C. A. PARSONS.

GEARING FOR TURBINES.

APPLICATION FILED JULY 2, 1910.

997,635.

Patented July 11, 1911.

3 SHEETS—SHEET 1.

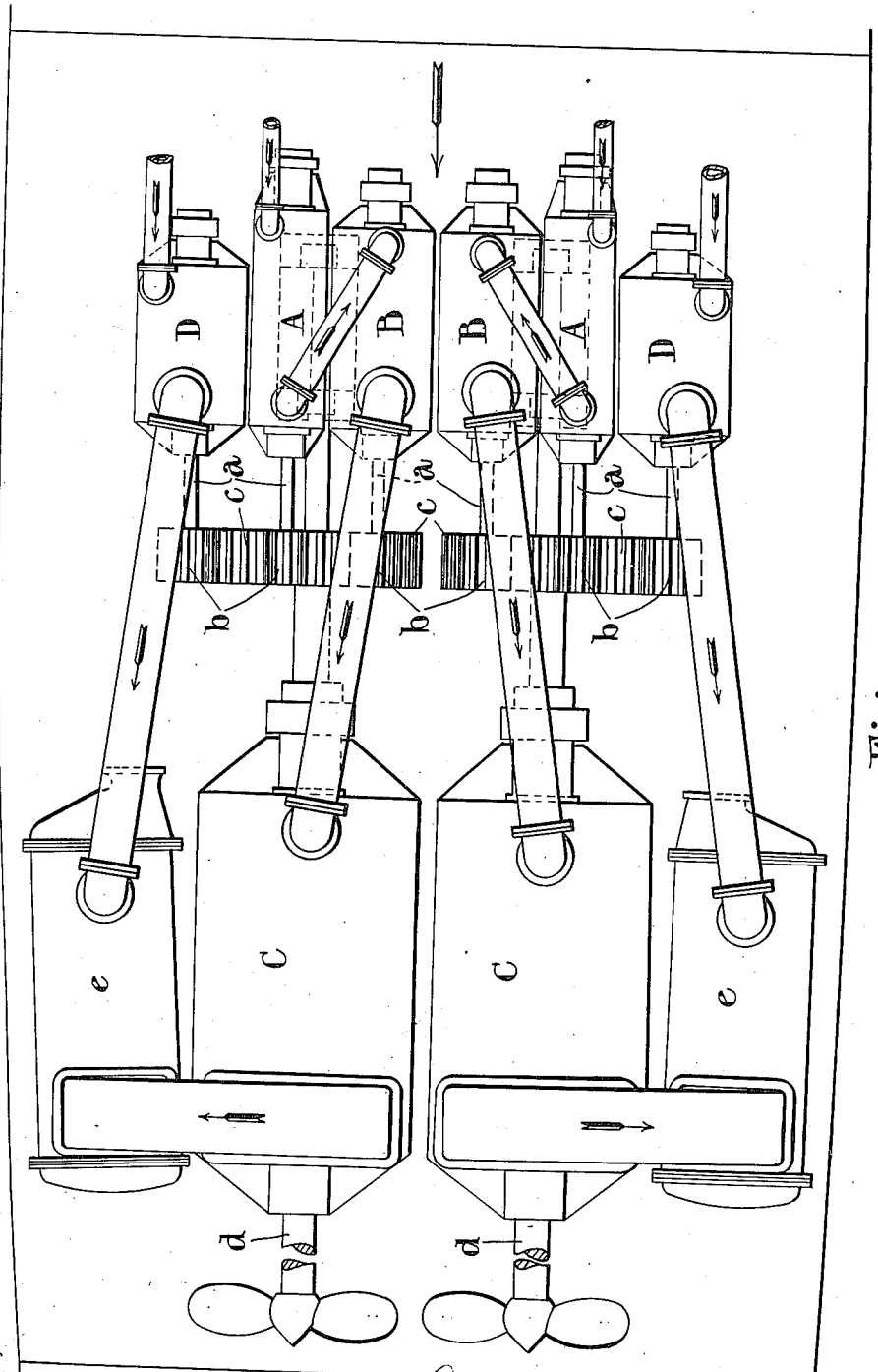

Fig. 1.

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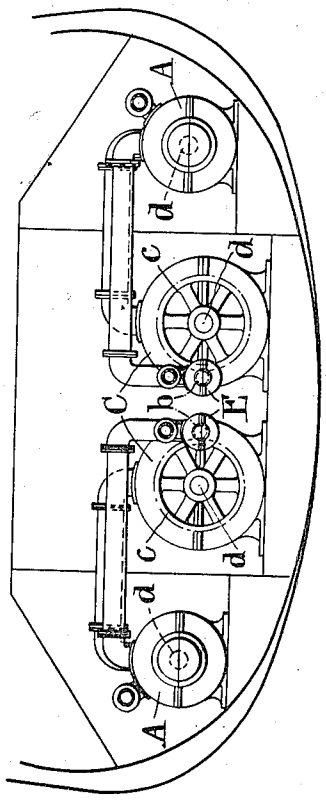

Fig. 4.

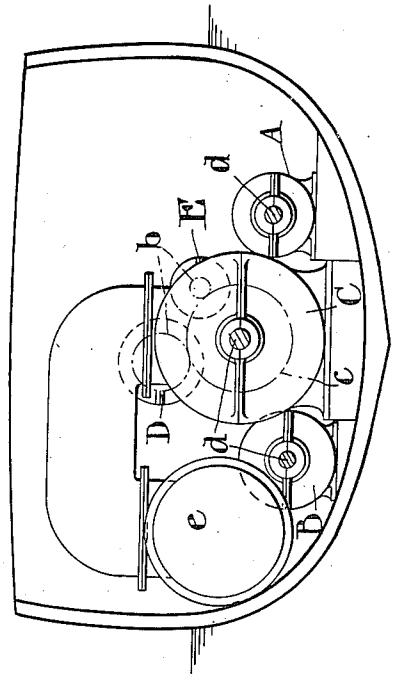

Fig. 6.

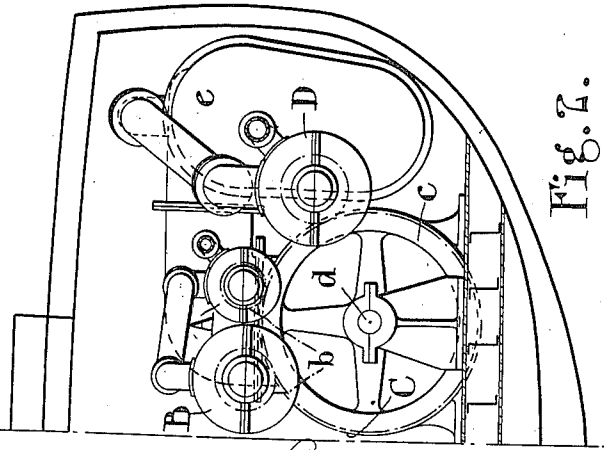

Fig. 7.

Witnesses:

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3 SHEETS—SHEET 3.

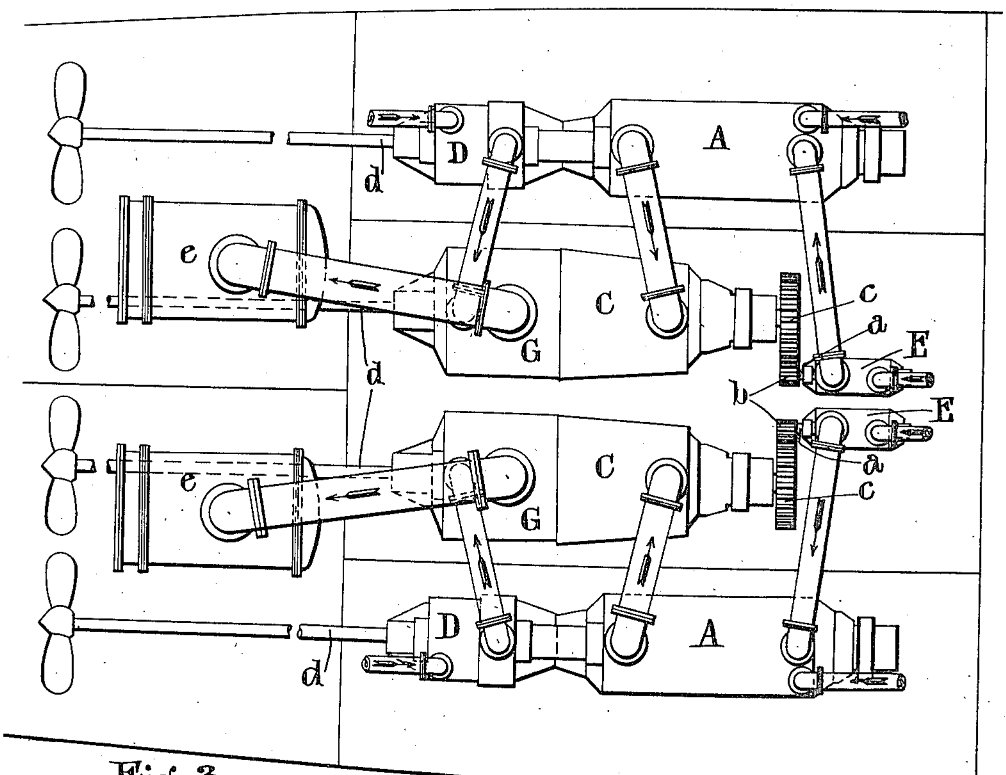

Fig. 3.

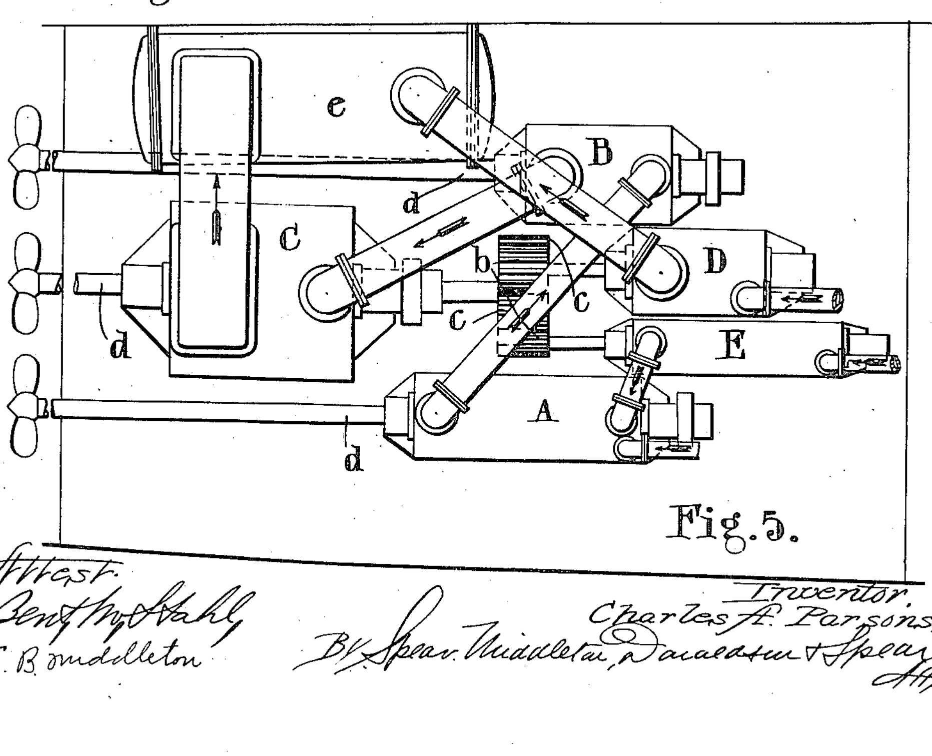

Fig. 5.

Attest.
Benj. M. Stahl
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Inventor.
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Att'ys.

UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, OF NEWCASTLE-UPON-TYNE, ENGLAND.

GEARING FOR TURBINES.

997,635. Specification of Letters Patent. Patented July 11, 1911.

Application filed July 2, 1910. Serial No. 570,062.

To all whom it may concern:

Be it known that I, CHARLES ALGERNON PARSONS, a subject of the King of Great Britain and Ireland, residing at Heaton Works, Newcastle-upon-Tyne, in the county of Northumberland, England, have invented certain new and useful Improvements in and Relating to Gearing for Turbines and the Like, of which the following is a specification.

This invention relates to gearing for turbines and the like.

It has already been proposed to group together a number of separate turbines, and to fit the ends of their shafts with pinions, each pinion gearing with a single wheel mounted on a common shaft. Such turbines have also been arranged to receive the steam in series, but they have only been arranged to run at the same speed.

The object of the present invention is to provide an arrangement of turbines as indicated above in which the energy of the working fluid is utilized to the best advantage.

To this end the invention consists in designing each separate turbine in relation to its most economical speed, and then arranging the differently speeded turbines suitably to drive the common shaft.

Further, the invention may be applied for a similar purpose to ship propulsion systems having one or more astern turbines, and in which one or more special turbines known as cruising turbines are added for cruising purposes.

Thus the invention also consists in arranging such cruising or astern turbines to drive through gearing shafts to which the other or main turbines are coupled direct, such gearing being adapted to allow the cruising or astern turbines to rotate at their most efficient speed. In some cases such cruising turbines or even the main turbines may be arranged to drive the propeller shaft, through double reduction gearing. By this means it is possible to run the turbines at their most economical speed without involving too great a reduction in a single gear with the consequent practical difficulties occasioned thereby.

This invention is equally applicable to turbines of the Parsons, impulse or mixed Parsons and impulse type, as by means of single or double reducing gear, such turbines or turbine parts can be run at their most economical speed. Further, the turbine elements on one or more shafts may be cross coupled or by-passed in whole or in part in any suitable manner. If desired, clutches of any convenient type may be used to disconnect the cruising or astern turbines at high speeds or when not in operation.

The invention further consists in the improved turbine arrangements hereinafter described.

Referring now to the accompanying drawings, which represent the invention as applied to marine propulsion and are diagrammatic only, Figures 1 and 2 represent in plan and end elevation a two propeller shaft installation with single reduction throughout. Figs. 3 and 4 show a four-shaft installation. Figs. 5 and 6 show a three-shaft installation.

In the illustrations it will be noted that no supports have been shown for the various turbine shafts as these do not form part of the present invention.

In carrying this invention into effect according to one manner, I arrange that the pressure drop of the working fluid shall be distributed in a known manner over a number of turbines, for instance, as shown in Figs. 1 and 2, over one high pressure turbine A, one intermediate pressure turbine B and one low pressure turbine C. The arrangement in these figures show two such sets of turbines. Each of the turbines A and B is mounted on a separate shaft *a* which carries a pinion *b* gearing with a large wheel *c* mounted on the propeller shaft *d*. A condenser *e* is also provided for each set of turbines and an astern turbine D is mounted on a separate shaft *a* which also carries a pinion *b* gearing with the large wheel *c*. When such an installation is arranged for ahead running the steam enters the high pressure turbine A and as indicated by the arrows, flows through the intermediate pressure and low pressure turbines B and C respectively and thence to the condenser *e*, the turbines A, B and C thus being in series. During astern running, steam is admitted to the astern turbine D which exhausts directly to the condenser *e* while for maneuvering purposes it will be seen that the turbines on one side of the ship may be running ahead while the remaining turbines are arranged for astern running.

The arrangement shown in Figs. 3 and 4 represents a four shaft installation in which

a high pressure turbine A is mounted on each of the side propeller shafts *d* and a low pressure turbine C upon the central propeller shaft. High and low pressure astern turbines D and G are also provided as shown on the side and central shafts, both ahead and astern high and the low pressure turbines being mounted directly on propeller shafts and therefore driving in the ordinary manner. On an extension of the central shaft is provided a gear wheel *c*, with which engage the pinions *b* on the shaft *a* of the cruising turbine E. By this means the cruising turbines can be made to rotate at their most efficient speed. Suitable clutches may be provided to disconnect such cruising turbines when not in operation, thus avoiding any drag upon the propeller shaft *d*. For cruising speeds, steam is supplied to the cruising turbine E and passed in series through the turbine A, and thence to the condenser *e* as indicated by arrows, while for higher speeds the cruising turbine E is disconnected and steam is supplied directly to the turbine A. For astern running, the steam flows through the turbines D and G in series as indicated.

In Figs. 5 and 6 there is shown a three-shaft installation suitable for a torpedo boat. The high pressure turbine A and intermediate turbine B in this case are mounted directly on the wing propeller shafts and the low pressure turbine C is mounted directly on the central shaft. A cruising turbine E and an astern turbine D are shown in gear with the wheels *c* mounted on the central shaft. These latter turbines can be either permanently coupled to the central shaft or suitable clutches may be provided to disconnect them when not in operation. The power can be distributed over various shafts in any desired manner, for instance, the power developed by the central shaft may be arranged to be about double that developed on each of the wing shafts.

At cruising speeds the arrangement shows that steam flows through turbines E, A, B and C to the condenser *e*, the steam being supplied directly to the turbine A for higher powers; while for reversing, the turbine D is supplied with steam which flows thence to the condenser. The separate turbines may be grouped in parallel for full powers to give the necessary exhaust area, or in series for low powers, also grouping in series parallel on the same or different shafts may be arranged for, and a complete turbine or parts on one or more shafts may, if desired, be by-passed. The larger the number of separate turbines the easier it is to obtain any desired grouping. The diameter of the pinion *b* is so chosen in relation to the diameter of the large wheel *c* with which the pinions engage and in relation to the speed of rotation of the propeller shaft that each separate turbine shall run at its most economical speed of rotation. Thus the high pressure turbine would be designed for a high speed of revolution and the low pressure turbine for a low speed of revolution and the intermediate pressure turbine would be designed for an intermediate speed. The actual speed however, is always chosen so that the maximum efficiency possible is obtained from the turbine.

As shown in the accompanying drawings, an astern turbine may be provided either separately mounted or incorporated with another turbine and this astern turbine may be designed with reference to its most economical speed and is suitably geared to the propeller shaft. As has before been stated suitable clutches, either mechanical or electrical, may be provided to disconnect the cruising or astern turbines when required.

It will be seen that the present invention is in no way limited to the number of turbines or to the number of shafts or to the manner in which the various turbines are grouped, the various arrangements described herein being examples only. Part of the whole of the cruising and high pressure turbines may be of either the impulse or reaction type or a combination of impulse and reaction. Suitable arrangements are also provided for absorbing the thrust on the turbine shafts, such as balancing or dummy pistons arranged within the turbine or by providing suitable thrust blocks on the turbine shafts. Or balancing may be provided for in other known ways or effected by the thrust of the gear.

By this invention I am enabled to obtain the highest economy for ships under all conditions and also it facilitates the design and constructions of a turbine to obtain the highest degree of efficiency as already explained.

It will be seen that many modifications can be made in the manner of carrying this invention into effect without in any way departing from the spirit of the same.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, gearing means between said shafts, and turbine elements some of which are reversing turbine elements distributed over all of said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

2. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, low pressure turbine elements mounted on all of the propeller shafts and high pressure turbine elements on the other shafts, gearing means

between said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

3. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, low pressure turbine elements mounted on all of the propeller shafts, and high pressure turbine elements on the other shafts, reversing turbine elements on some of said shafts, and gearing means between said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

4. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, an ahead and astern turbine element mounted on each of the propeller shafts and higher pressure turbine elements on the other shafts, gearing means between said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

5. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, low pressure turbine elements mounted on the propeller shafts, and cruising and high pressure turbine elements on the other shafts, gearing means between said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

6. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, low pressure turbine elements mounted on the propeller shafts, and cruising and high pressure turbine elements on the other shafts, astern turbine elements on some of said shafts and gearing between said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

7. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, combined ahead and astern turbine elements mounted on the propeller shafts, cruising high pressure turbine elements on the other shafts, and gearing means between said shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

8. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, combined ahead and astern turbine elements mounted on the propeller shafts, cruising high pressure turbine elements on the other shafts, and gearing means between said cruising turbine shafts and the propeller shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

9. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, low pressure turbine elements mounted on some of the propeller shafts, cruising turbine elements and high pressure and reversing turbine elements distributed over the other shafts, and gearing means between the latter shafts and the propeller shafts whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

10. A marine turbine installation comprising in combination one or more propeller shafts, a plurality of other shafts, low pressure turbine elements mounted on some of the propeller shafts, cruising turbine elements and high pressure and reversing turbine elements distributed over the other shafts, gearing means between the shafts driven by the cruising and astern turbine elements and the propeller shafts, whereby said turbine elements can be arranged to run at their most economical speed independently of the speed of the propeller shafts.

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

CHARLES ALGERNON PARSONS.

Witnesses:

FREDERICK GORDON HAY BEDFORD,

WILLIAM SHEARER.