G. WESTINGHOUSE.

PROPELLING DEVICE.

APPLICATION FILED JULY 25, 1904.

968,823. Patented Aug. 30, 1910.

2 SHEETS—SHEET 1.

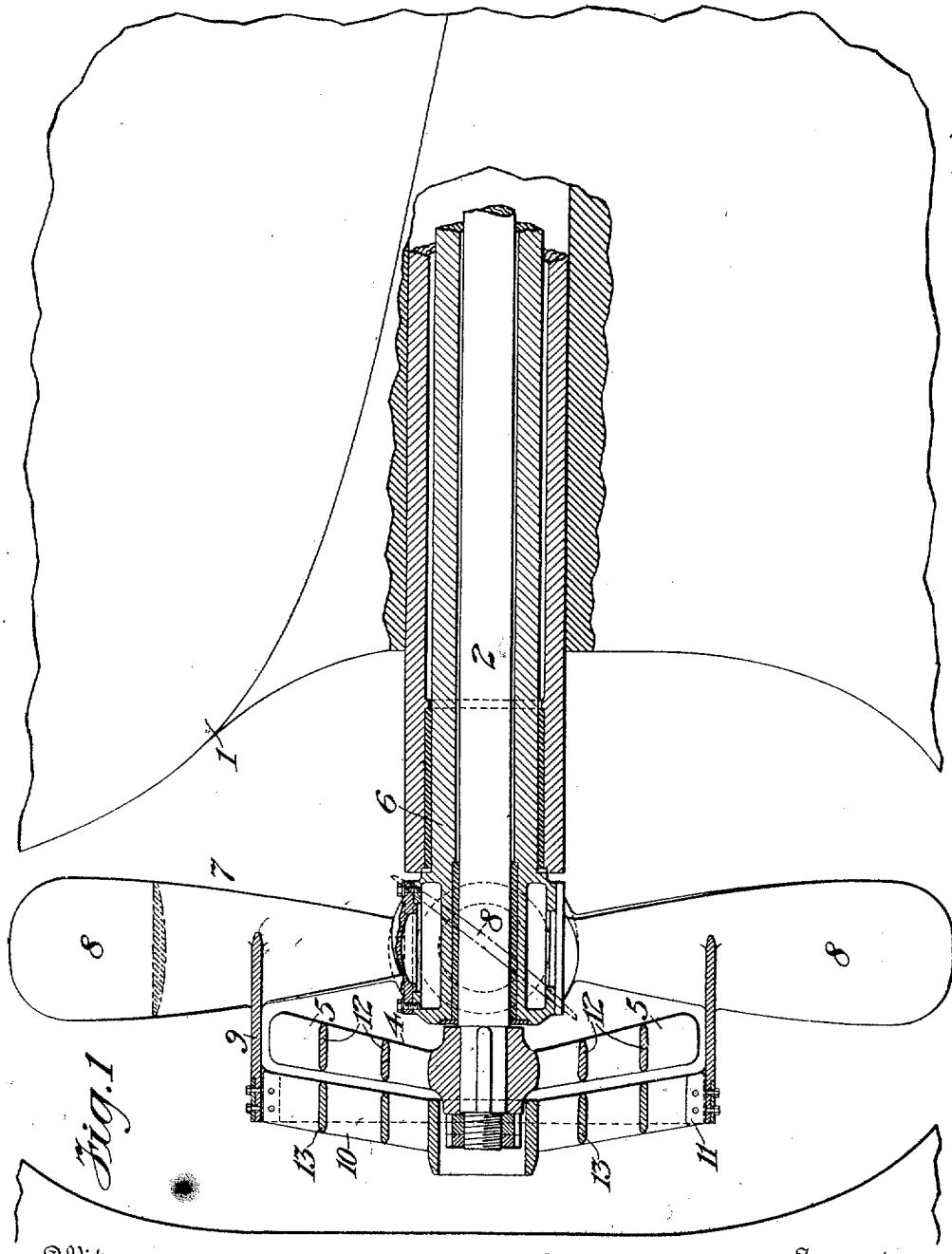

Fig. 1

Witnesses:
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Wm. H. Capel

Inventor
George Westinghouse
By his Attorney
Charles A. Terry

Turbine dr
4 which dr
10, connected
8

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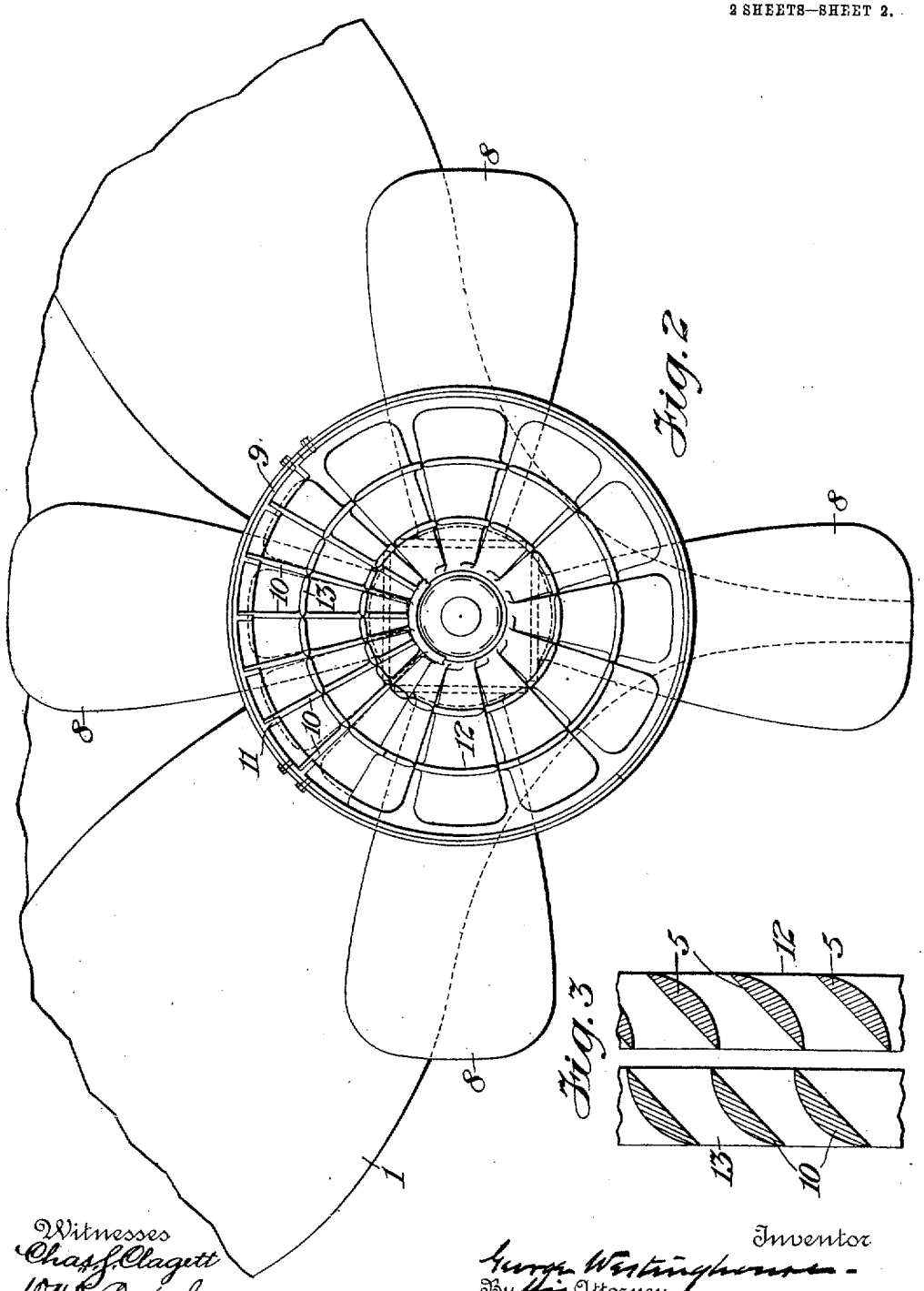

Fig. 2

Fig. 3

Witnesses
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UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

PROPELLING DEVICE.

968,823. Specification of Letters Patent. **Patented Aug. 30, 1910.**

Application filed July 25, 1904. Serial No. 217,910.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, a citizen of the United States, and resident of Pittsburg, county of Allegheny, State of Pennsylvania, have invented certain new and useful Improvements in Propelling Devices, of which the following is a specification.

For many purposes the steam turbine engine is a desirable form of prime mover, but the normal and efficient speed at which the screw-propeller of a steamship should be driven is so greatly less than the normal speed at which a turbine of convenient size can efficiently operate, that a direct connection between the shaft of a turbine and a propeller can only be resorted to by the use of propellers and turbines both of abnormal proportions, and then not without seriously affecting the efficiency of the apparatus as a whole, and encountering other serious difficulties due to the large space required for installing such abnormal turbines. For like reasons, the normal speed of the turbine engine is too great for the operation of a properly proportioned centrifugal pump.

My present invention relates to a method of applying the power of a turbine at a preferred speed, for the propulsion of vessels and for other similar uses in an economical and effective manner, and securing a rate of revolution of a propeller best suited to the requirements.

The general plan of the invention consists in combining with an ordinary propeller and its shaft, a relatively small propeller driven by the turbine, and causing this to act both as a propeller and the primary element of a pump, the secondary of which is attached to and forms part of a main propeller. The rate of revolution of the secondary element with the main propeller, will be dependent upon the slip between the primary and the secondary elements of the pump. If, for instance, the primary element revolves at the rate of, say, 900 revlutions per minute and the slip between the primary and secondary elements be such that the secondary revolves at one-third the speed of the primary, then the main propeller will revolve at the rate of 300 revolutions per minute. In a general way the difference of 600 revolutions per minute between the two elements represents the energy expended in communicating motion and power to the main propeller, but by properly arranging and proportioning the parts such difference in speed may be provided without any material or excessive loss in efficiency, because the portion of the net energy which is imparted to the fluid medium passing through the pump which is not expended in driving the secondary element is expended in thrust against the exterior fluid medium. One way of regarding the apparatus is to view it as a centrifugal pump forcing fluid outwardly and tending to propel the prime mover by ejecting force while a portion of the energy is communicated through the pump to the exterior propeller. The question as to which of these forces shall predominate is determined in any case by the conditions thereof. Various different well-known forms of centrifugal pumps may be readily adapted to the purpose.

There are various uses other than the propulsion of ships to which the broad principles of my invention are applicable, but for the purposes of description it is more convenient to consider it in connection with a turbine-driven ship.

In the accompanying drawings; Figure 1 is a longitudinal cross section of a portion of a ship equipped with a turbine and propelling apparatus embodying the general features of my invention; Fig. 2 is an end view thereof; and Fig. 3 is a detail.

Referring to the drawings, 1, represents a portion of the hull of a ship, and, 2, represents a portion of the shaft of a steam turbine of which there may be any desired number, one shaft only being shown for the present purposes. The shaft of the turbine projects through the stern of the ship in any usual and convenient manner and carries at its end a screw-propeller, 4, having for instance, twelve blades 5. A hollow shaft, 6, surrounds the shaft 2 and carries a main propeller, 7, which in this instance is shown as having four blades 8. These blades carry a ring or cylinder, 9, inclosing the propeller 4. The outer end of the cylinder 9 is provided with inclined blades, 10, arranged in such manner as to be driven forward by the pressure of the water forced against them by the revolution of the inner propeller 4. In this manner the propeller 4 acts as the primary element of a pump and the blades 10 and their support, as the secondary element.

The blades 5 are here shown as provided with transverse walls 12 for preventing a useless and wasteful radial movement of the

water within the space between the blades 5 and 10. In the drawing, I have shown two sets of these walls making in effect practically two cylindrical partitions within the circumference of the propeller 4. Similar walls 13, are shown for the blades 10, for better insuring the direct flow of the water passing outward from the propeller 4.

When the steam turbine is driven at the speed best suited to secure the highest efficiency water will be drawn between the inner portions of the blades of the propeller 7 and forced outward against the blades 10, causing the main propeller 7, to revolve at a rate which will be dependent upon the proportions of the operative parts and the consequent slip between the two elements. By suitably adjusting the parts, this slip may be made such as to secure any desired relative rate of revolution on the part of the main propeller. For instance, in a given case, it may be desired to drive the turbine at, say, 900 revolutions per minute and the main propeller at, say, 300 revolutions per minute. The diameter of the main propeller may be, say, sixteen feet and of the inner propeller, say, eight feet.

In constructing propellers of the ordinary type it is obvious though impossible of realization that the best advantages would result if approximately the same speed in feet per minute could be attained by each portion of the propeller blades regardless of their distance from the center of revolution. In the construction described herein it will be observed that a high speed is secured on the part of the propeller 4, thus approximating the rate of the outer ends of the main propeller. This combination of two propellers as herein described results in securing more nearly the desirable propeller blade rate of speed on the part of the entire combination, with the attendant advantages.

The energy is imparted by the turbine to the propeller 4, and sets in motion the water between it and the blades 10, in such a manner that the reactive effect of the water emerging from between these blades is mostly expended in rotating the main propeller 7; any remaining energy is utilized in assisting propulsion by the reaction against the water of flotation. In this way it is believed a high efficiency can be obtained by properly proportioning the operative parts since the losses should only be those incidental to the friction of the water. The blades 5 are shown as extending in an inclined direction for the purpose of bringing the parts in close relation to the stern of the vessel and rendering the entire structure strong and compact. It will be further understood that the apparatus may be driven in the reverse direction for the purpose of backing a ship, the operation under such circumstances being apparent.

My improvement in propellers is of a nature, as will be readily understood, which will admit of the application of turbine engines to ships already fitted with other types of engines and propellers with a minimum amount of alteration, since the old type of propeller can be removed and the new substituted without structural change in the ship.

The invention is applicable to other prime movers than steam turbines and is susceptible of various modifications and general applications.

The apparatus as described is intended to be illustrative of the character of the invention and may be variously modified to meet the requirements of different cases. It will also be understood that the inner propeller may be of a general form and construction similar to that employed in centrifugal pumps or water turbines.

I claim as my invention:

1. The combination of a vessel, a prime mover carried thereby, a propeller, propelling blades driven by the fluid acted upon by the propeller, and a second propeller driven by said propelling blades.

2. The combination of a prime mover and a fluid pump comprising primary and secondary elements, the primary element of which is driven by the prime mover, a propeller attached directly to and driven by the secondary element of the pump, the arrangement being such that the flow of fluid through the secondary element is utilized for aiding in the propulsive effort of said propeller.

3. The combination of a steam turbine, a propeller directly driven thereby, a second propeller of larger diameter, and blades carried thereby acted upon by fluid pressure produced by the first named propeller to drive the second propeller.

4. The combination with a screw-propeller and a prime mover, of an intermediate speed reducing device, comprising a propeller directly driven by the prime mover, a water turbine driven thereby, and communicating its motion to the first named propeller.

5. In combination with a propeller secured to and driven by a rotatable shaft, a casing rotatably mounted on said shaft and provided with outwardly extending blades on one side of the propeller and a set of inwardly extending blades located at the other side of said propeller.

6. In combination with a propeller secured to and driven by a rotatable shaft, a casing rotatably mounted on said shaft and inclosing said propeller and a set of radial blades mounted on each side of said propeller.

7. The combination with a main propeller, of a second high speed propeller, a

casing surrounding said second propeller and secured to said main propeller, and means whereby the fluid delivered by said second propeller is effective in driving said main propeller.

8. The combination with a high speed propeller, of radially extending propeller blades mounted in front and radially extending propeller blades mounted in the rear of said propeller, of means whereby the fluid delivered to the blades to the rear of said propeller is effective in driving the blades located in front of said propeller.

9. In combination with a propeller, means for abstracting a portion of the velocity energy transmitted to the immersing fluid and devices driven by said means for imparting rotary motion to the fluid delivered to said propeller and for imparting longitudinal motion to a body of fluid surrounding said propeller.

10. In combination with a propeller, means for abstracting a portion of the velocity energy transmitted to the immersing fluid and devices, driven by said means, for imparting rotary motion to the fluid delivered to said propeller.

11. In combination with a propeller secured to and driven by a rotatable shaft, a casing rotatably mounted on said shaft and inclosing said propeller and blades mounted on said casing and on opposite sides of the propeller for abstracting a portion of the velocity of the fluid impelled by said propeller and for driving said casing.

Signed at New York, in the county of New York, and State of New York this 22nd day of July A. D. 1904.

GEO. WESTINGHOUSE.

Witnesses:

H. C. TENER,

WM. H. CAPEL.