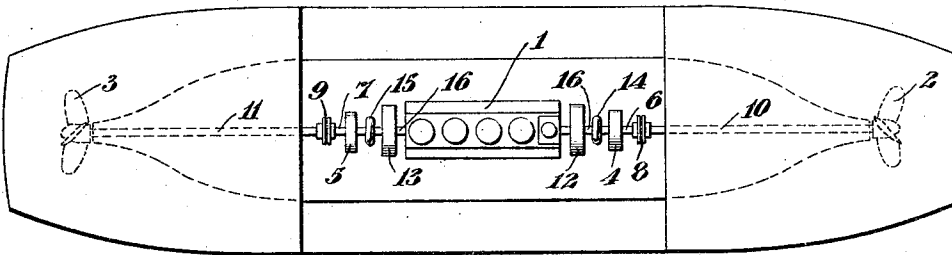
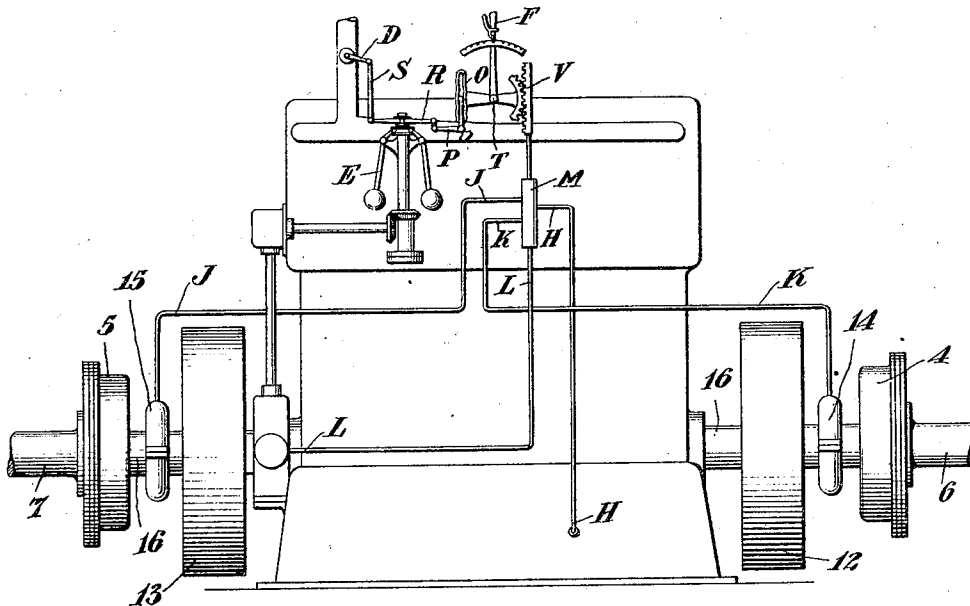


Fig. 2.



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2 Sheets-Sheet 2

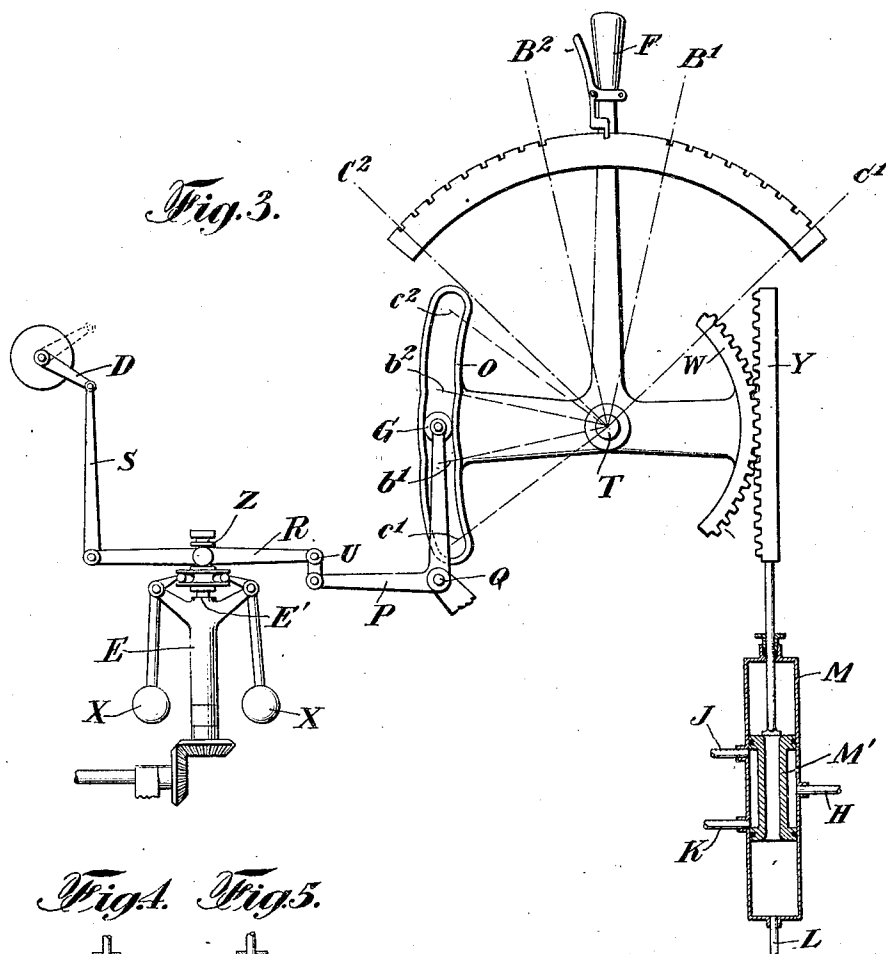


Fig. 4. Fig. 5.

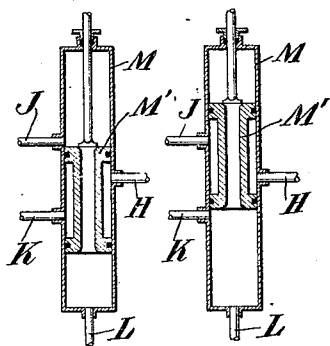
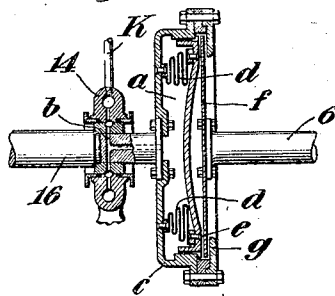


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN F. METTEN, OF PHILADELPHIA, PENNSYLVANIA.

SHIP-PROPULSION SYSTEM.

Application filed August 12, 1925. Serial No. 49,692.

This invention relates to a system of propulsion for ships driven by internal combustion engines or other types of engine requiring special equipment to adapt them to be reversed or to start under load.

The object of the invention is to provide a propulsion system having a simple, easily-operated control, and permitting rapid maneuvering of a ship driven by an internal combustion engine.

A further object of the invention is to provide a simple rugged construction capable of transmitting large powers without cumbersome expensive apparatus.

The usual oil engine drive requires an engine having special reversing gear and maneuvering air tanks. Electrical means have been employed in an effort to utilize the non-reversible engine with its inherent advantages. In this system the engine drives a generator supplying current to a motor coupled to a propeller shaft, the reversing being accomplished within the electrical apparatus. The electric drive, however, is unsatisfactory, due to the expense, weight and low efficiency resulting from the electrical losses involved.

My system avoids these objections and has the additional advantage of great power available for going ahead or astern at the moment the reversal takes place, due to energy stored in the flywheel and other revolving parts which would not be available if the engine were brought to a dead stop and started on air in the reverse direction.

My system of propulsion is particularly applicable to ferry boats, or similar vessels, where much maneuvering is required.

Fig. 1 is a diagrammatic plan view showing the arrangement as installed in a ferry boat, the vessel being driven in either direction alternately by propellers at either end.

Fig. 2 is a diagrammatic elevation showing the engine with hand and governor control gear and clutches to larger scale.

Fig. 3 is a still larger scale drawing of hand control gear and governor control, with a section through oil control valve in neutral position.

Figs. 4 and 5 are sections of the oil control valve in the two different running positions.

Fig. 6 is a section through one of the oil clutches and oil supply bearings.

Referring to Fig. 1, the non-reversible engine 1 alternately drives the propellers 2

and 3 through clutches 4 and 5, intermediate shafts 6 and 7, flexible couplings 8 and 9, and propeller shafts 10 and 11. The change in direction of the vessel is accomplished by the opposed pitch of the propellers; thus, when propeller 2 is rotated by the engine the ship is driven forward in one direction and propeller 3 is allowed to revolve idly. If propeller 3 is clutched to the engine instead of propeller 2, the ship is driven in the reverse direction. The engine is run continuously at low or idling speed when neither propeller is engaged, and at high speed after clutching has taken place.

The main engine has on its crankshaft 16 flywheels 12 and 13 and is fitted with special bearings 14 and 15 for admitting oil to the clutches 4 and 5. These clutches are preferably of the type disclosed in my Patent No. 1,157,793 and shown in section in Fig. 6. Oil under pressure is admitted to chamber *a* of the clutch through a passage in bearing 14 and holes *b* in the crankshaft 16 in order to cause the clutch to grip the shaft 6 to the engine crankshaft 16. A clutch casing *c* carrying an expansion ring *d* is mounted on the crankshaft 16. The diaphragm *e* is fastened to the expansion ring *d*. The disc *f* is mounted on intermediate shaft 6 and may adjust itself with respect to ring *g* by a small axial movement permitted by flexible coupling 8 shown in Fig. 1. The surfaces of diaphragm *e* and ring *g* adjacent to the disc periphery are lined with asbestos lining material. It will be apparent that when oil is forced under pressure into the chamber *a*, the diaphragm *e* will be forced against the tension of the expansion ring, *d*, and the disc *f* will be frictionally gripped between the ring *g* and the diaphragm *e*. It is essential that this gripping action be gradual and the size of the supply pipe and the oil chamber, *a*, must therefore be so proportioned as to allow some slippage during the time required to build up oil pressure in the chamber *a*.

The control system is shown in Figs. 2 and 3. Oil is supplied under pressure through pipe L from an oil pump (driven by engine or independently driven) to oil control valve, M, which alternately admits oil through pipe K to right hand clutch 4, or through pipe J to left hand clutch 5.

Fig. 4 shows position of the oil control valve when oil under pressure is admitted to the left hand clutch, the oil at the same time

being released and discharged from the right hand clutch through pipes K and H, to oil sump in engine crank case.

Fig. 5 shows the position of the oil control valve when oil is admitted under pressure to the right hand clutch, the oil passing in through center of piston M¹, and at the same time being discharged from the left hand clutch through pipe J, around piston and through pipe H.

When the handle, F, Fig. 3, is in mid position, as shown, the oil control valve, actuated through gear quadrant, W, and rack, Y, is also in mid position, which allows the oil to discharge from both clutches due to pipes K and J being open simultaneously to the discharge pipe H. Under this condition the engine runs under control of the governor, E, operating on engine throttle, D, through lever R, pivoted at U, and links, S and D. The arm, P, which supports lever R, carries a cam roller, G, at its upper end which is guided between faces of sector, O. Between points b^1 and b^2 , this sector is of equal radius from center pin, T. From b^1 to c^1 and b^2 to c^2 the radius of sector increases towards c^1 and c^2 , and accordingly when arm F is moved beyond B^1 and B^2 , corresponding to b^1 and b^2 , the cam roller, G, moves outward and the pivot, U, is moved downward. Just before b^1 or b^2 , moving in the arc b^1-b^2 , reaches the cam roller, G, the piston M¹ in oil control valve uncovers pipe K or J, permitting either one or the other clutch to function, and when the engine tends to slow down under load the governor weights X X drop, which raises collar, Z, opening throttle, D. As cam roller, G, passes beyond points b^1 , or b^2 , the pin, U, moves down, thereby opening the throttle and increasing the engine speed, which in turn causes the collar governor Z to move downwardly into engagement with fixed shoulder E¹ and thereby offsetting the increase in throttle opening, due to movement of pin U, to hold the engine to the same speed. Thereafter the governor coiler Z merely acts as a fixed fulcrum for the lever R. Accordingly, any further downward movement of the pivot U would open the throttle valve and accordingly increase the engine speed, the governor no longer being able to offset the increased speed. It will thus be seen that control has been taken away from the governor and transferred entirely to the handle F for higher speeds of the vessel and engine.

When the control lever is in a position between B^1 and B^2 the engine is under governor control and is running at low speed. Ordinarily all clutching and unclutching operations take place under these conditions. Positions of the control arm between B^1 , C¹ and B^2 , C² control the speed of the ship after clutching has taken place.

Due to the fact that the engine is run-

ning continuously it may develop its full torque in starting and stopping the ship. If, in an emergency, the control lever is thrown into the reverse position, the engine is prepared to deliver its full torque in overcoming the inertia of the reversing shaft and propeller. The friction clutch provides sufficient slippage during the stopping and re-starting in the reverse direction of the reversing shaft to prevent rupture or damage to the engine.

The single control lever provides a single flexible control of the engine for all the operations necessary in maneuvering the ship and insures the proper sequence of operations.

I have for the sake of simplicity shown the invention applied to a boat using propellers at each end to effect reversal but my invention may be applied to a single propeller by any of the common methods in use for driving said propeller in opposite directions. I have also shown a clutch operated by fluid pressure but any suitable type may be used.

I claim:

1. A system of ship propulsion comprising an internal combustion engine, a clutch adapted to connect said engine to a propeller shaft, a governor for said engine adapted to control said engine at low speeds, and means whereby during said low speed manipulation of said clutch may be effected, said means including a manual control for regulating the speed of said engine at high speeds and for operating said clutch.

2. A system of ship propulsion comprising a non-reversing internal combustion engine, clutches for selecting the direction of propulsion, operating means for said clutches, an automatic speed governor for said engine, and a manually operated speed regulator coacting therewith, said regulator being adapted to change the engine power independently of governor movement.

3. A system of ship propulsion comprising a non-reversing internal combustion engine, clutches for selecting the direction of propulsion, an automatic speed governor for said engine, and manually operated control and interlocking means for gripping one of said clutches at a time and for placing said engine under the control of said governor during the gripping and releasing operations of said clutches.

4. A system of ship propulsion comprising an internal combustion engine, a clutch for disconnecting said engine from a propeller shaft, a governor for controlling the speed of said engine while said clutch is being operated, and common manual means for variably controlling the speed of said engine when gripped to said shaft and for operating said clutch.

5. A system of ship propulsion comprising

a non-reversing internal combustion engine, a plurality of driven shafts, clutches for connecting said engine and shafts, means for effecting said connections alternatively, an automatic governor controlling the speed of said engine while maneuvering, and a manual control for use at high speeds when any one of said clutches are connected.

6. A system of ship propulsion comprising a non-reversing internal combustion engine, fluid pressure operated clutches for selecting the direction of propulsion, an automatic governor setting a minimum speed for said engine, a manual control for operating said clutches, and means for increasing the speed of said engine coacting with said manual control.

7. A system of ship propulsion comprising a non-reversing engine, propellers situated at each end of the ship, fluid pressure operated clutches for alternately connecting said engine with said propellers, an automatic governor for said engine, and common manually operated means for governing the speed of said engine and for operating said clutches.

8. A system of ship propulsion comprising a non-reversing engine, a propeller and shaft adapted to drive the ship forward and a propeller and shaft adapted to drive the ship in the reverse direction, fluid pressure operated clutches for connecting said engine with said shafts, an automatic governor controlling the speed of said engine and manually operated means for controlling the speed of said engine when one of said clutches is gripped and for operating said clutches.

9. In a ferry boat, or the like, having a propeller at each end, the combination with, an internal combustion engine adapted to run in only one direction, of means for connecting said engine to said propellers to propel the boat in opposite directions, means to control the power of said engine, and a common controlling element for said connecting and power control means whereby substantially the same effectiveness of control can be had during the driving of either propeller.

10. In a ferry boat, or the like, having a propeller at each end, the combination with an internal combustion engine adapted to run in only one direction, of means for connecting said engine to said propellers to propel the boat in opposite directions, means to control the power of said engine comprising common means to couple said engine alternatively to either propeller and for controlling the engine control means.

11. A system of ship propulsion comprising a non-reversible oil engine, in combination with a plurality of special clutches, an automatic governor control and common controlling means for said governor and

clutches operative to control the speed of said engine while the clutches are disconnected.

12. A system of ship propulsion comprising a non-reversible prime mover in combination with a plurality of fluid pressure operated clutches, a combined hand and governor engine control means, and means for releasing fluid pressure on said clutches whereby the engine is placed under automatic governor control.

13. A system of ship propulsion comprising a non-reversible prime mover, a pair of fluid pressure operated clutches, control means for said prime mover adapted to be operated by hand or by a governor, and means controlled by said hand operated means for applying fluid pressure to engage one of said clutches while disengaging the other of said clutches.

14. A system of ship propulsion comprising a non-reversible prime mover in combination with a pair of clutches and a combined hand and governor control mechanism for controlling power of said prime mover and means for shifting the control from governor to hand control and from hand control to governor, whereby substantially the same effectiveness of control can be had during connection of either clutch.

15. In a ship having propellers for driving alternately from either end, the combination with a non-reversible oil engine, of means for connecting said engine to said propellers, comprising a plurality of fluid pressure operated clutches and governing means for said engine adapted to place said engine under either governor or hand control, whereby substantially the same effectiveness of control can be had during connection of either clutch.

16. A propelling mechanism comprising a motor having a power controlling element, a shaft, a clutch for connecting said shaft and motor, and means for controlling said power element and clutch, said means including a pivotal member having a cam and follower member so arranged as to permit said power controlling element to remain stationary while said clutch is made operative.

17. A propelling mechanism comprising a motor having a power controlling element, a shaft, a clutch for connecting said shaft and motor, and means for controlling said power element and clutch, said means including a member having a cam and follower member so arranged as to permit said power controlling element to remain stationary while said clutch is made operative, and to permit manual operation of said cam member to vary said controlling element after said clutch is engaged.

18. A propelling mechanism comprising a motor having a power controlling element,

a shaft, clutch mechanism for connecting said shaft and motor, means for controlling said power element and clutch including cam means and an actuating handle common to said clutch and power element.

19. A ship propulsion mechanism comprising a motor having a power controlling element, a propeller shaft, fluid actuated clutch mechanism between said motor and shaft, a valve for controlling clutch actuating fluid, linkage connections for actuating said power controlling element, and means for moving said valve to render the clutch operative prior to movement of certain of said linkage connections.

20. A propelling mechanism comprising a motor having a power controlling element, a pair of shafts, clutch mechanisms for alternatively connecting said motor and shafts, and common means for controlling said clutch mechanisms and said power controlling element including means whereby substantially the same effectiveness of control can be had during connection of either clutch.

21. A propelling mechanism comprising a motor having a power controlling element, a shaft, clutch mechanism for connecting said motor and shaft, common means for controlling said clutch and said power element, including a manually operated lever adapted upon initial movement from a neutral position to permit engagement of the clutch and upon continued movement to allow increased power generation by said motor and means whereby said increased power is under the direct control of the manually operated lever.

22. A ship propulsion mechanism comprising a driving motor having a power controlling element, propeller shafts extending in opposite directions from said motor, a clutch mechanism associated with each shaft and adapted to connect the same to said motor, a single controlling handle, and means associated therewith for rendering either one of said clutches operative and for controlling power generation of said motor, including means whereby said handle is movable in one direction to effect con-

trol of one clutch and is movable in a different direction to control the other clutch.

23. A propelling mechanism comprising a motor having a power controlling element, a shaft connectable to said motor, a governor, means for controlling said power element by said governor, manual means for also controlling said element, including means operatively connected to said governor, whereby the manual means can move said power element and hold the governor substantially in a single position.

24. A propelling mechanism comprising a motor having a power controlling element, a shaft connectable to said motor, a governor, means for controlling said power element by said governor, manually operated means for also controlling said element, including means operatively connected to said governor, and means, whereby when said shaft is being connected to said motor said governor will substantially exclusively control said power element, while the manually operated means will remain relatively stationary.

25. A ship propulsion system comprising a prime mover, propeller shafts extending in opposite directions therefrom, a clutch mechanism associated with each shaft for connecting the same alternatively to the prime mover, a power controlling element for said prime mover, and means for controlling said power element and clutch mechanisms including a speed governor adapted to control the power element during low speeds, manually operated means for effecting alternative operation of said clutch mechanisms, manually operated means for operating said power element including linkages pivotally supported and having operative connection with the governor whereby the control of said power element by said governor may be rendered substantially inoperative to thereby allow control of said power element to be vested in manual operation, said manual means for controlling said clutch mechanisms and power element including a common controlling lever.

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