H. FÖTTINGER.

TURBINE POWER PLANT.

APPLICATION FILED APR. 28, 1914.

1,166,756.

Patented Jan. 4, 1916.

Fig. 1.

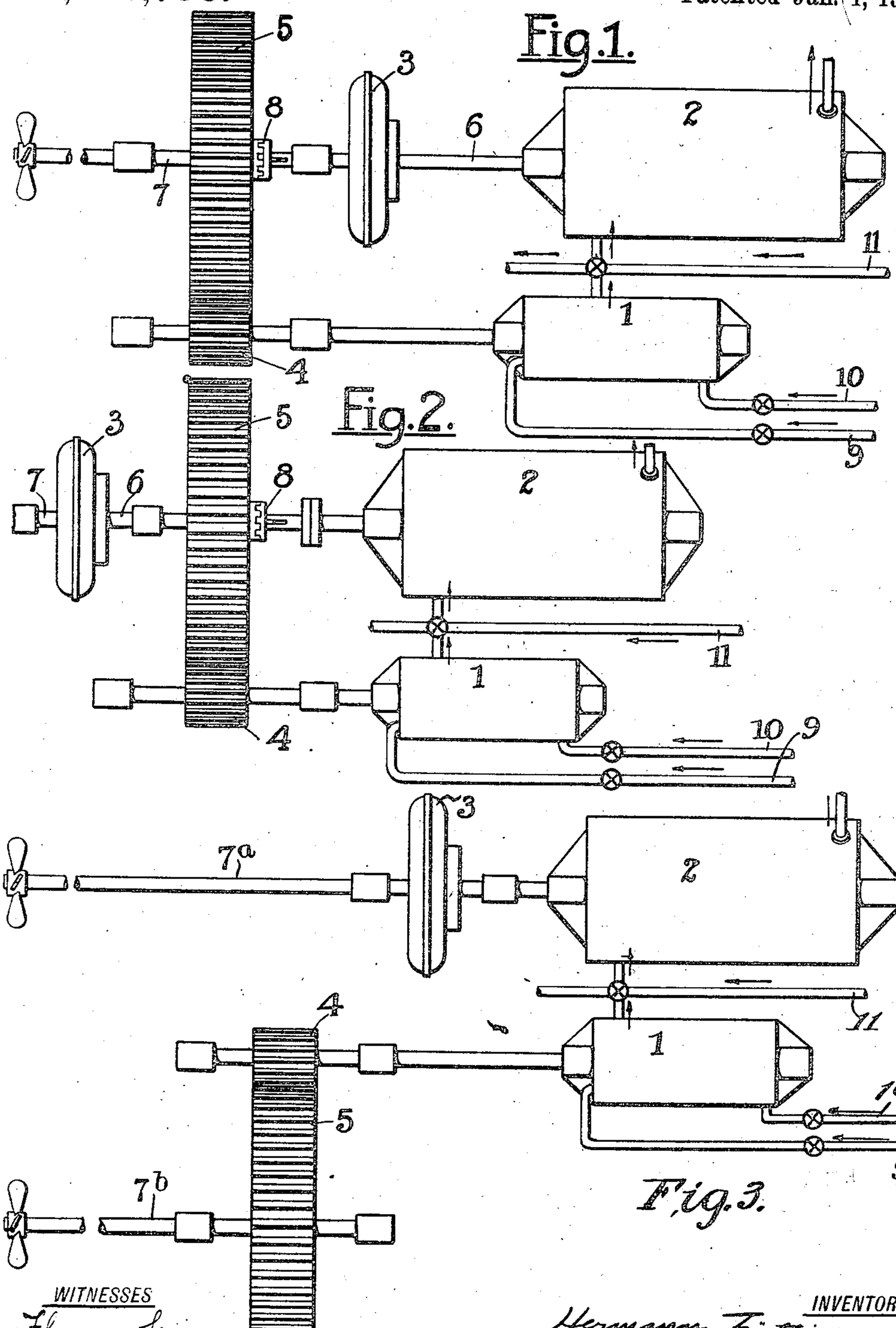
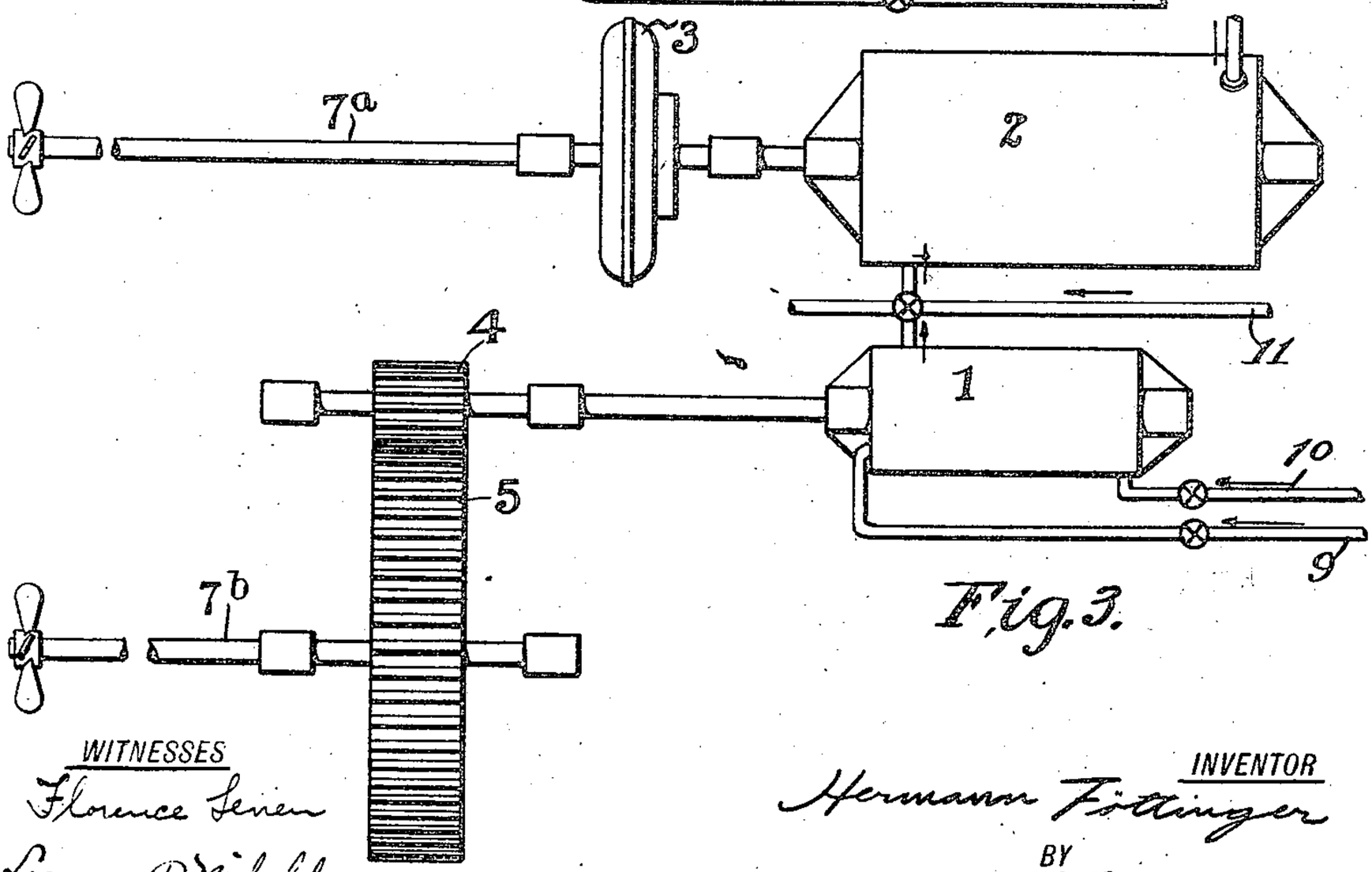


Fig. 2.

Fig. 3.



WITNESSES

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TURBINE POWER PLANT.

1,166,756. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed April 28, 1914. Serial No. 834,907.

To all whom it may concern:

Be it known that I, HERMANN FÖTTINGER, a subject of the German Emperor, and resident of Zoppot, near Danzig, in the Empire of Germany, have invented certain new and useful Improvements in Turbine Power Plants, of which the following is a specification.

This invention relates to certain improvements in turbine plants of that type in which a plurality of separate turbines coöperate in the performance of the work to be done.

My invention is particularly applicable to turbine power plants of large ships in which the power from two or more separate turbines is delivered to the propeller or propellers, at a greatly reduced speed.

My invention contemplates the employment of mechanical or electrical gearing between the high pressure turbine and the propeller shaft, while a hydraulic power transmitter of the type capable of producing either forward or reverse rotation is employed between the low pressure and slower running turbine and the same propeller shaft or one intended to run at the same speed. By this arrangement the separate turbines may run at their respective speeds of high efficiency and the proper relative speeds of the turbines may be maintained. Thus the highest efficiency is obtained from the plant as a whole. Furthermore, by this arrangement it is possible to obtain with suitable couplings and clutches, all desired service conditions, for varying speed, ahead, or reverse, and still maintain high speed in the turbine. As the hydraulic power transmitter is employed only between the low pressure turbine and its propeller shaft, a low speed reduction ratio and correspondingly high efficiency in this power transmitter may be obtained. As the mechanical gear operates to give the desired speed reduction from the high pressure turbine to the propeller shaft, the propeller may also be designed to give high efficiency and both the mechanical gear and the hydraulic power transmitter operate under the most favorable working conditions.

Reference is to be had to the accompanying drawings, in which similar reference characters indicate corresponding parts, and in which:

Figure 1 illustrates diagrammatically one arrangement of turbines and gearing; Fig. 2 shows a slightly modified arrangement of parts; and Fig. 3 shows an arrangement suitable for driving independent propeller shafts.

In the specific arrangement illustrated in Fig. 1, I employ a high pressure turbine 1, and a low pressure turbine 2, the former designed to run at high speed and to deliver its exhaust to the low pressure turbine for driving the latter at lower speed. The low pressure turbine is mounted with its shaft 6 in alinement with the propeller shaft 7 and connected thereto by a hydraulic gear or hydraulic power transmitter preferably of the Föttinger type, and so designed as to effect forward or reverse rotation of the propeller shaft at will, and with the low pressure turbine rotating in but one direction.

I have not illustrated the details of this hydraulic power transmitter as I do not wish to be limited to any specific construction. I may employ various different forms illustrated in my co-pending applications, or in my various foreign patents.

The high pressure turbine shaft is provided with a pinion 4 meshing with a gear wheel 5 on the propeller shaft and between the propeller and the hydraulic power transmitter. With this arrangement the high speed of the high pressure turbine is reduced through the mechanical gearing to the desired speed at the propeller shaft, and the speed of the low pressure low speed turbine is also reduced to the desired propeller speed, but its speed reduction is far less than that secured through the mechanical gear. Thus the transmission ratio of the transmitter 3 is comparatively low and a correspondingly high transmission efficiency is secured. In utilizing this power plant for driving a ship at full speed ahead, both turbines would be employed and the parts connected as illustrated. In case it is desired to back the ship the hydraulic power transmitter 3 may be reversed and the pinion 4 and gear 5 may be disengaged or rendered inoperative by

means of any suitable form of clutch or coupling as for instance a clutch 8.

Instead of disengaging or disconnecting the pinion and gear, the high pressure turbine may have embodied therein a reversing section and may have steam admitted thereto through a conduit 9, instead of through the main inlet 10, so as to produce reverse rotation of the high pressure turbine. Such construction is well-known in the art and therefore need not be illustrated.

If desired the turbine 2 may be built as the main turbine and the turbine 1 may be built as a cruising turbine, designed to drive the ship only at low speed. In this arrangement the cruising turbine 1 may normally be at rest with the pinion and gear disconnected and steam admitted through conduit 11. The main turbine 2 would drive the propeller shaft through the hydraulic power transmitter 3. For going at low speed the cruising turbine 1 alone may be employed, while for going astern the hydraulic gear 3 may be reversed and either the gear and pinion rendered inoperative for the transmission of power or a reversing section embodied in the cruising turbine 1.

In Fig. 2 I have shown a very similar arrangement but with the hydraulic power transmitter 3 arranged between the propeller and the gear 5, rather than between the gear 5 and the turbine 2. With this arrangement the turbine 1 may be constructed as a high pressure turbine to drive the shaft 6 through the mechanical gear 4, 5, the gear ratio corresponding to the relative speeds of maximum efficiency of the high and low pressure turbines. The hydraulic power transmitter 3 transmits the power to the propeller shaft and permits of a reversing either with the power derived from the turbine 2 alone or with the power derived from both turbines. In this arrangement I may also construct the turbine 1 as a cruising turbine, so that it may work alone, the main turbine 2 being disconnected at a suitable clutch 8. The two turbines may work together in the well-known compound arrangement or at full speed the cruising turbine 1 may remain at rest with the mechanical gear 4, 5 disconnected. The main turbine 2 would then alone drive the shaft 6 and its power would be transmitted to the propeller through the power transmitter 3. Here again reversing may be secured by means of the hydraulic power transmitter or by a reversing section in the turbine 1.

The specific forms of turbine plants illustrated in Figs. 1 and 2 are adapted for use where the power from both turbines is to be utilized on a single shaft, preferably that of a propeller. In Fig. 3 I have shown an arrangement whereby the two turbines deliver their power to separate shafts. Here the high pressure turbine 1 may deliver through a pinion 4 and gear 5 to a propeller shaft 7^b, while the low pressure turbine 2 delivers its power through a hydraulic power transmitter 3 to a separate propeller shaft 7^a. Here again the turbine 1 may be a cruising turbine instead of the high speed high pressure turbine and the turbine 2 may be the main turbine instead of a low pressure, low speed turbine.

Having thus described my invention, what I claim as new and desire to protect by Letters-Patent, is:

1. A turbine plant including in combination a high pressure, high speed turbine, a low pressure, low speed turbine mounted for independent rotation, a driven shaft, mechanical gearing for transmitting power from said high pressure turbine to said shaft and a hydraulic power transmitter for delivering power from said low pressure turbine to said shaft.

2. A turbine plant including a high pressure, high speed turbine, a low pressure, low speed turbine, a driven shaft, means including mechanical gearing for transmitting power to said driven shaft from said high pressure turbine, and means including a hydraulic power transmitter for delivering power from said low pressure turbine to said driven shaft.

3. A turbine plant including two independently operable turbines, a driven shaft, means including mechanical gearing for transmitting power to said driven shaft from one of said turbines, and means including a hydraulic power transmitter for delivering power from the other of said turbines to said driven shaft.

4. A turbine plant including a high pressure turbine, a shaft driven thereby and provided with a pinion, a low pressure turbine, a shaft driven thereby and provided with a gear meshing with said pinion, and a hydraulic power transmitter connected to said last-mentioned shaft.

5. A turbine plant including a high pressure turbine, a low pressure turbine, a propeller shaft, separate gearings for transmitting power to said shaft from said turbines, the gearing between said low pressure turbine and said propeller shaft comprising a hydraulic power transmitter.

6. A turbine plant including a high pressure turbine, a low pressure turbine, a propeller shaft, separate gearings for transmitting power to said shaft from said turbines, the gearing between said low pressure turbine and said propeller shaft comprising a hydraulic power transmitter of a type adapted to drive the propeller in either direction in respect to the direction of rotation of the low pressure turbine.

7. A turbine plant including two separate turbines, propelling means, mechanical gearing for transmitting power from one of said turbines to said propelling means, and a hydraulic power transmitter transmitting power from the other of said turbines to said propelling means.

Signed at Danzig, Germany, this 11th day of April, A. D. 1914.

DR. HERMANN FÖTTINGER.

Witness:
MARTA FRIESE.