L. Y. SPEAR.

PROPELLING APPARATUS FOR VESSELS.

APPLICATION FILED MAR. 30, 1915.

1,152,567.

Patented Sept. 7, 1915.

2 SHEETS—SHEET 1.

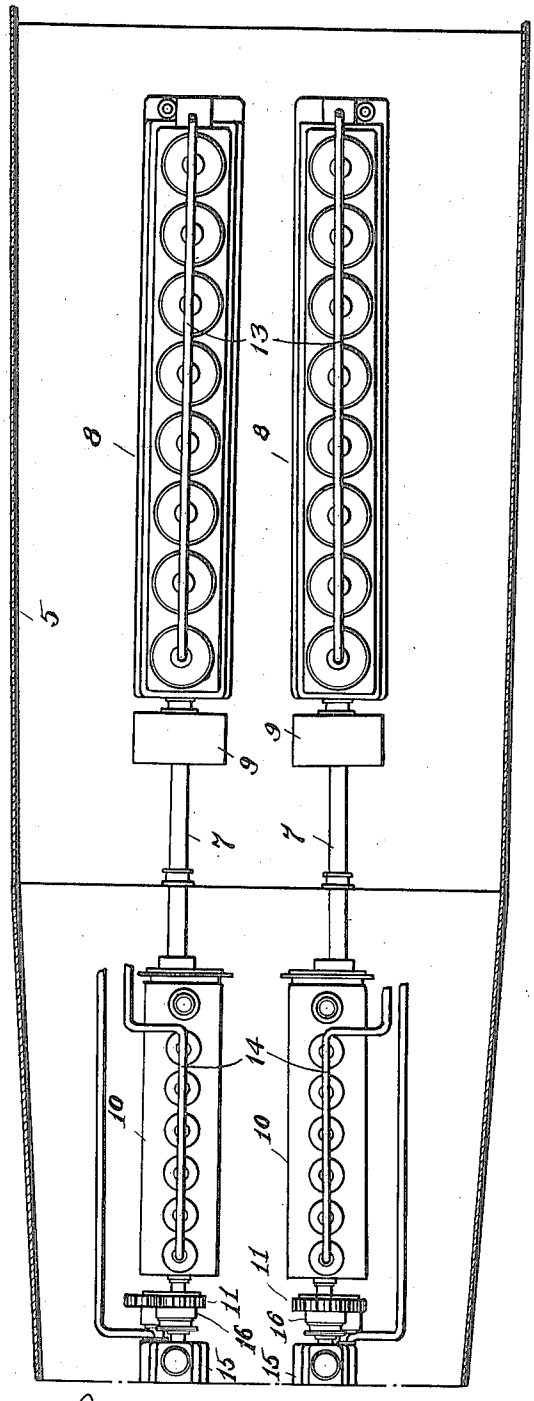

Fig. 1.

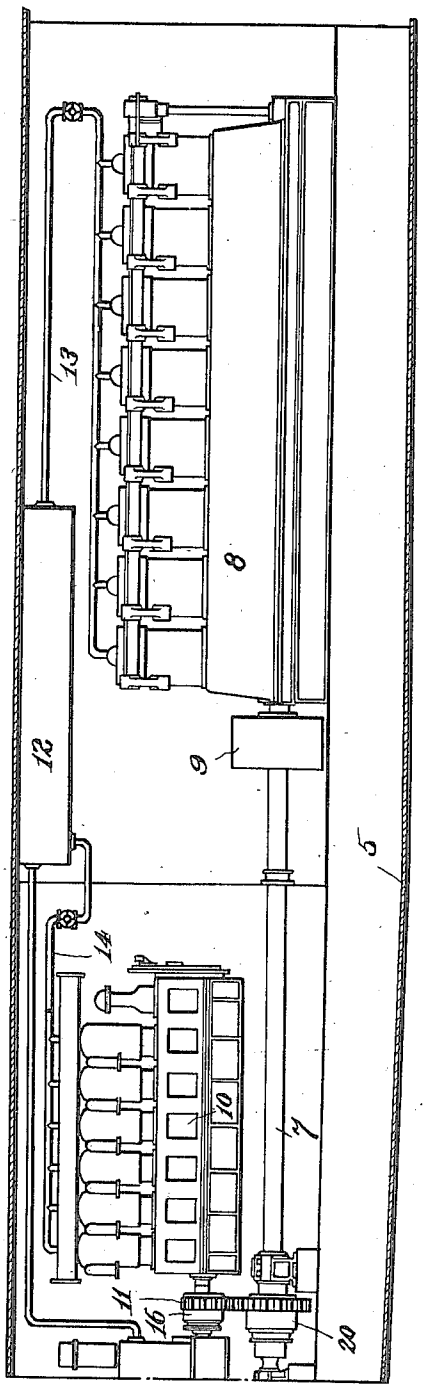

Fig. 2.

WITNESSES

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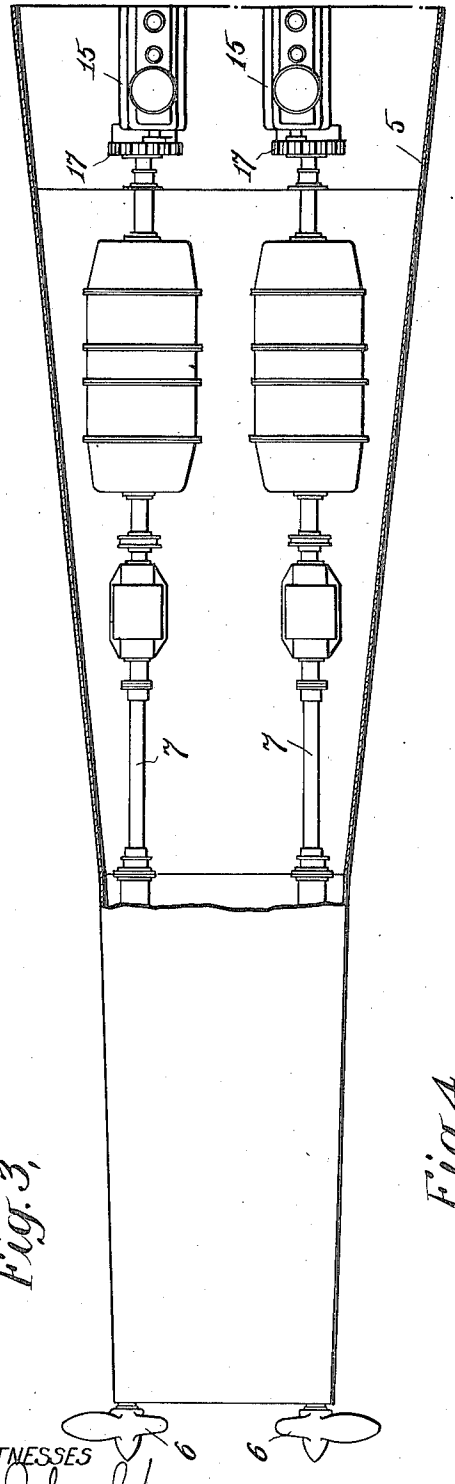

Fig. 3.

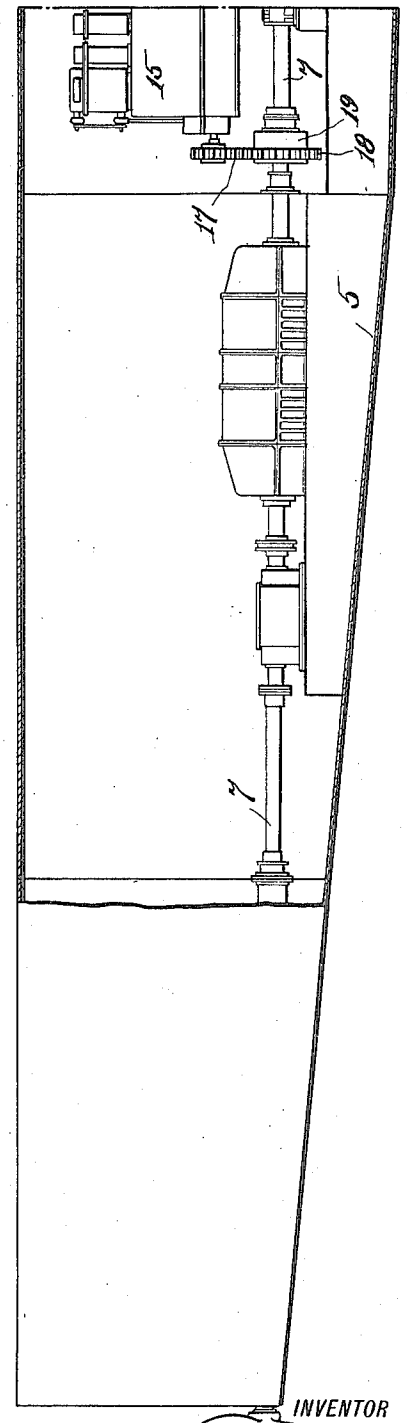

Fig. 4.

WITNESSES

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UNITED STATES PATENT OFFICE.

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PROPELLING APPARATUS FOR VESSELS.

1,152,567. Specification of Letters Patent. Patented Sept. 7, 1915.

Application filed March 30, 1915. Serial No. 17,971.

To all whom it may concern:

Be it known that I, LAWRENCE Y. SPEAR, a citizen of the United States, residing at Groton, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Propelling Apparatus for Vessels, (Case A;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention is directed to the provision of an improved form of apparatus for use in the propulsion of vessels.

While the invention may be employed in the propulsion of vessels of various descriptions, it is of special utility in the propulsion of submarine boats wherein the maximum cruising radius obtainable with a given supply of fuel is a consideration of great importance.

As is well known, engines for the propulsion of vessels operate at their best economy only when running at a particular speed and developing a given amount of power. When a propelling engine is run at a reduced speed and the rate of movement of the vessel reduced, the resistance offered to movement of the vessel is generally reduced to a degree greater than that of the reduction in the speed of the engine; therefore, if the engine operated at the reduced speed with its maximum efficiency, the cruising radius of the vessel with a given supply of fuel could be substantially increased by running at reduced speed. The fact is, however, that the efficiency of the engine falls off very considerably when its speed is reduced, and as a result the cruising radius with a given supply of fuel cannot be materially increased in this way.

This invention involves the provision of a plurality of engines of different sizes for propelling a vessel, these engines being so arranged as to permit of operating them at high efficiency so as to increase the cruising radius obtainable with a given supply of fuel.

In accordance with the invention, two or more propelling engines of different sizes are employed, either of which may be connected to the propeller shaft and operated to propel the vessel. The larger of the two engines when only two are employed, may be used and operated at its highest efficiency to propel the vessel at high speed; the smaller engine may be employed and operated at its highest efficiency when cruising at lower speed and this engine may also serve as an auxiliary in connection with the operation of the larger engine. Preferably both of the engines are internal combustion engines of the type employing oil as the fuel and operating upon the Diesel cycle. With such engines it is common to provide a supply of compressed air for use in scavenging and combustion, in forcing the fuel oil into the cylinders and for other purposes, such for instance, as in starting the engine in operation. In the preferred embodiment of the invention, an air compressor is provided for compressing air in a suitable reservoir, this compressor being arranged for connection to the smaller or auxiliary engine whereby it may be driven to supply compressed air for use in the operation of the larger or main engine; also, suitable gearing is provided whereby the larger engine, the smaller engine, and the air compressor may be connected to the propeller shaft and disconnected therefrom as desired.

With the several elements of the apparatus constructed and arranged in this manner, the vessel may be propelled at high speed by the main engine with the latter operating at its best efficiency and air for use in the operation of the main engine may be supplied by the air compressor driven by the smaller engine. For cruising at a slightly reduced speed, the operation of the smaller engine may be discontinued and the compressor for supplying air to the main engine may be coupled to that engine or to the propeller shaft driven thereby. For cruising at low speed the small engine only is used, this being run at such speed that it operates at its best efficiency, the small engine being connected to the propeller shaft and the larger engine disconnected therefrom.

Such an apparatus as that above outlined is illustrated in the accompanying drawings which show one form of apparatus with which the invention may be employed; it will be understood, however, that this apparatus is illustrated as typical of apparatus which may be employed in the practice of

the invention and that changes in the construction and arrangement of the parts may be made while still retaining the characteristic features of the invention.

In these drawings, Figures 1 and 2 are horizontal and vertical sections of a portion of a submarine boat, and Figs. 3 and 4 are similar views constituting extensions of Figs. 1 and 2 respectively.

Referring to these drawings, the hull of a submarine boat is indicated diagrammatically at 5. Twin propellers 6 are provided for the propulsion of the boat, these propellers being mounted at the stern of the boat on the projecting ends of the propeller shafts 7 which rotate in suitable bearings secured upon the frame of the boat. A main engine 8 is provided for driving each of the propeller shafts 7. Each of the two engines 8 is preferably an internal combustion engine of the Diesel type and each is connected to the corresponding propeller shaft 7 by means of a clutch illustrated diagrammatically at 9. In addition to the main engine 8, a smaller auxiliary engine 10 is provided for driving each of the propeller shafts 7. These auxiliary engines are also preferably internal combustion engines of the Diesel type. Each of the auxiliary engines is connected to the corresponding shaft 7 through a clutch as indicated diagrammatically at 20, whereby the engine may be connected to and disconnected from the propeller shaft. In the drawings the auxiliary engines are shown as adapted for connection to the corresponding propeller shafts by means of coacting gears 11.

A compressed air reservoir is shown at 12 from which compressed air is supplied by means of pipes 13 and 14 to the inlet valves of the several cylinders of both the large engine 8 and the small engine 10 in order to force the liquid fuel into the cylinders of the engines when the inlet valves are open. Compressed air is supplied to the reservoir 12 by air compressors 15, each of which is arranged to be connected to both the corresponding auxiliary engine 10 and the corresponding propeller shaft 7. Preferably, the air compressor is arranged with its shaft in alinement with the shaft of the auxiliary engine 10 and a clutch is provided as shown at 16 whereby the compressor may be connected to the auxiliary engine so as to be driven thereby. The opposite end of the shaft of the compressor 15 carries a gear 17 meshing with a gear 18 which may be connected to and disconnected from the propeller shaft 7 by a clutch 19.

With the parts thus constructed, the vessel may be propelled at high speed by means of the main engines 8, operating those engines at their most economical speed and connecting the engines to the propeller shafts 7 by means of the clutches 9 and disconnecting the smaller engines 10 and the air compressors 15 from the propeller shafts 7 by means of the clutches 20 and 19. When operating at high speed in this manner, the air required for the operation of the main engines 8 may be supplied by the air compressors 15, the latter being driven by the auxiliary engines 10 through the clutches 16. The use of the smaller engines 10 may be discontinued if desired with some reduction in the speed of the vessel by connecting the air compressors 15 to the propeller shafts 7, this being done by disconnecting the air compressors from the auxiliary engines by means of the clutches 16 and connecting them to the propeller shafts by means of the clutches 19. For cruising at a substantially reduced speed, the smaller engines 10 may be employed to propel the vessel and the operation of the main engines 8 discontinued, this being done by disconnecting the main engines from the propeller shafts at the clutches 9 and connecting the smaller engines to the propeller shafts with the clutches 20. The air compressors 15 would then be disconnected as the small engines 10 would receive air from their own compressors. Under these conditions the smaller engines 10 may be operated at their best economy to propel the vessel at the desired speed. It is thus apparent that whether the vessel be propelled at the high speed or at the low speed, the propelling engines will be run at the speeds at which they operate with the greatest efficiency and as a result the maximum cruising distance will be obtained with a given supply of fuel.

What I claim is:

1. In a vessel, propelling apparatus comprising the combination of a propeller shaft, two internal combustion engines of different sizes, and means for mechanically connecting either of the two engines at will to the propeller shaft to drive the latter and thus propel the vessel, whereby the vessel may be propelled at different speeds with the propelling engine operating at high efficiency; substantially as described.

2. In a vessel, propelling apparatus comprising the combination of a propeller shaft, a main internal combustion engine, means for connecting the main engine to and disconnecting it from the propeller shaft, a second internal combustion engine, an air compressor supplying air for the main engine, and means for connecting the second engine to either the air compressor or to the propeller shaft; substantially as described.

3. In a vessel, propelling apparatus comprising the combination of a propeller shaft, a main internal combustion engine, means for connecting the main engine to and disconnecting it from the propeller shaft, a second internal combustion engine, an air compressor supplying air for the main en-

gine, and means for connecting the air compressor to either the second engine or the propeller shaft; substantially as described.

4. In a vessel, propelling apparatus comprising the combination of a propeller shaft, a main internal combustion engine, means for connecting the main engine to and disconnecting it from the propeller shaft, a second internal combustion engine, an air compressor supplying air under pressure to the main engine, means for connecting the second engine to and disconnecting it from either the air compressor or the propeller shaft, and means for connecting the air compressor to and disconnecting it from the propeller shaft; substantially as described.

5. In a vessel, propelling apparatus comprising the combination of a propeller shaft, a main internal combustion engine, means for connecting the main engine to and disconnecting it from the propeller shaft, a second internal combustion engine, an air compressor supplying air for the main engine, and means for connecting the air compressor to either engine so as to be driven thereby; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

LAWRENCE YORK SPEAR.

Witnesses:
T. L. BRAKE,
W. D. FESLER.