Feb. 17, 1959 N. LYRITZIS 2,873,587

COMBINATION SPARE AND SERVICE TAIL SHAFT ASSEMBLY

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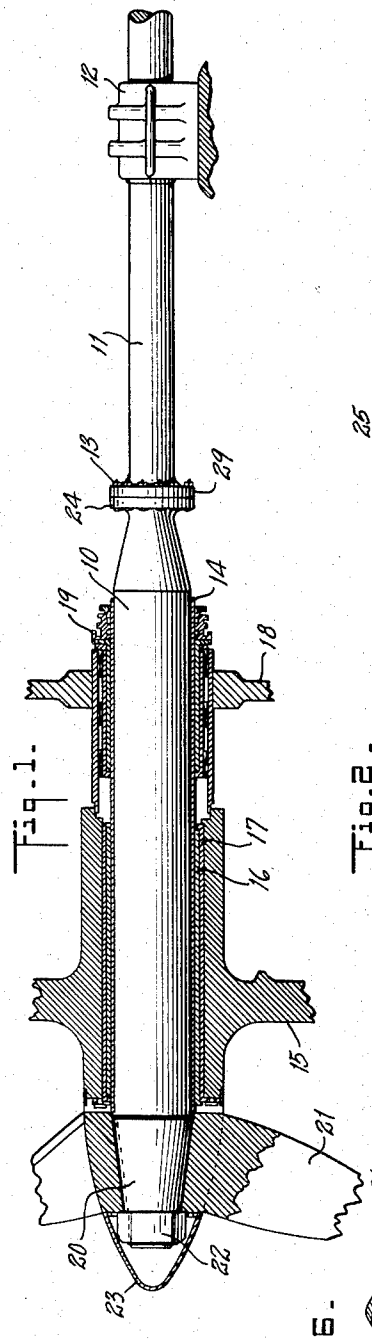


Fig. 1.

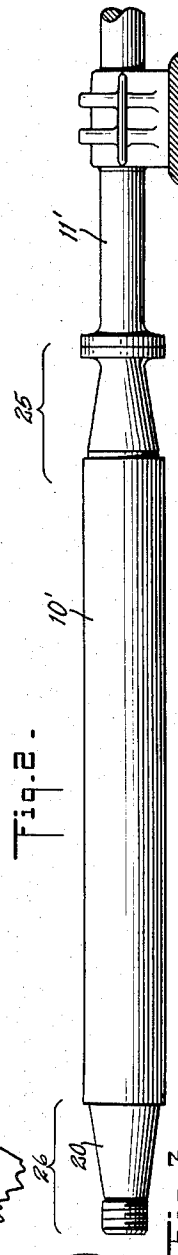


Fig. 2.

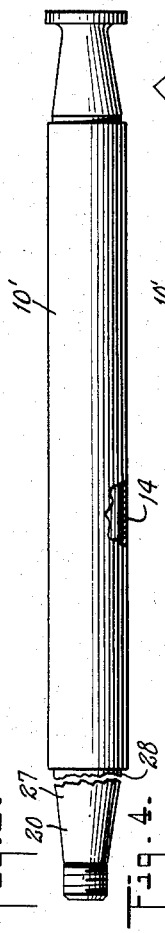


Fig. 3.

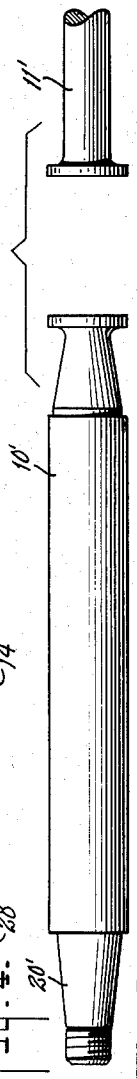


Fig. 4.

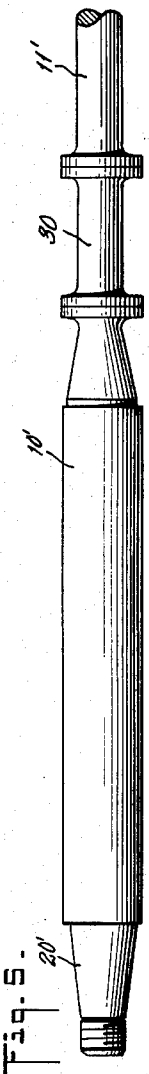


Fig. 5.

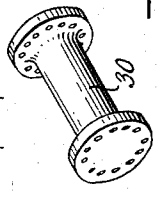


Fig. 6.

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COMBINATION SPARE AND SERVICE TAIL SHAFT ASSEMBLY

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7 Claims. (Cl. 64—1)

This invention relates to combination spare and service tail shaft assemblies and more particularly to tail shafts for steamships which are repairable thereby permitting their continued use after the portion to which the propeller is keyed breaks or in some manner is sheared off from the remainder of the tail shaft.

Steamships presently in use are powered by one or more propellers, depending upon the size and weight of the ship. The propeller is keyed on the conical end of the tail or propeller shaft, which is in turn coupled to the intermediate shaft. The power source of the ship is connected to the intermediate shaft which transmits rotary power to the propeller. It has been found that after varying periods of service time the conical portion of the tail or propeller shaft exterior of the stern tube or frame of the ship, and to which the propeller is keyed, will begin to shear or fracture. This fracture generally occurs at the forward end of the conical section of the tail shaft adjacent the propeller, which is a high stress area and subject to corrosion.

When a fracture of this type occurs while the ship is in a foreign port the ship must remain in that port until a replacement tail shaft can be fabricated and sent to the ship for installation. This disrupts the ship's schedule which is costly, often necessitating that the ship remain out of service for weeks. In order to decrease the period of time that a ship is out of service when a fracture develops in the tail shaft, it has heretofore been the practice for ships to carry a spare tail shaft. This enables a ship which has been disabled while distant from its home port due to a fracture in the tail shaft, to proceed to the nearest drydock and replace the fractured tail shaft with the spare. This has the advantage of enabling the ship to be put quickly back in service. The disadvantage, however, is that this practice necessitates that each ship carry a spare tail shaft which is expensive. These tail shafts cost approximately $35,000 for a 70,000 ton ship and represents a considerable standby investment.

In view of the foregoing it is the primary object of this invention to provide a combination spare and service tail shaft assembly in which the conical end portion can be cut off after a fracture occurs, a new conical end machined and the tail shaft extended so that its length is equivalent to the length of the original tail shaft assembly.

Another object of the present invention is to provide an insert for tail shaft assemblies which is inexpensive to fabricate as compared to the tail shaft, and which may be carried by ships in lieu of a spare tail shaft.

For a better understanding of the present invention as well as further objects and features thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawings wherein like components in the several views are identified by like reference numerals.

In the drawings:

Figure 1 is a side elevation of a tail shaft assembly presently used, portions of the assembly being shown in cross section in order to illustrate structural details.

Figure 2 is a side elevation of the tail shaft assembly in accordance with the present invention.

Figure 3 is a side elevation of the tail shaft illustrated in Figure 2 after a fracture has occurred in the conical end section.

Figure 4 is a side elevation of the tail shaft illustrated in Figure 3 after a new conical end section has been machined and the tail shaft moved rearward such that the new conical section lies in the same vertical plane as the old conical section which has been removed.

Figure 5 is a side elevation of a tail shaft assembly embodying the principles of the present invention, an insert having been provided between the tail and intermediate shafts, and

Figure 6 is a perspective view of the insert.

Referring now to the figures, and particularly to Figure 1, there is illustrated a tail or propeller shaft **10**, and an intermediate shaft **11**, as installed and used in present day steamships. The intermediate shaft **11** is connected at its forward end to the ship's source of power (not shown) and is rotatively supported in bearing **12**.

The tail or propeller shaft which is designated generally by the numeral **10**, is coupled to the intermediate shaft **11** by bolts **13**, and forms an axial extension thereof. A bronze sleeve **14** annularly surrounds the tail shaft **10** and protects the tail shaft from corrosion. The tail shaft **10** is rotatively supported by the stern tube **15** which has a lining **16** with a low coefficient of friction, such for example as lignum vitae. This lining is held in position by a bronze sleeve **17**. The bulkhead of the ship is designated generally at **18** and the annular gland at **19**, the purpose of the latter being to prevent water from entering the ship.

The rear end of the tail shaft **10** is formed with a conical section **20** to which the propeller **21** is secured and held in position by the bolt **22**. A cap **23** protects the bolt **22** from corrosion. The foregoing are details of propeller shaft assemblies which are well known to those skilled in the art.

After varying periods of service time the tail shaft **10** will frequently crack or develop fractures in the conical end section **20** due to corrosion and concentration of stresses. These cracks or fractures generally develop in the area of the conical end section **20** representing the clearance between the forward face of the propeller **21** and the stern tube **15**, as illustrated in Figure 3. When a crack or fracture of this type occurs it has heretofore been the practice to remove the tail shaft **10** and replace it with a new one. In order to avoid excessive delays virtually every ship today carries a spare tail shaft, which represents a considerable stand-by investment.

Previous efforts to repair and utilize a tail shaft after a crack or fracture develops in the conical end section have proven impractical and been thought impossible. This is due to the relative spacing between the bulkhead **18** and the flange **24** on the forward end of the tail shaft **10** which has heretofore prevented the tail shaft from being moved rearward. This spacing is generally small since tail shafts are made as short as possible due to their cost as compared to intermediate shafts. This is due to their greater diameter and the cost of the liners.

The present invention enables a tail shaft to continue in service after a crack or fracture occurs in the conical end section. This is accomplished by initially installing a tail shaft **10'** which is longer than tail shafts presently used. The length of the intermediate shaft **11'** is decreased proportionately such that the overall length of the tail and intermediate shaft combination in accordance with the present invention is identical to that of existing

tail and intermediate shaft combinations. In this manner the improved tail and intermediate shaft combination of the present invention may be installed on new or existing ships without necessitating any structural changes in the bearings or mountings.

An extensible tail shaft in accordance with the present invention is illustrated in Figures 2 through 5. As illustrated in these figures, and particularly in Figure 2, the tail shaft of the present invention is made longer than present day tail shafts, and greater in length than that required upon installation. The extension in length is designated by the numeral **25** and is equivalent to, or slightly greater than, the length of the conical end section **20** and its threaded portion for engagement of the bolt **22**, this length being designated generally by the numeral **26**. The intermediate shaft **11'** of the present invention is made shorter by the amount of the extension **25**. In this manner the combined length of the tail and intermediate shaft of the present invention is equivalent to the combined length of presently used tail and intermediate shafts. This is illustrated from a comparison of Figures 1 and 2. The tail and intermediate shafts of the present invention may be installed in the same manner as present shafts.

When the tail shaft **10'** of the present invention fractures or shears at the conical end section **20**, such for example as at **27** illustrated in Figure 3, the tail shaft **10'** is uncoupled from the intermediate shaft **11'** and removed from the ship. The damaged conical end section **20** is cut off at shoulder **28** and a new conical end **20'** machined. As illustrated in Figure 4 the tail shaft **10'**, after the removal of the conical end section **20'** is the same length as the presently used tail shafts **10**.

After the new conical end **20'** has been machined the tail shaft **10'** is reinserted in the ship. Due to the removal of the conical end section **20'**, however, the tail shaft **10'** does not occupy its original position but is displaced rearward such that the propeller **21**, when secured to the conical end **20'**, will be in the same vertical plane as originally. When the tail shaft **10'** is positioned in this manner the flange **24** of the tail shaft will be spaced from the flange **29** of the intermediate shaft by the axial distance represented by the removal of the conical section **20**. This is best illustrated by Figure 4.

In order to couple the tail shaft **10'** and the intermediate shaft **11** together an insert shaft, generally designated by the numeral **30**, is interposed between the two. As illustrated in Figure 5 the axial length of this insert **30** is equal to, or slightly greater than the length of the conical end section **20** that was removed. This insert **30**, when placed in position, forms an axial extension of the tail and intermediate shafts and effectively couples these shafts together.

As can be seen from the foregoing, through the utilization of the present invention it is no longer necessary for a ship to carry an expensive spare tail shaft. In lieu of a spare tail shaft all that the ship must carry as a spare is the insert **30**. This insert **30** requires no lining and cost approximately $2,000 as contrasted to $35,000 for a tail shaft for a 70,000 ton ship.

I claim:

1. A repairable shaft assembly comprising a tail shaft having a tail portion at one end thereof for mounting a propeller and a coupling portion at the other end thereof, an intermediate shaft engageable with said coupling portion to transmit rotary motion to said propeller, and an insert having an axial length corresponding substantially to that of said tail portion and adapted to intercouple said coupling portion with said intermediate shaft to restore the length of said assembly to its initial value in the event it is necessary to sever the existing tail portion and to reform said tail portion on said tail shaft.

2. A repairable shaft assembly comprising a tail shaft having a tail portion at one end thereof for mounting a propeller and a coupling flange at the other end thereof, an intermediate shaft engageable with the coupling flange of said tail shaft to form an axial extension thereof and transmit rotary motion to said propeller, and an insert shaft having an axial length corresponding substantially to that of said tail portion and adapted to intercouple said coupling flange with said intermediate shaft to restore the length of said assembly to its initial value in the event it is necessary to sever the existing tail portion and to reform said tail portion on said tail shaft.

3. A repairable shaft assembly for transmitting rotary motion from a power source to a propeller comprising a tail shaft having a tail portion at one end thereof for mounting a propeller and a first coupling flange at the other end thereof, an intermediate shaft having a second coupling flange at one end thereof engageable with the first coupling flange of said tail shaft to form an axial extension thereof, the other end of said intermediate shaft being linked to a power source to transmit rotary motion to said propeller, and an insert shaft having an axial length corresponding substantially to that of said tail portion of the tail shaft, said insert having coupling flanges at each end, one of said coupling flanges of said insert adapted to intercouple with the first coupling flange of said tail shaft and the other coupling flange of said insert adapted to intercouple with the second coupling flange of said intermediate shaft to restore the length of said assembly to its initial value in the event it is necessary to sever the existing tail portion and to reform said tail portion on said tail shaft.

4. A repairable shaft assembly for transmitting rotary motion from a power source to a propeller comprising a tail shaft having a conical tail portion of predetermined length at one end thereof for mounting a propeller and a first coupling flange at the other end thereof, an intermediate shaft having a second coupling flange at one end thereof engageable with the first coupling flange of said tail shaft to form an axial extension thereof, the other end of said intermediate shaft being linked to a power source to transmit rotary motion to said propeller, and an insert shaft having an axial length corresponding substantially to that of said tail portion of the tail shaft, said insert having coupling flanges at each end, one of said coupling flanges of said insert adapted to intercouple with the first coupling flange of said tail shaft and the other coupling flange of said insert adapted to intercouple with the second coupling flange of said intermediate shaft to restore the length of said assembly to its initial value in the event it is necessary to sever the existing tail portion and to reform said tail portion on said tail shaft.

5. A repairable shaft assembly for transmitting rotary motion from a power source to a propeller, said assembly comprising a tail shaft for supporting said propeller and including a tail portion at one end on which said propeller is mountable and a coupling portion at the other end thereof, an intermediate shaft engageable with the coupling portion of the tail shaft to link said propeller to a power source, said tail shaft having an axial dimension exceeding the axial dimension of a given standard tail shaft by a predetermined length, and an insert having an axial length corresponding to said predetermined dimension which said tail shaft is lengthened to intercouple said tail shaft with said intermediate shaft in the event said tail portion is severed from said tail shaft and a new tail portion formed thereon whereby the length of the resultant assembly including said insert is substantially the same as the length of the original assembly before removal of said tail portion.

6. A repairable shaft assembly for transmitting rotary motion from a power source to a propeller, said assembly comprising a tail shaft for supporting said propeller and including a tail portion at one end on which said propeller is mountable and a coupling flange at the other end thereof, an intermediate shaft engageable with the

coupling flange of the tail shaft to form an axial extension thereof linking said propeller to a power source, said tail shaft having an axial dimension exceeding the axial dimension of a given standard tail shaft by a predetermined length and said intermediate shaft having an axial dimension less than the axial dimension of a given standard intermediate shaft by said predetermined length, and an insert having an axial length corresponding to said predetermined dimension by which said tail shaft is lengthened and said intermediate shaft is shortened to intercouple said tail shaft with said intermediate shaft in the event said tail portion is severed from said tail shaft and a new tail portion formed thereon whereby the length of the resultant assembly including said insert is substantially the same as the length of the original assembly before removal of said tail portion.

7. A repairable shaft assembly for transmitting rotary motion from a power source to a propeller, said assembly comprising a tail shaft for supporting said propeller and including a conical tail portion at one end of predetermined length on which said propeller is mountable and a coupling flange at the other end thereof an intermediate shaft engageable with the coupling flange of the tail shaft to form an axial extension thereof linking said propeller to a power source, said tail shaft having an axial dimension exceeding the axial dimension of a given standard tail shaft by the axial length of said conical portion and said intermediate shaft having an axial dimension less than the axial dimension of a given standard intermediate shaft by the axial length of said conical tail portion, and an insert having an axial length corresponding to the axial length of said conical tail portion to intercouple said tail shaft with said intermediate shaft in the event said tail portion is severed from said tail shaft and a new tail portion formed thereon whereby the length of the resultant assembly including said insert is substantially the same as the length of the original assembly before removal of said tail portion.

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