

O. F. BRUMAN.
 STATIONARY DIAPHRAGM FOR STEAM TURBINES.
 APPLICATION FILED JAN. 2, 1912.

1,036,184.

Patented Aug. 20, 1912.

2 SHEETS—SHEET 1.

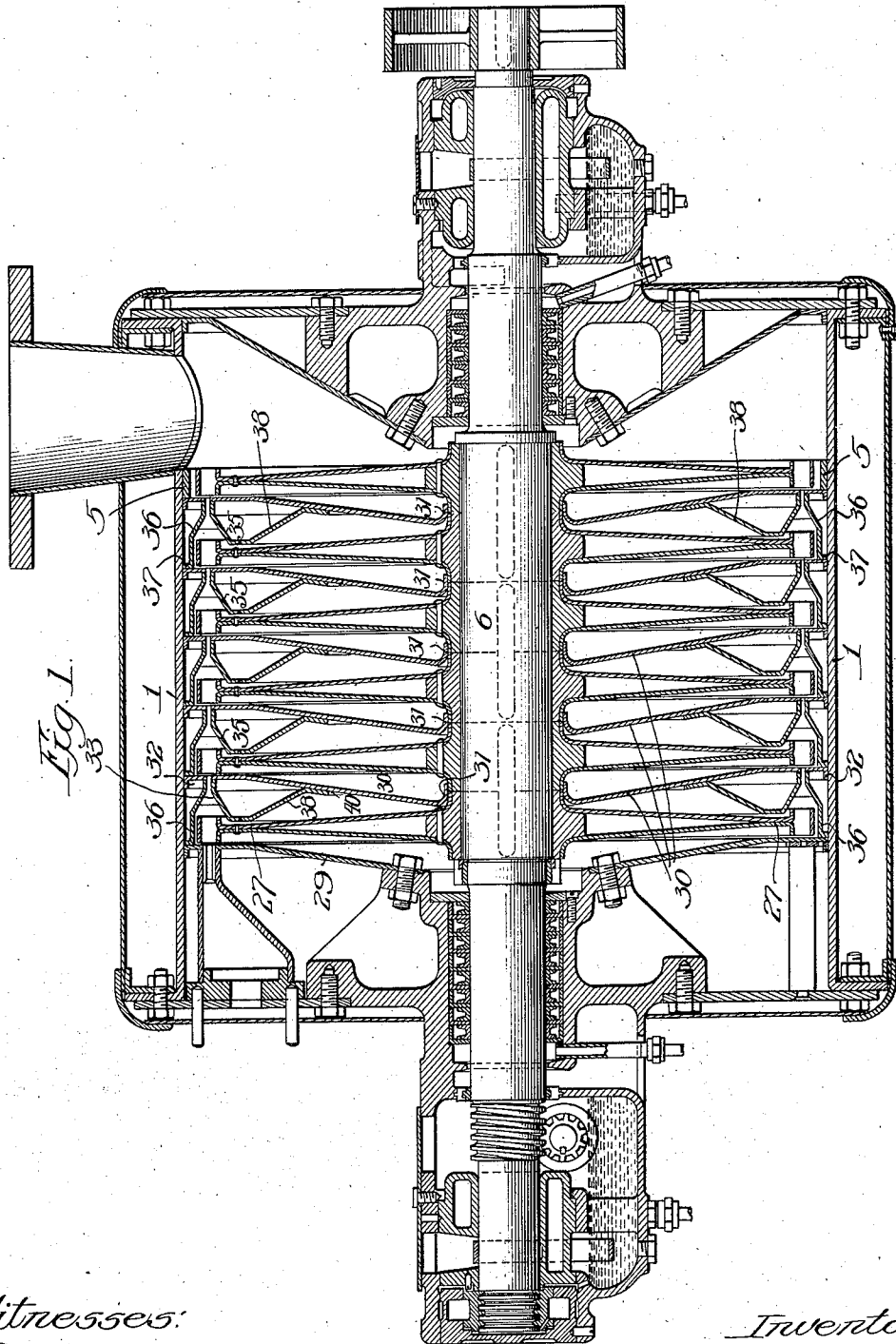


Fig. 1.

Witnesses:
Geo. E. Brown
McAllister Young.

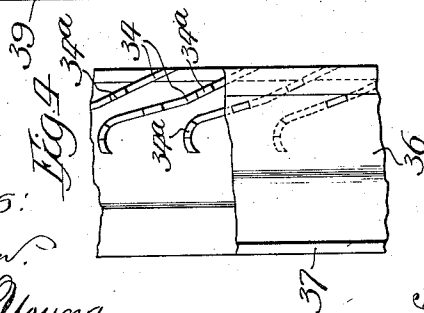
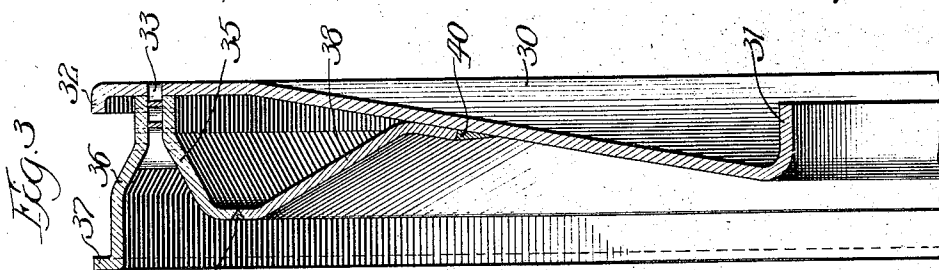
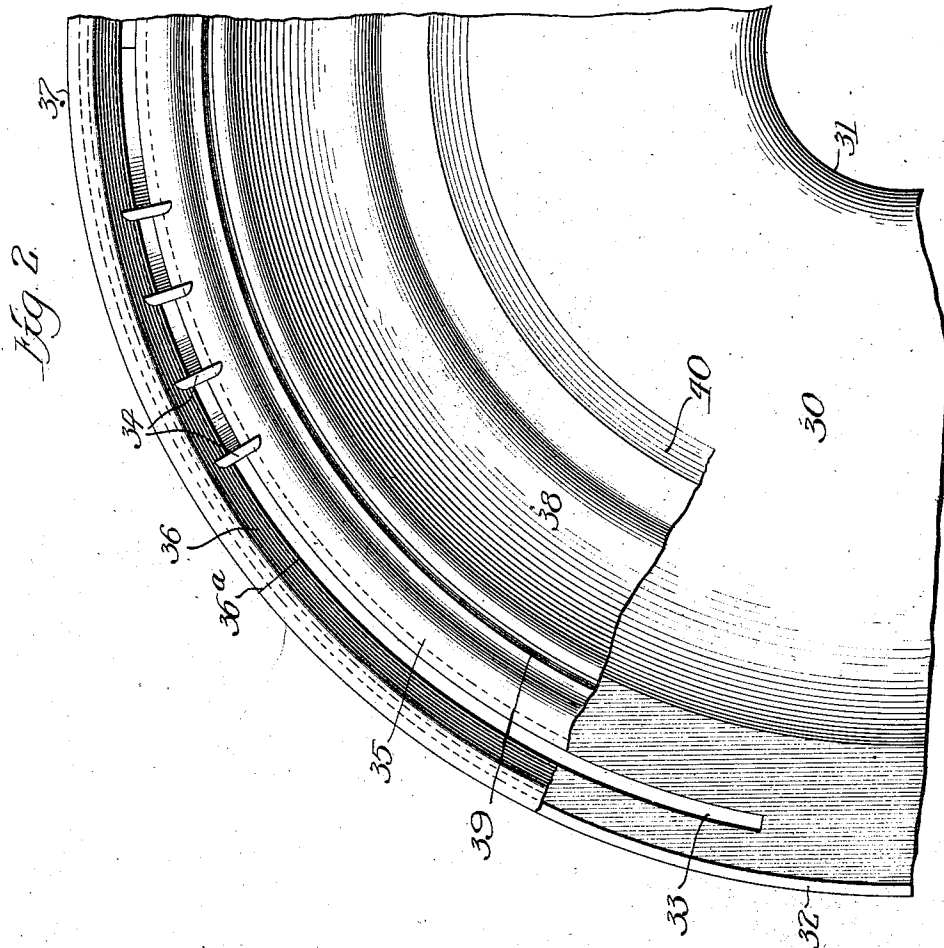
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UNITED STATES PATENT OFFICE.

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STATIONARY DIAPHRAGM FOR STEAM-TURBINES.

1,036,184.

Specification of Letters Patent.

Patented Aug. 20, 1912.

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To all whom it may concern:

Be it known that I, OTTO F. BRUMAN, citizen of the Republic of Switzerland, residing at Berlin, Germany, have invented a certain new and useful Improvement in Stationary Diaphragms for Steam-Turbines, of which the following is a full, clear, concise, and exact description.

My invention relates to steam turbines and more particularly to the stationary diaphragms which constitute the separating walls of the several cells or pressure stages of the turbine. Its object is to provide a diaphragm of great rigidity and strength combined with lightness of weight.

A well-known type of steam turbine consists of a casing divided into a series of cells or pressure stages, the separating walls of which are stationary diaphragms, these diaphragms being located between the rotating wheels of the turbine. Guide vanes or fixed blades are set in each of the diaphragms to form nozzles for directing the steam to the rotary blades carried by the wheels. The steam enters these cells or pressure stages in succession and gradually decreases in pressure as it travels through the several stages until it expands down to exhaust pressure. The diaphragms are therefore subjected not only to a strong steam pressure but to a pressure which is unequal upon the opposite sides of the several diaphragms. For this reason said diaphragms must possess great lateral strength and they are therefore ordinarily made either of cast iron or cast steel and are very heavy.

My invention contemplates a diaphragm made of sheet metal so shaped and supported as to possess the requisite lateral strength and stiffness.

The several features of my invention and the advantages arising therefrom may be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a longitudinal central section through a steam turbine provided with diaphragms embodying my invention; Fig. 2 is an enlarged fragmentary front elevation of the diaphragm; Fig. 3 is a radial section of the diaphragm; and Fig. 4 is a fragmentary plan view partly broken away.

Like reference characters refer to like parts throughout the several views.

The main wall of the diaphragm consists

of a sheet metal plate 30 which is dished to add to its stiffness or lateral strength. The opening through the center of said plate, which fits about the hub of the shaft 6, is provided with an annular flange 31, and the perimeter of said plate is provided with a circumferential flange 32. The flanges 31 and 32 project in opposite directions.

The flange 32 fits tightly within the casing 1 and the flange 31 provides the usual clearance for the hub of the shaft 6, at the same time extending about said hub in such manner as to reduce to a minimum the steam leakage at this point.

Near its circumference the plate 30 is provided, as usual, with arc-shaped slots 33 to form passages for steam from one pressure stage to the next succeeding stage.

The usual stationary blades 34 which are located in the slots 33 are supported between annular shells 35, 36 located the one within the other concentrically of the steam chamber. The forward end of the shell 36 is provided with an annular flange 37 adapted to fit tightly within the casing 1. From the flange 37 said shell 36 extends for approximately one-half of its axial width substantially parallel to the casing 1 and is then tapered inwardly for a short distance and is then extended in an axial direction, it being secured preferably by welding to the plate 30 immediately above the slots 33. Secured immediately below the slots 33 is the annular shell 35 which is of less axial width than the shell 36 in order to provide space in the cell for the wheel 27. The shell 35 tapers toward the shell 36 and then extends axially, parallel with said latter shell, and is secured by welding to the plate 30 flush with the arc-shaped openings 33 therein. The shell 35 is braced by an annular plate 38 which is welded at its outer circumference to the shell 35 as indicated at 39 and which, at its inner circumference, is welded to the plate 30 as is indicated at 40.

The blades 34 are held between the shells 35 and 36, said blades being provided with the usual tangs 34^a which fit in slots in said shell. In order that the shell 36 may be placed about said blades it is split, as indicated at 36^a, and is welded together at this place after the blades have been secured to position.

As will be seen from Fig. 1 the interior of the casing 1 is preferably provided at its

outlet end with a steady or supporting ring 5 against which the diaphragm of the last pressure stage rests. The flange 37 of this diaphragm constitutes a supporting ring for 5 the diaphragm of the preceding pressure stage, etc. The shell 36 of the diaphragm of the first pressure stage rests against the inner plate 29 of the cylinder head. The diaphragms are thus rigidly mounted so as 10 to mutually strengthen each other. The plate 38 not only braces the shell 35 but gives added strength and rigidity to the plate 30.

The structure and arrangement of the 15 diaphragms is thus such as to afford great strength and rigidity and also to provide a steam passage for the nozzles which will conduct the steam from the rotary blades with gradually increasing velocity through 20 the nozzles determined by the stationary blades 34. The pressure drop from one pressure stage to the next succeeding one is not so great but that the nozzles themselves may be substantially of uniform cross section 25 along their length, that is they need not be divergent. This nozzle construction gives efficiency combined with cheapness of construction.

Matter shown and described but not 30 claimed herein forms the subject matter of my co-pending applications.

I claim:

1. In a steam turbine, a diaphragm comprising a sheet metal plate provided near its 35 circumference with arc-shaped slots, two concentric sheet metal shells secured to said plate upon opposite sides of said slots, and guide vanes secured between said shells.

2. In a steam turbine, a diaphragm comprising a sheet metal plate of dished form 40 provided at its center with an opening having a flange thereabout extending rearwardly from said plate and provided at its circumference with an annular flange ex-

tending parallel and in an opposite direction to said first mentioned flange, said plate being provided near its circumference with arc-shaped slots, two concentric sheet metal shells secured to said plate upon opposite sides of said slots, and guide vanes secured 50 between said shells.

3. In a steam turbine, a diaphragm comprising a sheet metal plate provided near its circumference with arc-shaped slots, two concentric sheet metal shells secured to said 55 plate upon opposite sides of said slots, said shells tapering toward each other to provide a steam passageway of gradually tapering cross-section, and guide vanes secured between said shells. 60

4. In a steam turbine, a diaphragm comprising a sheet metal plate of dished form provided at its center with an opening having a flange thereabout extending rearwardly from said plate and provided at its 65 circumference with arc-shaped slots, two concentric tapering sheet metal shells secured upon opposite sides of said slots and forming between them a converging steam passage, and guide vanes secured between 70 said shells.

5. In a steam turbine, a diaphragm comprising a sheet metal plate provided near its circumference with arc-shaped slots, two concentric sheet metal shells secured to said 75 plate upon opposite sides of said slots, said shells being provided adjacent said slots with parallel walls and being also provided with tapering walls converging toward said parallel walls, and guide vanes secured between 80 said shells.

In witness whereof, I hereunto subscribe my name this 4th day of December, A. D., 1911.

OTTO F. BRUMAN.

Witnesses:

HENRY HASPER,
WOLDEMAR HAUPT.