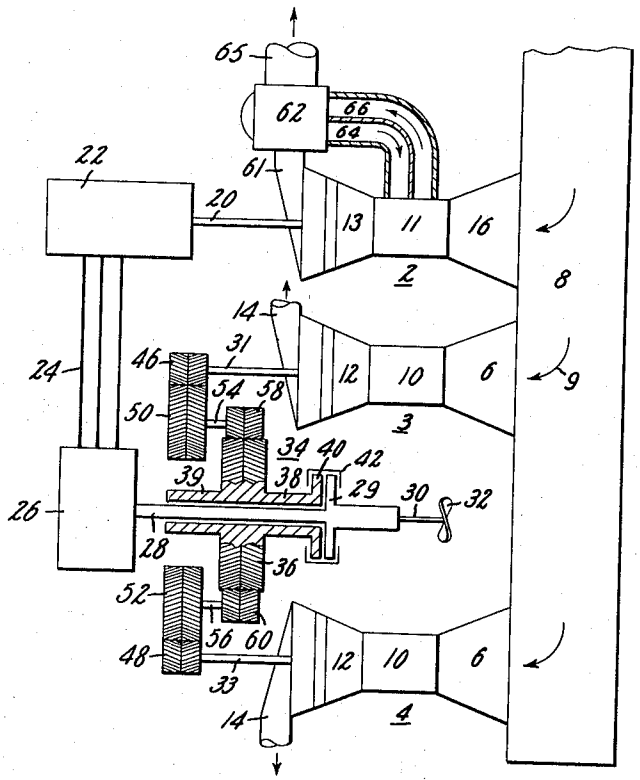
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PROPULSION POWER SYSTEM

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PROPULSION POWER SYSTEM

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My invention relates to a system for propelling water vehicles and more particularly to a propulsion system for ships that features interchangeability between a quiet gearless drive and a conventional drive.

In the operation of ships and other water vehicles, it is often desirable to interchange between a ship's conventional propulsion system, which has a tendency to generate some noise, and an alternate drive which is almost completely silent. Both drives should be capable of operating the same propeller, and the silent drive should also be capable of operating in conjunction with the conventional high speed drive during normal operation, to add more power thereto. Ship propulsion drives presently employed require gearing or other high noise level transmission equipment even during the most silent operation available. In one particular propulsion system presently in use, the propeller is driven through conventional gearing for normal high speed operation and, even for silent operation the propeller is still driven through a substanital part of this same noisy gearing system. Thus, the desired silent operation is not in reality achieved. A ship propulsion system is then needed wherein substantially noiseless, gear free, operation is available when desired. My invention envisions a water vehicle propulsion system having two interrelated drives which both operate the same propeller, one drive which is gearless for use during silent operation and another which is employed for conventional high speed operation.

The chief object of my invention is the provision of a water vehicle propulsion system having a silent, gearless, drive.

Another object of my invention is the provision of a ship propulsion system which has a silent drive and a conventional drive which both operate the same propeller.

A further object of my invention is the provision of a ship propulsion system which employs a noiseless drive which may be used alone or in conjunction with the main propulsion system, to drive the ship.

These and other objects of my invention will be more readily perceived from the description which follows:

In carrying out the objects of my invention, I provide a propulsion system for ships which has alternative turbine drives, a conventional high speed drive and a silent gear-free drive, both of which drive the same propeller, the latter drive being capable of operating alone or in conjunction with the high speed drive to increase the power thereof. Significantly, the silent drive is substantially noiseless, not requiring any gears for its operation.

The attached drawing illustrates a preferred embodiment of my invention in which:

The figure is a view of the ship propulsion system of my invention.

In the figure there is shown a view partially in cross section of the ship propulsion system which embodies my invention. The construction includes gas turbines **2**, **3**, and **4** which provide the propulsion force to drive the water vehicle, such as a ship. Turbines **3** and **4**, which are conventional single shaft, simple cycle combustion gas turbines, comprise compressor **6**, combustion system **10** and turbine wheel **12**. In operation, air is brought into compressor **6**, as shown by arrows **9** from the atmosphere by a suitable air inlet within the ship, such as plenum **8**. The air pressure is substantially increased in compressor **6** and then the air is passed through combustion system **10**

wherein fuel is injected and burned therein in the presence of the compressed air. The working fluid, consisting of hot gases resulting from the burning process now expands through turbine wheel **12** to generate mechanical motion and drive suitable transmission means, such as shaft **31** to provide the ship with the required power for effective propulsion. The hot gases after driving turbine wheel **12** are exhausted to the atmosphere through duct **14**, as shown by arrow **15**. The turbine described is but one of many that can be successfully employed with my propulsion system. Alternatively, two turbine wheels may be employed in place of single turbine wheel **12** to form a simple cycle, two shaft combustion turbine. In this case, the first turbine wheel, which operates at high pressure, exhausts the hot gases emanating therefrom to the second turbine wheel, which operates at low pressure to drive a suitable output, such as shaft **31**. This arrangement permits output shaft speed variations independent of compressor speed when desired. Another type of turbine that may be employed is a regenerative cycle turbine, which is illustrated with respect to turbine **2**. This turbine is exactly the same as turbines **3** and **4** except that the gas exhausting through duct **61** is employed to heat the compressed air before it enters combustion system **11**. The compressed air passes from compressor **16** into the area of combustion system **11**, wherein it is bled off through passage **66** to be heated in regenerator **62** by the exiting exhaust gas. The heated compressed air then passes back through passage **64** and into combustion system **11** wherein it is mixed with fuel and ignited in the same manner as before. By using regenerator **62**, the amount of fuel needed to achieve the proper combustion in chamber **11** is substantially reduced. In a like manner, as aforementioned, one or two turbine wheels are employed, at **13**, to finally provide the mechanical output that drives shaft **20**. Also, the regenerator as described with respect to turbine **2** may also be successfully employed with either or both of the other turbines, **3** and **4**. A steam turbine or diesel engine can also be employed in place of any or all of the turbines aforementioned. It will thus be appreciated that there are many types of prime movers, some of which have been described, which can be successfully employed with my invention, for effectively imparting power to propeller **32**.

The mechanical power produced by turbine **2** enters generator **22**, which is preferably a water tight marine type generator, to be converted therein to electrical energy. Suitable electrical transmission means, such as wires **24**, transmit the electrical energy to motor **26** which in turn converts the energy back into mechanical energy to impart the spinning motion to shaft **28**, and thereby propeller shaft **30** and thrust producing means or propeller **32** to drive the ship. Thus during silent operation when turbine **2** previously described is the sole means of propulsion for the ship, power transmission between turbine **2** and propeller **32** is accomplished without any gearing or other noisy transmission system, save what is inherent in the turbine motor and generator themselves. Therefore, silent, substantially noise-free operation is achieved for propelling the ship or other water vehicle when noise suppression is essential to the successful completion of the ship's journey. Motor **26** may be reversible so that the direction of propeller **32** may be reversed if desired for rearward motion of the ship. It is noted that alternatively shaft **20** and shaft **28** may be combined so that turbine **2** directly drives propeller **32** with no auxiliary equipment therebetween. Also by the use of generator **22** and motor **26**, the positioning of turbine **2** with respect to propeller **32** is not critical since the only connection between the two is by means of electrical wires **24**. Thus, by the use of motor **26** and generator **22** turbine **2** can be positioned as desired with-

out regard to the position of propeller **32**, and also reversibility can be employed, when desired. It is also noted that a battery, a fuel cell, a reactor, a hydraulic system or other suitable energy generation means may be employed in place of turbine **2**, to drive motor **26**.

Turbines **3** and **4** provide the main propulsion means by respectively driving shafts **31** and **33**, which interconnect by means of gear train **34** to propeller shaft **30** and thereby to propeller **32**, to drive the ship. The principal gear of gear train **34** is main gear **36** which is positioned perpendicular to and surrounding shaft **28**, but spaced therefrom. Extension **38** of gear **36** proximate propeller **32** and extension **30** on the other side thereof provide the requisite support to the gear to insure its correct position and alignment and thereby proper operation thereof. The remainder of gear train **34** will be discussed at a later point. A suitable joining means such as a clutch, as provided to connect gear train **34** through gear **36** to shaft **28**, for turbines **3** and **4** to transmit their power through the gear train to shaft **28** and thereby to propeller **32**. A preferable means of effectuating this joining is to provide flange **29** on shaft **28**, perpendicular thereto and mating flange **40** which projects from extension **38** of gear **36**, also perpendicular thereto, and to shaft **28**. Clutch **42** is suitably controlled to interconnect flanges **40** and **29** and thereby gear train **34** with shaft **28** to thereby transmit power to propeller **32**. Gear train **34** preferably consists of the minimum number of gears to effectively transmit the rotary motion of shafts **31** and **33** to propeller **32** to impart motion thereto and thereby drive the ship. The forces inherent in the transmission of power and other factors such as vibration of the ship are taken into consideration in proper choice of the gear train to insure optimum operation of the system. A preferred embodiment of this gear train, as illustrated in the drawing, comprises gears **46** and **48** which are rigidly connected to shafts **31** and **33** respectively. Intermeshed with gears **46** and **48** are larger gears **50** and **52** which are connected by small stub shafts **54** and **56** to gears **58** and **60** which then intermesh with main gear **36** to transmit power from the turbines to propeller **32**. The gears employed are helical gears but may be spur gears or any other suitable type of gearing that effectively transmits high speed power. It is thus seen that turbines **3** and **4** effectively transmit power to propeller **32** for normal operation of the ship. A particular embodiment of the transmission system for transmitting the power of turbines **3** and **4** to the propeller is illustrated, but it will be appreciated that there are many embodiments of gear trains and other transmission equipment which may be successfully employed for conveying the power of the turbines to propeller **32**.

In operation, turbines **3** and **4** are employed together to drive propeller **32**, through clutch **42**, or alternatively are used in conjunction with turbine **2**, which is employed as aforementioned, so that all three turbines impart their power to drive propeller **32** during high speed operation. It is also noted that either turbine **3** or **4** may be disconnected and the other turbine employed to drive propeller **32** alone, if desired. During silent or cruise operation of the ship, turbine **2** alone drives propeller **32** so that the inherently noisy gearing train **34** is completely eliminated, and preferably remains stationary during this mode of operation. It will be appreciated that the number and arrangement of turbines and also the exact type

of turbines illustrated are merely preferred embodiments of many that may be successfully employed for operation of my propulsion system.

It is further noted that other water movement means, such as jet propulsion, may be employed in place of propeller **32** to drive the ship.

It will be appreciated from the foregoing that my invention attains the objectives set forth. Apparatus embodying the invention is sturdy in construction and well adapted for use in conjunction with ship propulsion. Because of the elimination of the noisy, gearing transmission system during silent operation, the propulsion system may be successfully employed where noise is a barrier to successful operation.

A specific embodiment of my invention has been illustrated but the invention is not limited thereto, since many modifications may be made by one skilled in the art and the appended claim is intended to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

A propulsion system for driving ships comprising
a propeller,
a rotatable shaft integral with said propeller having a flange thereon,
a first propulsion drive comprising
a plurality of gas operated turbines,
a second propulsion drive comprising
a gas operated turbine having a compressor combustion area, turbine wheel and regenerator,
regenerative means connected to said second propulsion drive to increase the efficiency thereof comprising a passageway for feeding compressed air from the combustion area to the hot regenerator and another passageway for returning the heated air to said combustion area, said regenerator being heated by the hot exhaust gas exiting from said combustion area,
a generator driven by said second propulsion drive,
a motor, which is electrically driven by said generator, which directly drives said rotatable shaft and thereby said propeller to propel the ship in a substantially silent manner,
a gear, which surrounds said rotatable shaft, having a flange which is adaptable to be connected to said flange on said rotatable shaft,
a gear train, driven by said first propulsion drive, which in turn drives said gear, and
clutch means which is adapted to connect the flange of said gear and the flange of said rotatable shaft so that power from said first propulsion drive may be employed when desired to propel said propeller in conjunction with the power of said second propulsion drive.

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