P. A. CHALEIL.

TURBINE.

APPLICATION FILED APR. 7, 1909.

1,012,813.

Patented Dec. 26, 1911.

4 SHEETS—SHEET 1.

Fig. 1.

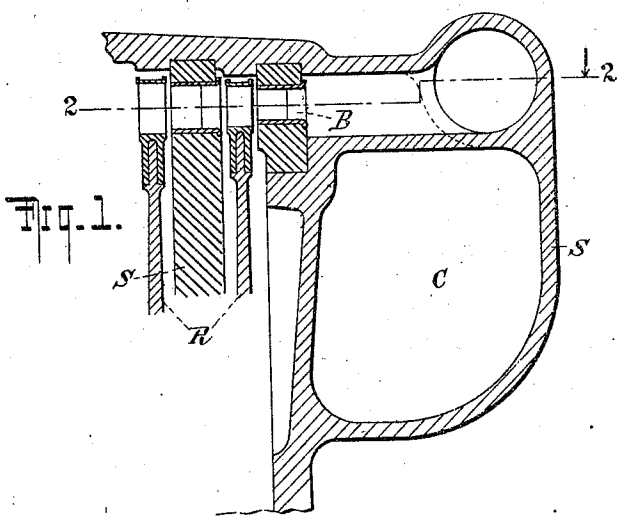
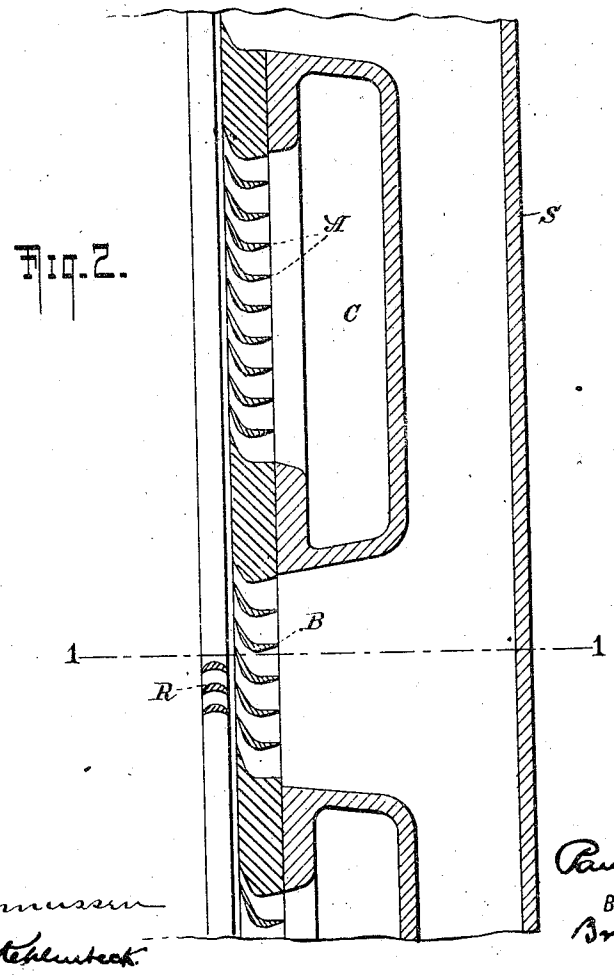


Fig. 2.



WITNESSES

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4 SHEETS—SHEET 2.

Fig. 3.

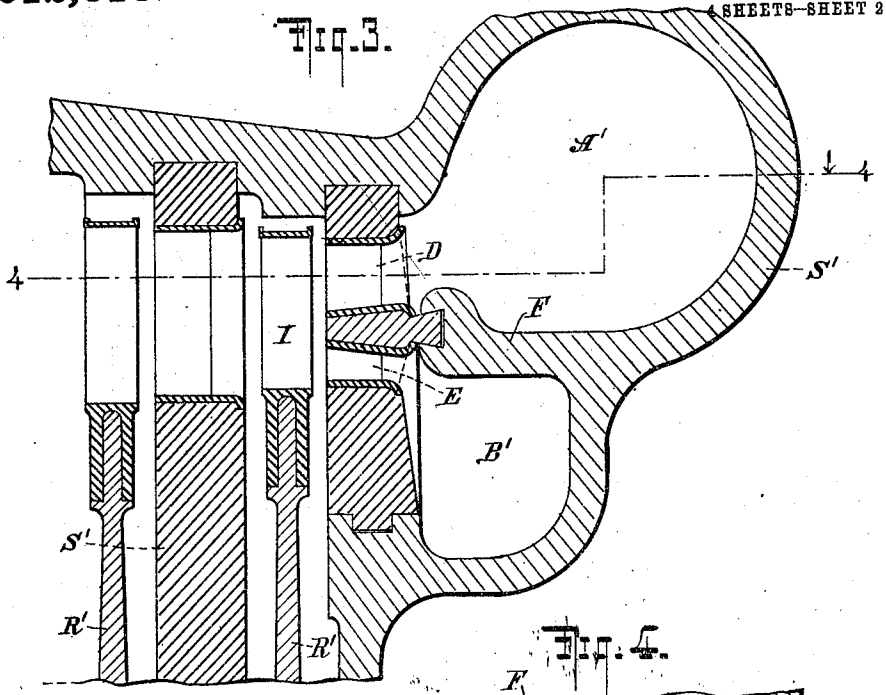
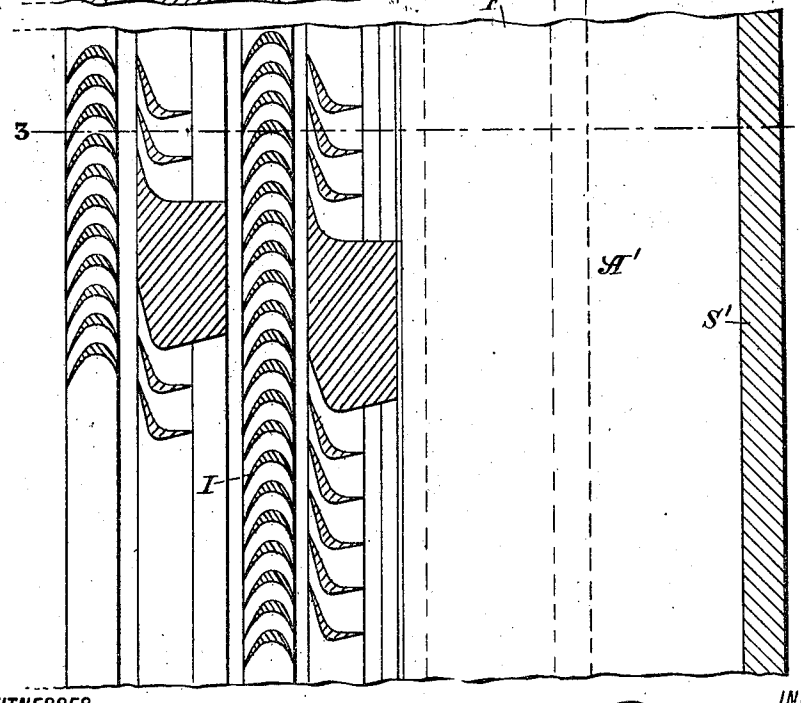


Fig. 4.



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4 SHEETS—SHEET 3.

Fig. 5.

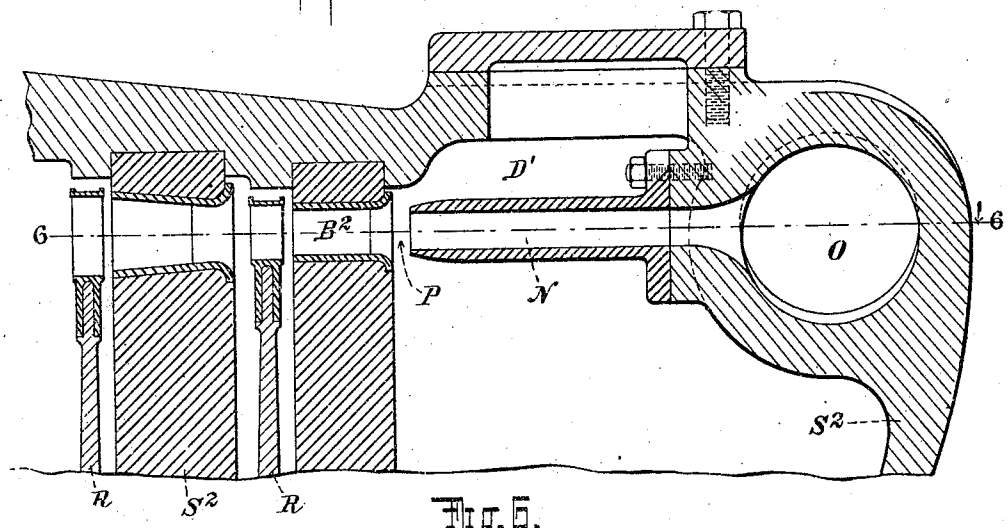
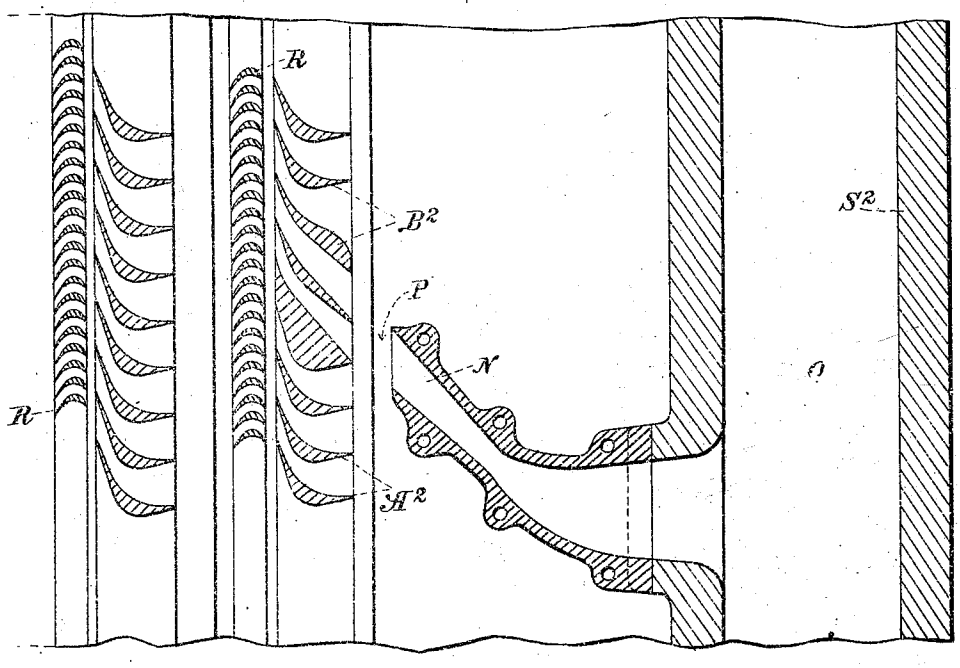


Fig. 6.



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4 SHEETS—SHEET 4.

Fig. 7.

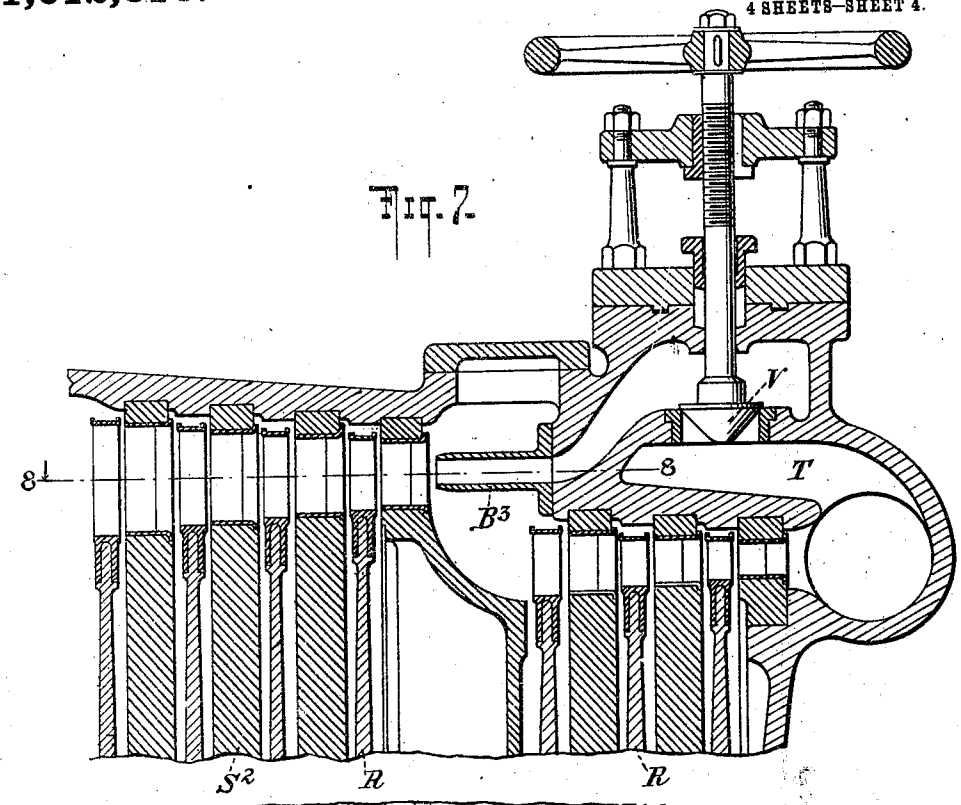
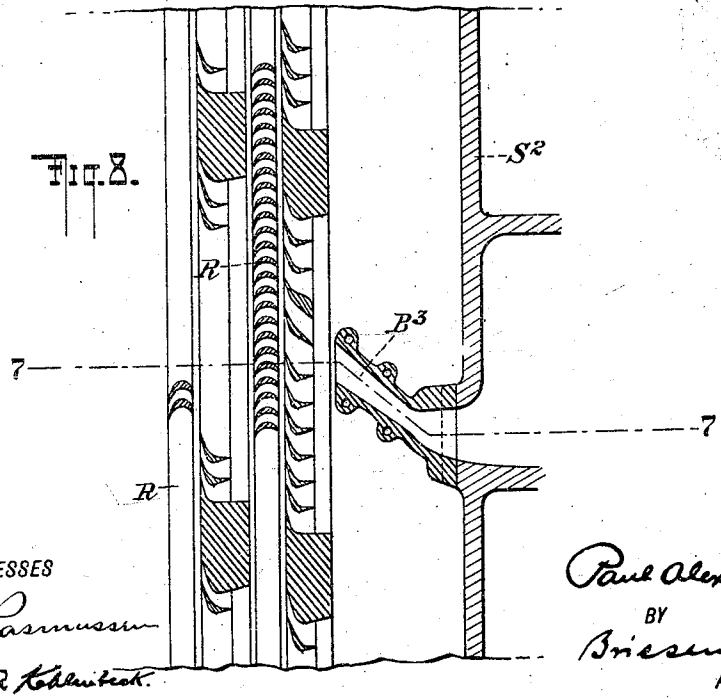


Fig. 8.



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UNITED STATES PATENT OFFICE.

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TURBINE.

1,012,813. Specification of Letters Patent. Patented Dec. 26, 1911.

Application filed April 7, 1909. Serial No. 488,497.

To all whom it may concern:

Be it known that I, PAUL ALEXIS CHALEIL, a citizen of the French Republic, and resident of Paris, France, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to turbines intended to be operated with steam of different pressures and more especially to turbines driven at low pressure by the exhaust steam of reciprocating engines and also at high pressure by live steam from the boiler when the exhaust steam supply is insufficient or ceases completely.

In low pressure turbines receiving low pressure steam from the exhaust of engines running intermittently it is necessary, when the steam is deficient, to use live steam from the boilers expanded from the boiler pressure to the low pressure for which the turbine has been designed. A portion of the energy contained in the high-pressure steam is thus lost. When the turbine is to run for long periods on live steam, it has been the practice, in order to secure a good steam efficiency, to have the live steam act upon separate wheels designed for high pressure work and then to admit the steam from the high pressure wheel section to the low pressure section of the turbine. The price of such machines and their size are both greatly increased on account of the two special sections used in the turbine.

My invention relates to the use of one wheel or one set of wheels only, adapted to receive directly steam of different pressures, either simultaneously or separately. That is to say, the same buckets or blades receive the impact of the high-pressure steam and of the low-pressure steam. I inject steam at different pressures through nozzles having different sections.

In the accompanying drawing I have illustrated several constructions embodying my invention.

Figure 1 is a vertical section on line 1—1 of Fig. 2; and Fig. 2 is a horizontal section on line 2—2 of Fig. 1, showing a turbine in which the steam nozzles or distributers are arranged in alternate segments at a uniform distance from the axis; Fig. 3 is a vertical section on line 3—3 of Fig. 4; and Fig. 4 is a horizontal section on line 4—4 of Fig. 3 in which the nozzles for steam of different pressures are disposed at different distances from the axis; Fig. 5 is a partial axial section and Fig. 6 is a section on the line 6—6 of Fig. 5 of a further construction in which the high pressure nozzles discharge their steam into the low pressure nozzles. Fig. 7 is a vertical section on line 7—7 of Fig. 8 and Fig. 8 a horizontal section on line 8—8 of Fig. 7 showing a construction in which a by-pass is provided to lead the live steam directly to the low pressure portion when desired.

The stationary member S of the turbine shown in Figs. 1 and 2 is divided at its periphery into a number of sectors, some of them for the use of high pressure steam and others for the use of low pressure steam. The sectors A for low pressure use receive steam through the low pressure inlet channel C. The sectors B for high pressure use have no communication whatever with low pressure sectors and receive live steam through a pipe connected with the boiler directly. It should be understood that the nozzles attached to the high and low pressure sectors respectively have different shapes and are designed to expand the steam in a different manner according to whether it be high pressure or low pressure steam. Both the high and low pressure steam, when emerging from the nozzles, will therefore act efficiently on the rotating wheel R having buckets or blades of any approved construction. When the turbine is run with either low or high pressure steam alone only the jets coming from the sectors A or the sectors B respectively will strike the first rotating wheel R and the steam becomes more and more uniformly distributed in the succeeding wheels.

In Figs. 3 and 4 the stationary member S′ is divided into two nozzle rows A′ and B′ respectively one within the other and separated from each other by a cylindrical wall F. One of these sections A′ is for low

pressure steam and the other B′ is for high pressure steam. Each kind of steam can be brought to its particular row of nozzles through annular chambers such as D and E. Both high and low pressure steam (after suitable expansion) are discharged into the steam buckets I of the rotating wheel R′ which in some cases may be the only bucket member, although in the drawing it is the first wheel of a series through which the steam passes successively.

The nozzles described above may receive steam directly from the chambers or they may be combined with a suitable number of nozzles.

In the construction shown in Fig. 1, when the engine is using only low pressure steam, the steam will strike the first wheel in sections scattered all around the periphery; for instance, there may be four or five such spaced sections or segments. The jets of steam will, therefore, be discontinuous in the first wheel and also in some of the following wheels. In order to obviate this drawback, I may adopt a construction such as illustrated in Figs. 5 and 6. The stationary member S^2 in this case has a continuous annular row of double nozzles A^2, B^2. The low pressure nozzles A^2 receive steam direct from the exhaust chamber D′ and some of the nozzles B^2 are placed in registry with the nozzles N, which direct the live steam into the nozzles B^2. The nozzles N receive live steam from the conduit O. These nozzles N do not come quite close to the nozzles B^2 thus leaving a free space P behind the nozzles B^2 and allowing a certain quantity of low pressure steam to flow freely through the nozzles B^2 when the machine is running on low pressure steam. It will be seen that this method of directing steam will give a more uniform distribution in the wheel.

The special advantages of my system are as follows: It allows the utilization of the energy contained in high pressure steam without the loss involved in previously expanding it to the pressure for which the low pressure nozzles have been designed. The efficiency is not as great as in the case where there is a high pressure and a low pressure section in the turbine, but a considerable amount of the energy contained in the high pressure steam is utilized to produce power. The nozzles corresponding to the two different steam pressures are brought to act on the same wheels or buckets and by means of my invention the construction of a separate group of high pressure wheels is avoided. It will also be observed that when such a separate group of high pressure wheels is used, and the turbine is run by exhaust steam applied to the low-pressure section, the high-pressure section is carried along idly and a corresponding loss of power ensues. This I avoid by my invention. Furthermore, in Figs. 5 and 6 it is shown that the space P provided at the ends of the nozzles, has the effect of allowing the low pressure steam to flow on the entire periphery of the stationary member when the high pressure steam is cut off. In this way the entire nozzle area of the stationary member is utilized on low pressure work.

Various modifications may be made without departing from the nature of my invention as set forth in the claims.

This invention is also applicable to overloading turbines by means of a by-pass of steam, allowing a higher pressure to reach the lower pressure stage of the turbine.

Under the usual practice it is necessary to expand the steam so brought to the turbine with a consequent loss of energy. It is possible to avoid this drawback by employing a construction of the character shown in Figs. 7 and 8 where by opening the valve V part of the live steam from chamber T will pass to the nozzles B^3 and thus reach the low-pressure section of the turbine, while the remainder of the live steam passes first through the high pressure section and then to the low-pressure section.

My invention is of particular value in connection with turbine boats when run at slow speed with a reduced flux of steam, the provision of special cruising turbines being dispensed with.

In each of the constructions shown, it is intended that all the rotary members or wheels should be secured rigidly to a single shaft, although this is not absolutely essential in all cases.

While I have spoken of high-pressure steam and of low-pressure steam, it should be well understood that this refers only to the initial condition of the steam, and that both kinds of steam have practically the same pressure when they reach the buckets.

I claim as my invention:

1. A turbine comprising a rotary member having buckets, separate stationary nozzles located in the same plane transverse to the axis of rotation, said nozzles being of different construction to work efficiently with steam of different pressures, and additional high-pressure nozzles located in a different plane and arranged to discharge steam into some of the first-named nozzles.

2. A turbine comprising a rotary member having buckets, separate stationary nozzles located in the same plane transverse to the axis of rotation, said nozzles being of different construction to work efficiently with steam of different pressures, a low-pressure

channel communicating with all of said nozzles, and additional high pressure nozzles located within said channel and arranged to discharge steam into nozzles of the first-named set which differ in construction from the other nozzles of said set.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

PAUL ALEXIS CHALEIL.

Witnesses:
ELLWOOD AUSTIN WELDEN,
ALBERT NUNES.