970,106.

H. PETERS.

STEAM TURBINE.

APPLICATION FILED AUG. 4, 1910.

Patented Sept. 13, 1910.

6 SHEETS—SHEET 1.

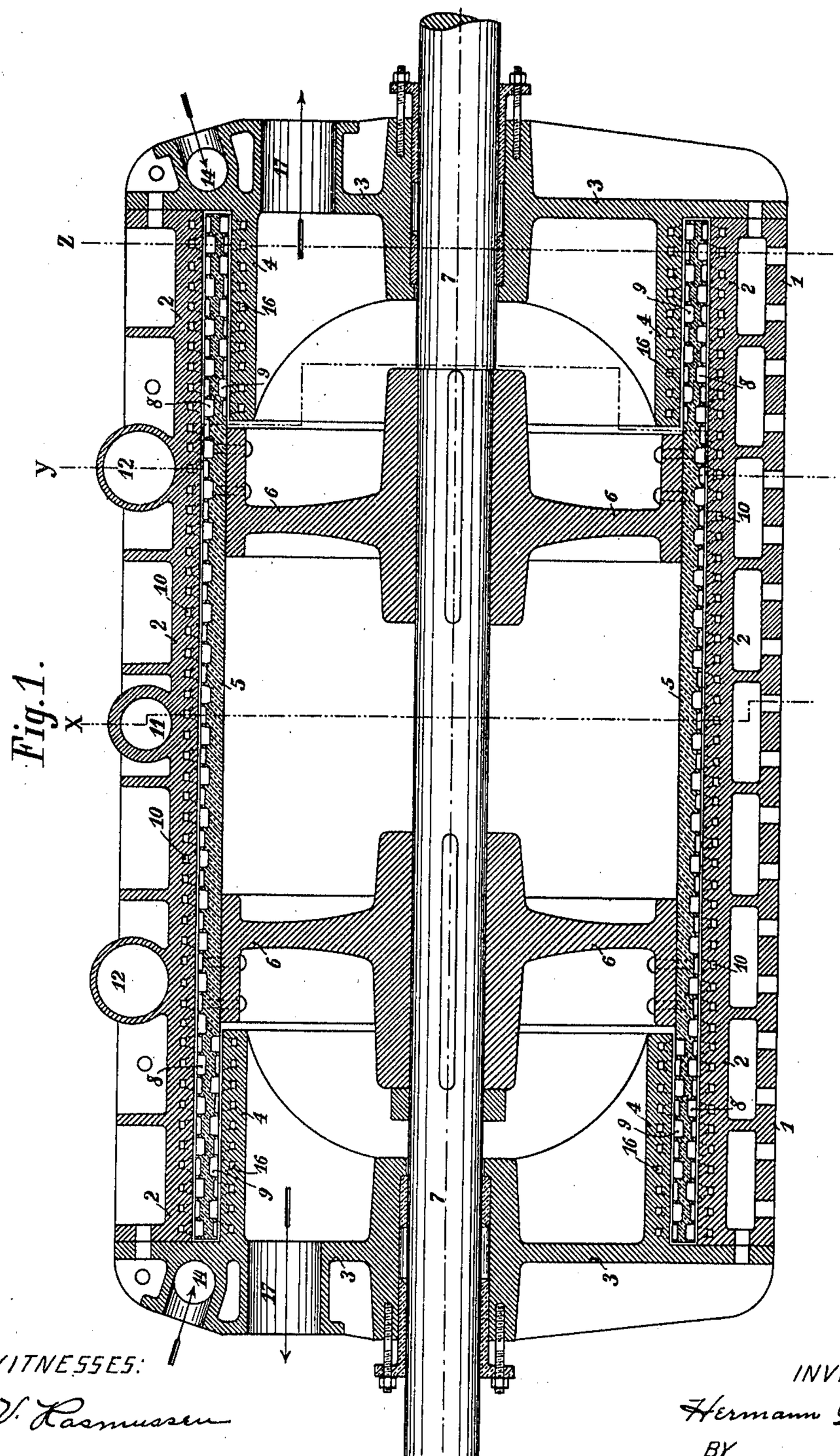

Fig. 1.

WITNESSES:

G. V. Rasmussen

Louis Alexander

INVENTOR

Hermann Peters

BY

Bressler & Kinauth

ATTORNEYS

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6 SHEETS—SHEET 2.

Fig. 3.

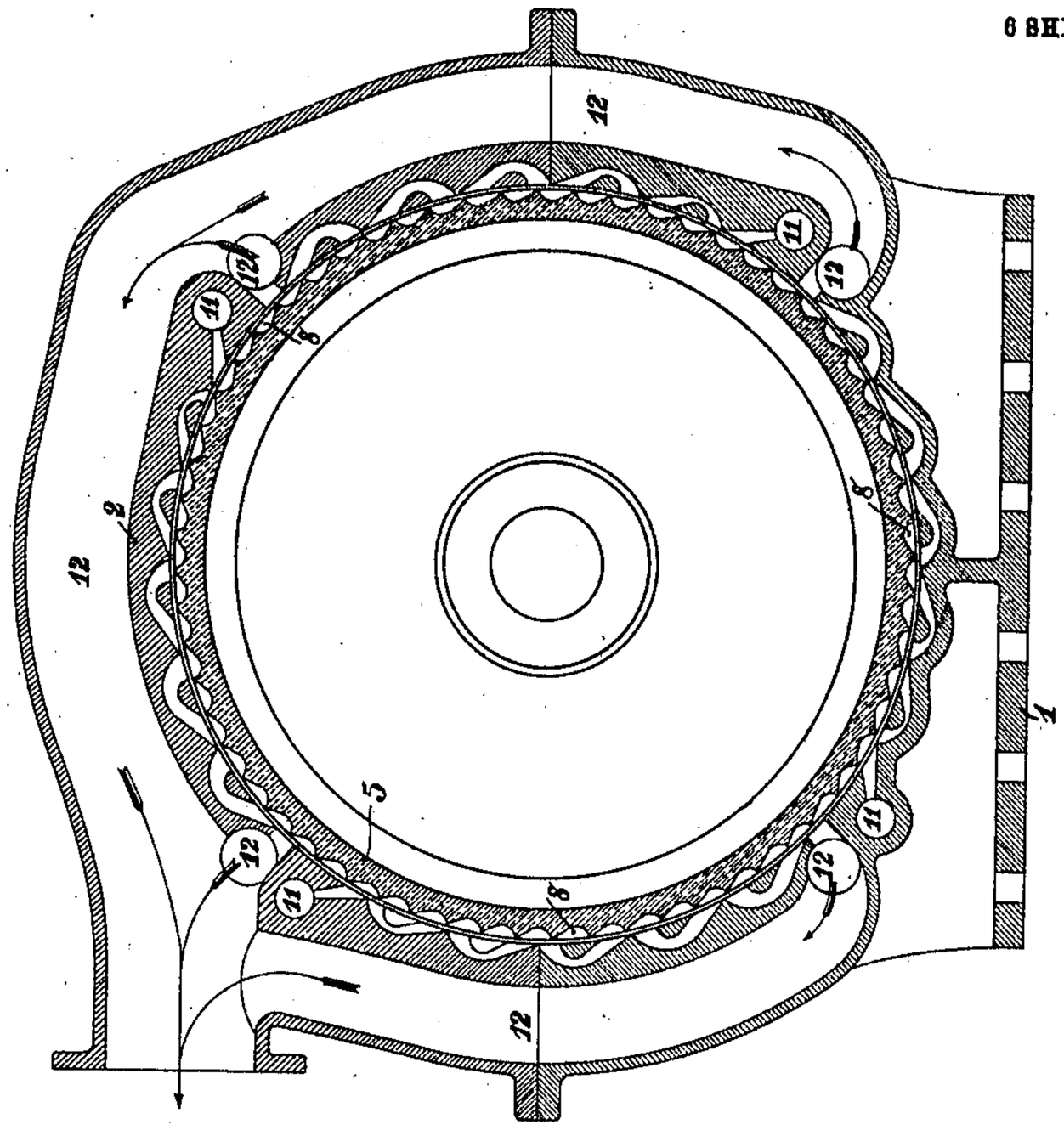
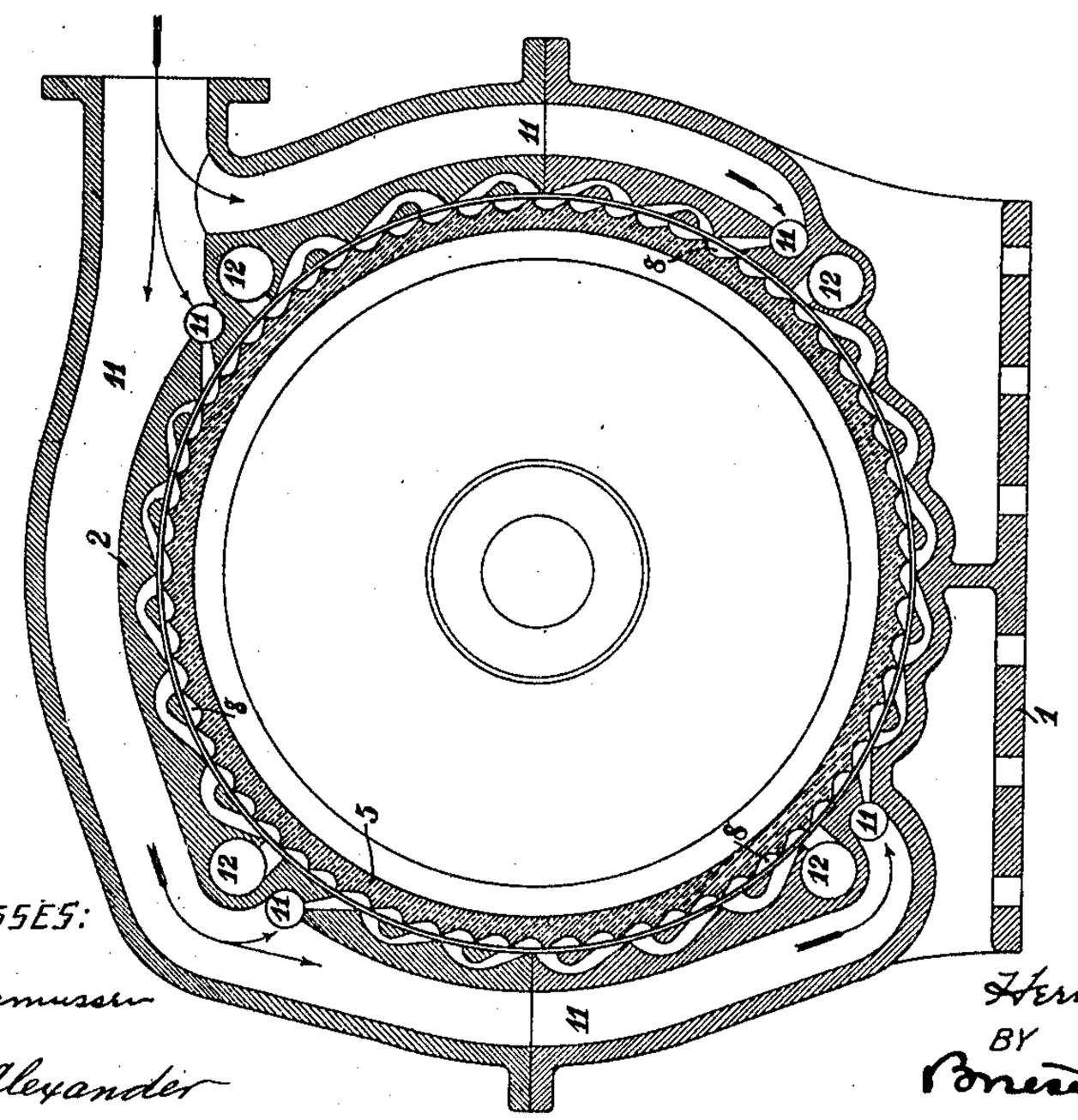


Fig. 2.



WITNESSES:

G. V. Rasmussen

Louis Alexander

INVENTOR

Hermann Peters

BY

Bonnell & Kennedy

ATTORNEYS

H. PETERS.

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6 SHEETS—SHEET 3.

Fig. 5.

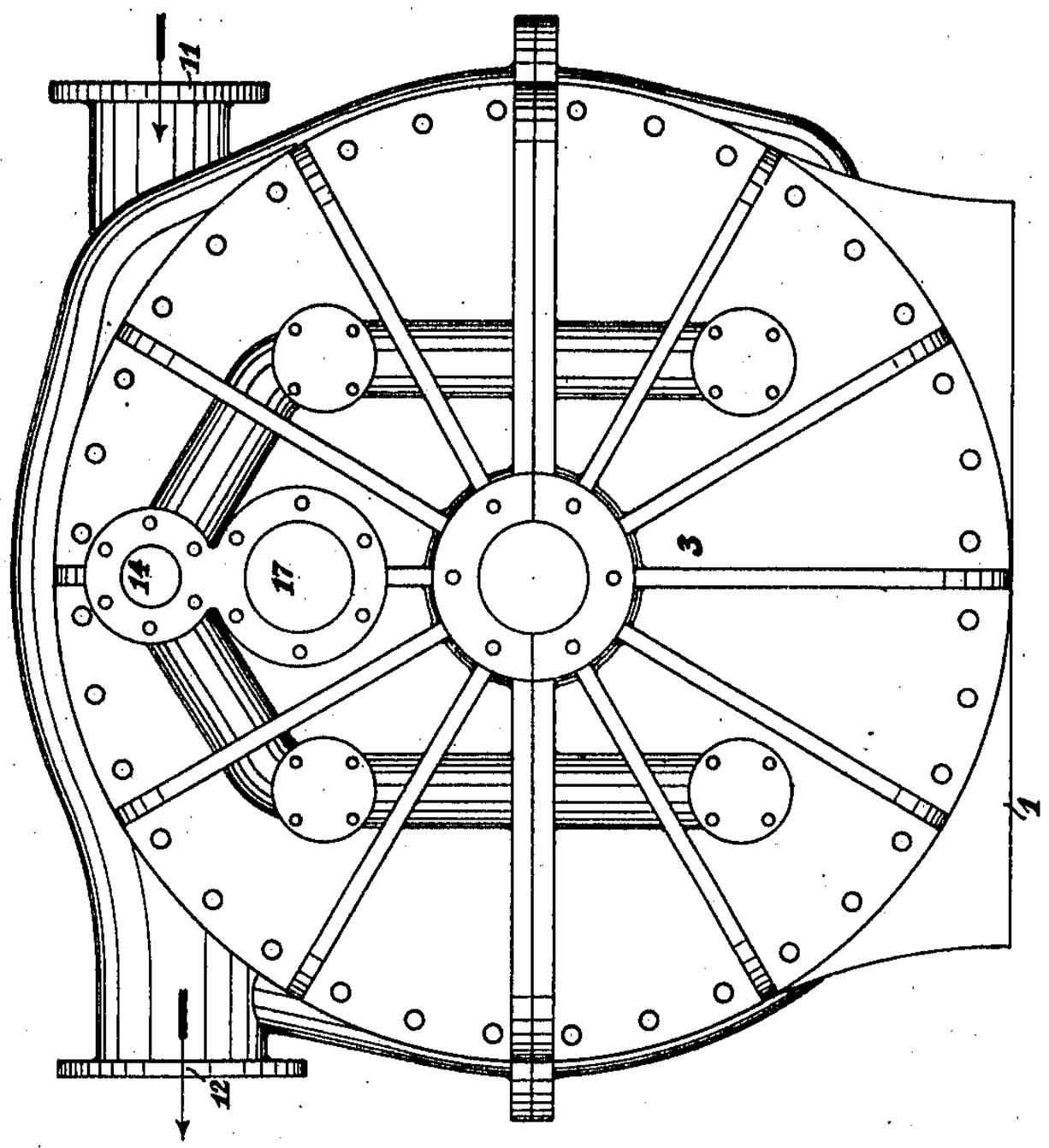
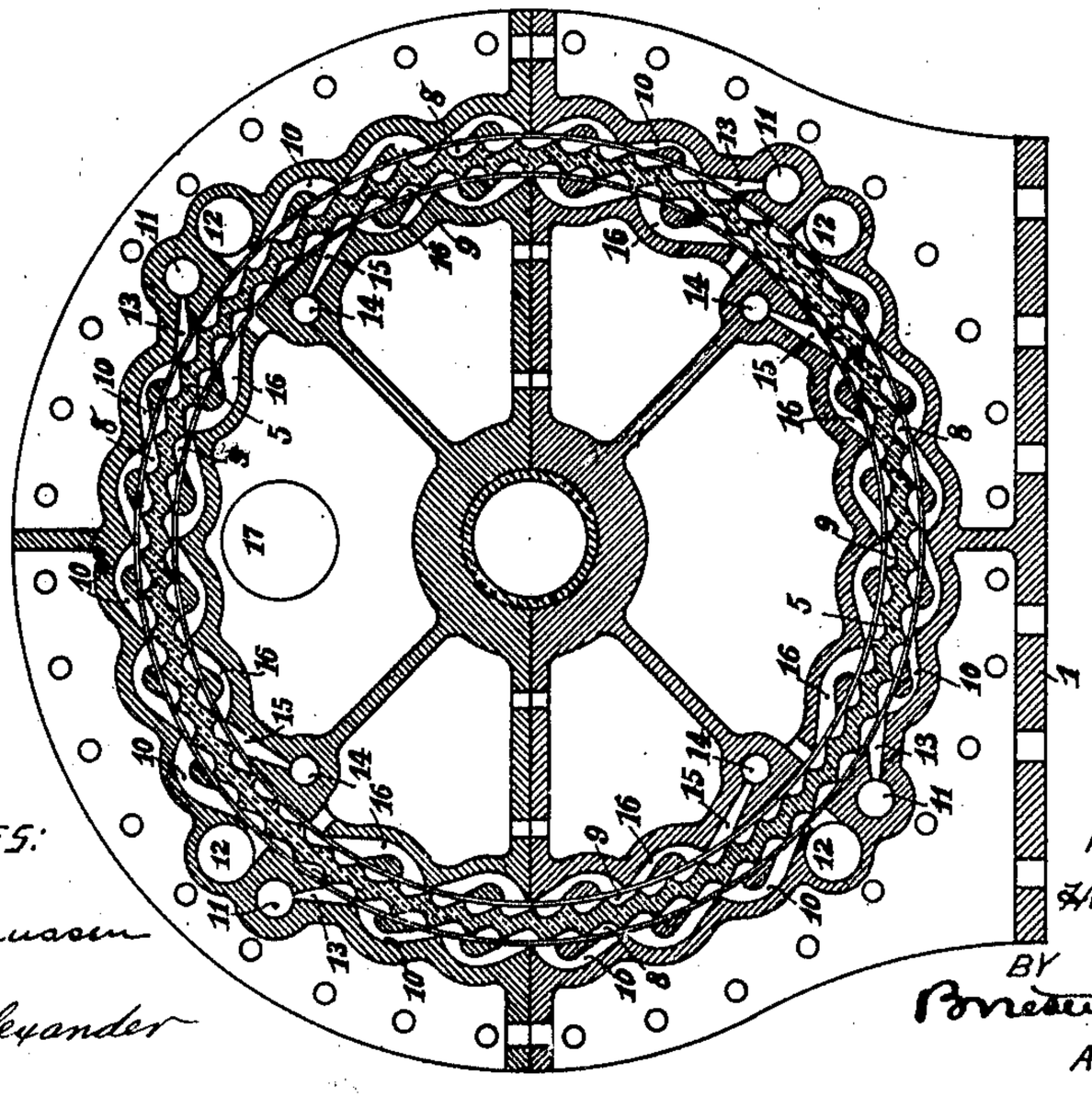


Fig. 4.



WITNESSES:

G. V. Rasmussen

Louis Alexander

INVENTOR

Hermann Peters

BY

Bonnesen & Knauth

ATTORNEYS

H. PETERS.

STEAM TURBINE.

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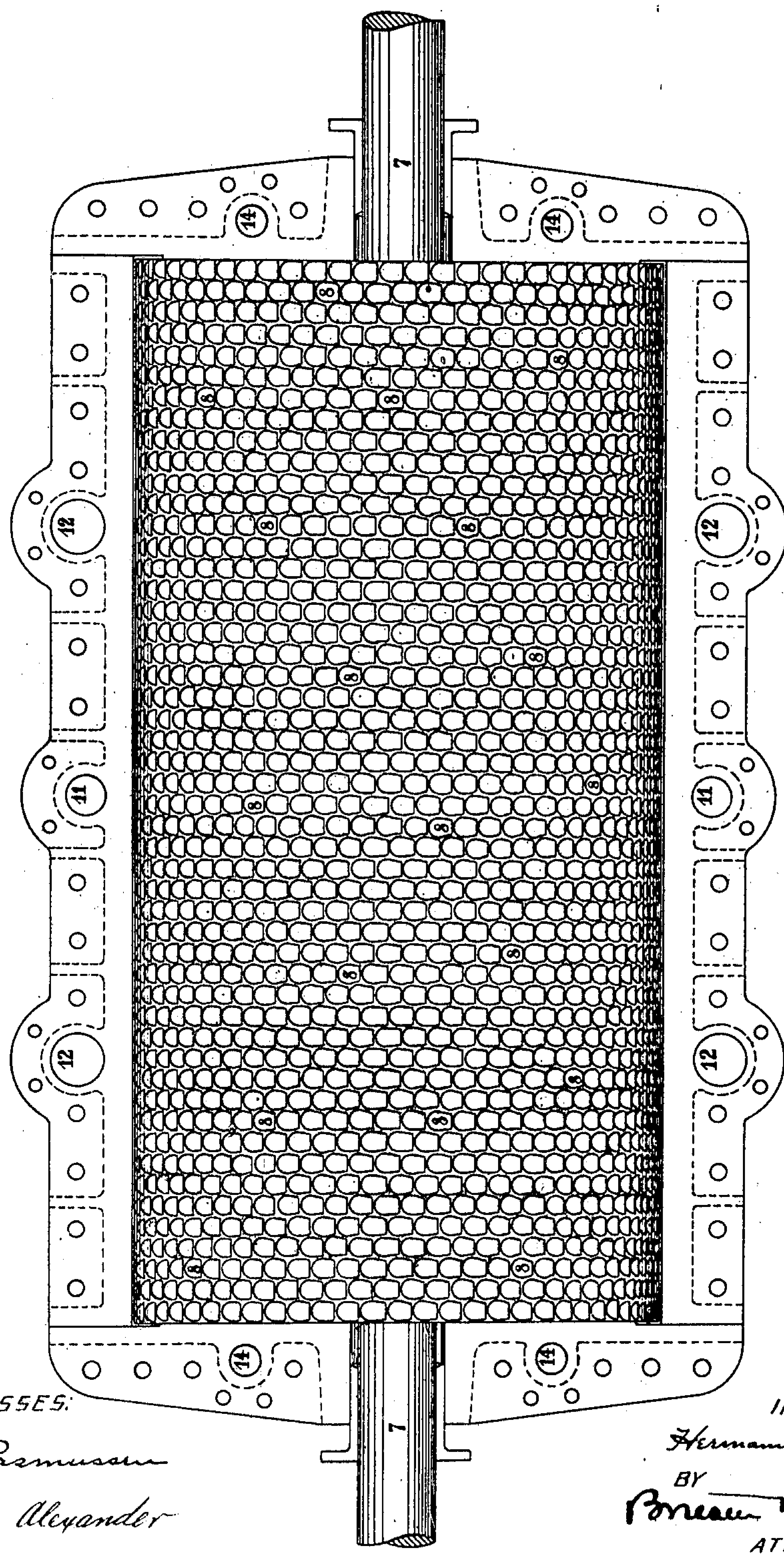
6 SHEETS—SHEET 4.

Fig. 6.



WITNESSES:

G. V. Rasmussen

Louis Alexander

INVENTOR

Hermann Peters

BY

Briesen & Knauth

ATTORNEYS

H. PETERS.

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6 SHEETS—SHEET 5.

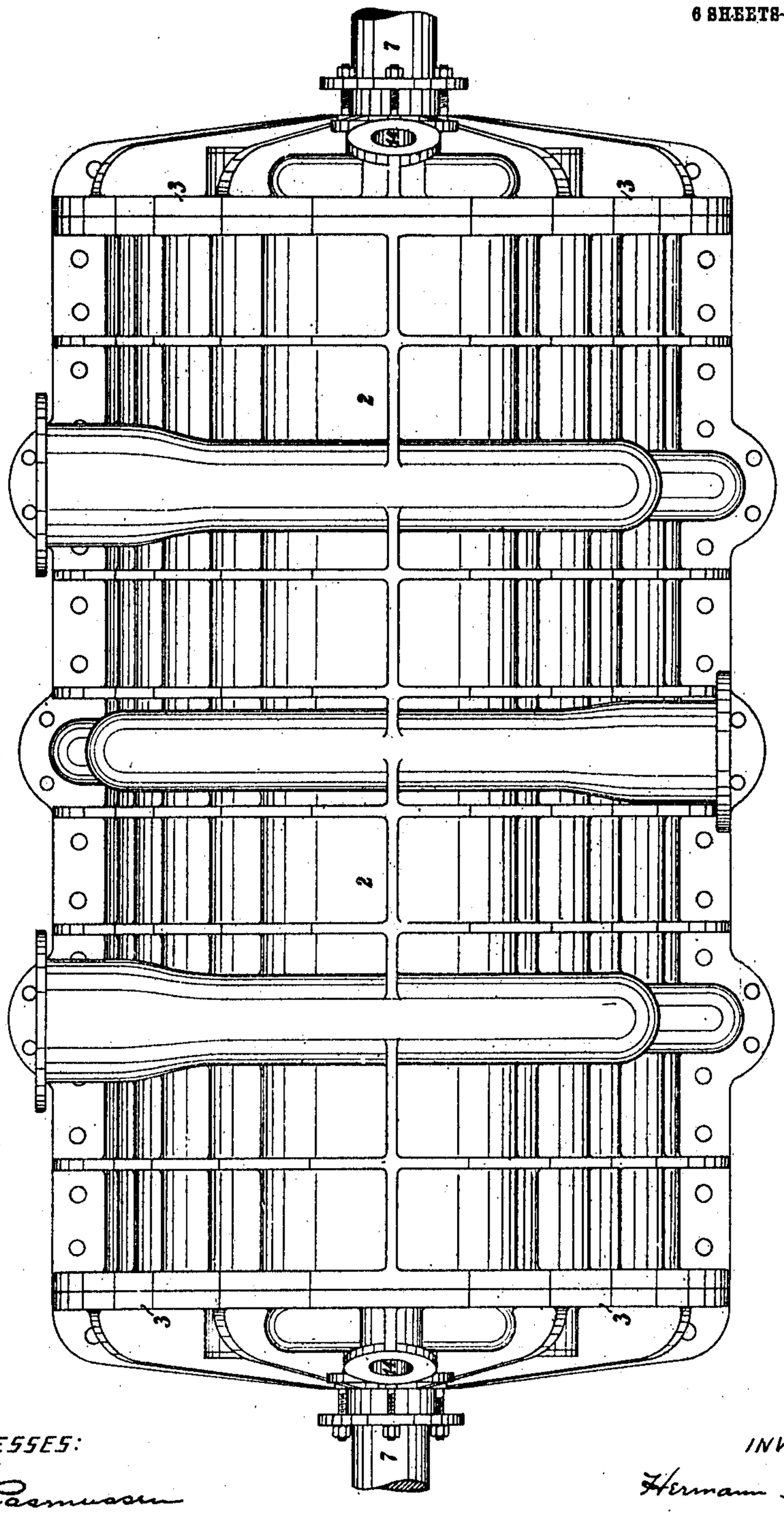

Fig. 7.

WITNESSES:

G. V. Rasmussen

Louis Alexander

INVENTOR

Hermann Peters

BY

Bonnesen & Knauth

ATTORNEYS

970,106.

H. PETERS.

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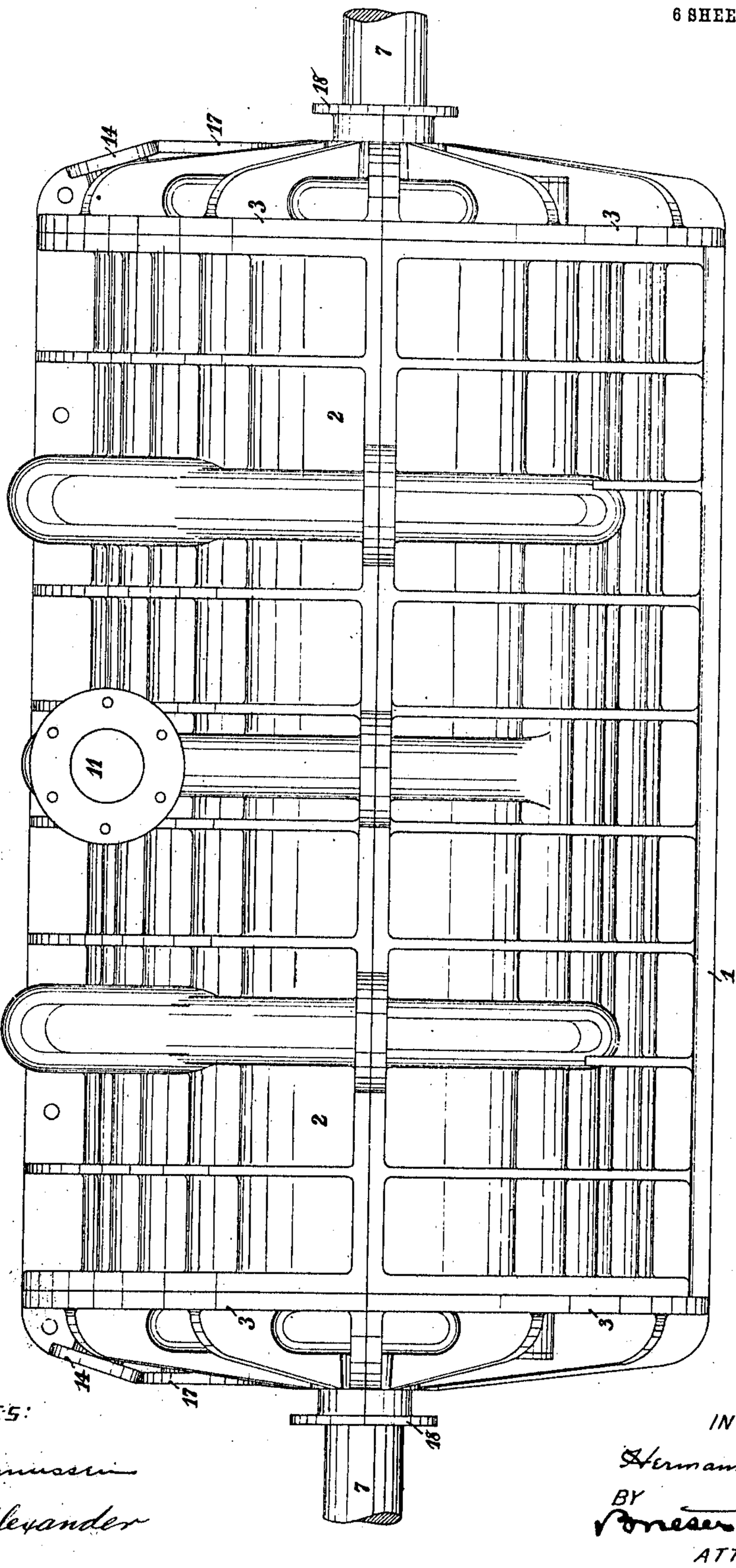
6 SHEETS—SHEET 6.

Fig. 8.



WITNESSES:

G. V. Rasmussen

Louis Alexander

INVENTOR

Hermann Peters

BY

Bonnesen & Kraus

ATTORNEYS

UNITED STATES PATENT OFFICE.

HERMANN PETERS, OF HAMBURG, GERMANY.

STEAM-TURBINE.

970,106. Specification of Letters Patent. Patented Sept. 13, 1910.

Application filed August 4, 1910. Serial No. 575,529.

To all whom it may concern:

Be it known that I, HERMANN PETERS, engineer, a subject of the German Emperor, residing at Mundsburgerdamm 37, Hamburg, Germany, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

The subject-matter of my invention is a steam turbine which comprises one single casing and one single rotor and can work in two directions of rotation, namely forward and backward.

One illustrative embodiment of my invention is represented by way of example in the accompanying drawings, wherein:—

Figure 1 is a vertical longitudinal section through the turbine, Figs. 2, 3 and 4 are transverse sections taken in Fig. 1 on the lines X, Y and Z, respectively, and Fig. 5 is an end elevation; Fig. 6 is a plan view of the rotor after the top part of the casing has been removed, while Figs. 7 and 8 are top plan view and side elevation, respectively, showing the closed turbine.

Referring to the drawings, the rotor is surrounded by a two-part casing or cylinder 2 which rests on a base plate 1 and is closed at its ends by covers 3. The latter have inwardly-projecting, annular collars or flanges 4 which inwardly surround portions of the rotor.

The rotor comprises a cylindrical steel tubular casing or cylinder 5 carried by suitably shaped members or spiders 6 keyed on the turbine shaft 7. The rotor is provided not only on its external periphery, but also on a portion of its internal periphery with cell-like, blade-shaped, milled cavities or recesses 8 and 9, respectively. The cavities or cells 8 are connected with peculiarly wave-shaped channels or ducts 10 which are necessary for altering the direction of flow of the steam and are arranged on the internal periphery of the casing 2 in a plurality of groups, five being shown in the illustrative embodiment. These channels 10 are cut in the casing 2 and then partially covered over by inserting dove-tail shaped strips over them, in order thus to give the passages the requisite shape. The channels 10 in each of the individual groups enlarge toward the condenser from the inlet nozzle to the exhaust in a definite relation which depends on the conditions of expansion of the steam. Each of these individual groups is connected with the steam supply pipe 11 and also with the exhaust pipe 12. The steam is admitted to the individual cells 8 of the rotor through radial nozzles 13, expands five times through the channels 10 and finally passes at about half an atmosphere excess pressure above atmospheric from the exhaust pipes 12 into the condenser.

The full steam pressure acting on all the blades of the exterior periphery of the rotor causes the turbine to run forward. The opposite, *i. e.* backward rotation of the turbine is brought about, on the contrary, when the steam acts on the blades on the inner periphery of the rotor, the cell-like blade-shaped cavities or recesses being cut here in the opposite direction. It is true that only a portion, in practice about two-fifths to one half of the internal periphery is operative, but the turbine runs backward with only a correspondingly less output which perfectly suffices for the purposes for which it is employed.

As seen in Fig. 4, when the turbine runs backward steam is supplied through the pipes 14 and exhausts through the pipe 17 exactly as when running forward. Accordingly, radial admission nozzles 15 are provided and also the peculiarly wave-shaped channels 16 which alter the direction of flow of the steam and communicate with the cells of the rotor. Steam is thus admitted through the pipes 14 and the nozzles 15 into the turbine, expands while guided through the wave-shaped channels 16 formed into groups until its driving power is completely utilized, and passes at about half an atmosphere excess pressure above atmospheric through the pipes 17 into the same condenser as when running forward.

As the steam almost completely gives up its energy to the turbine and is conducted with only very little excess pressure above atmospheric through the very wide exhaust pipes 17 into the condenser, the shaft 7 does not require any special pressure-proof packing. In general, quite ordinary stuffing-box packing perfectly suffices in order perfectly to pack the turbine shaft in the casing.

Steam is admitted either to the exterior or to the interior periphery of the rotor for starting the turbine running forward or

backward as desired by correspondingly supplying steam through the steam pipe 11 or through the steam pipes 14.

I claim:—

1. In a steam turbine which can run forward and backward, the combination, with a shaft, of one hollow steel cylindrical rotor secured thereon, a cylindrical casing surrounding said rotor and having one or more internal cylindrical portions projecting into the rotor, said rotor having outer, cell-like, blade-shaped cavities in its exterior periphery and inner, oppositely-directed cell-like, blade-shaped cavities in the one or more portions of its interior periphery opposite the one or more internal cylindrical portions of the casing, said casing having nozzles and wave-shaped passages for altering the direction of flow of the steam in its internal peripheries arranged in operative communication with said outer and with said inner cavities, and steam supply pipes for supplying steam to said nozzles.

2. In a steam turbine which can run forward and backward, the combination, with a shaft, of one hollow steel cylindrical rotor secured thereon, a cylindrical casing surrounding said rotor and having two internal cylindrical flanges projecting into the ends of the rotor, said rotor having outer, cell-like blade-shaped cavities in its exterior periphery and inner, oppositely-directed cell-like, blade-shaped cavities in the portions of its interior periphery opposite said flanges, said casing having a plurality of nozzles, and a plurality of wave-shaped passages arranged in groups, for altering the direction of flow of the steam, in its internal periphery and in said flanges arranged in operative communication with said outer and with said inner cavities, and steam supply pipes for supplying steam to said nozzles.

In witness whereof I have hereunto signed my name this 25″ day of June 1910, in the presence of two subscribing witnesses.

HERMANN PETERS.

Witnesses:

ERNEST H. L. MUMMENHOFF,

IDA CHRIST HAFERMANN.