No. 791,949. PATENTED JUNE 6, 1905.

G. SCHEUBER.

TURBINE.

APPLICATION FILED SEPT. 24, 1902.

2 SHEETS—SHEET 1.

Fig 1

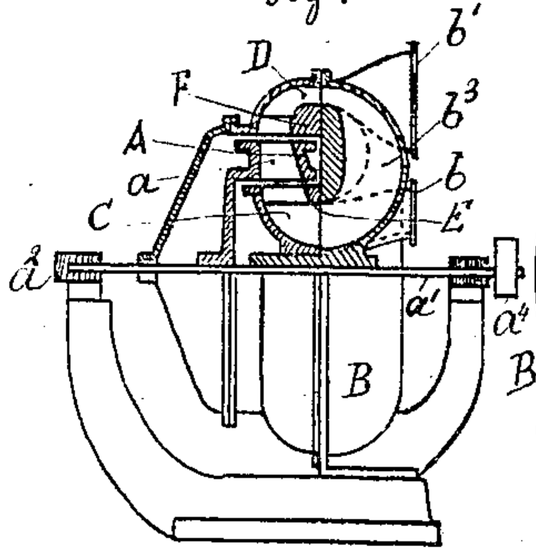


Fig 2

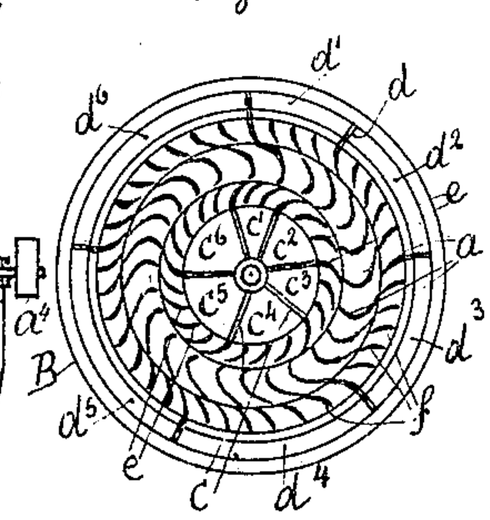


Fig. 3

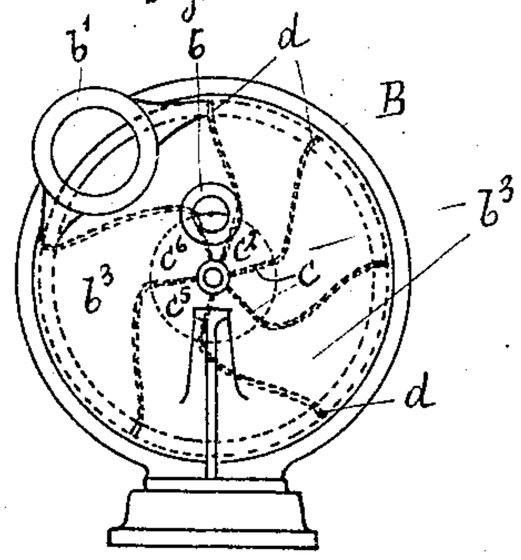


Fig 4

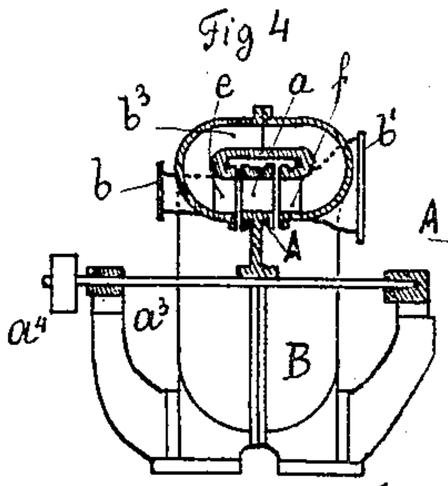


Fig. 5

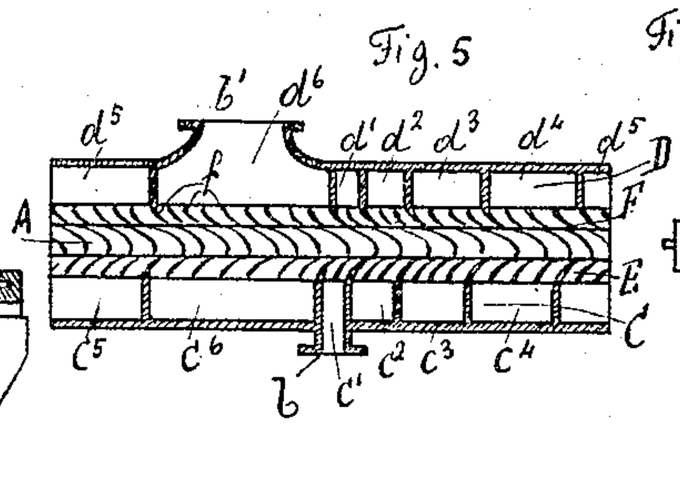


Fig.6

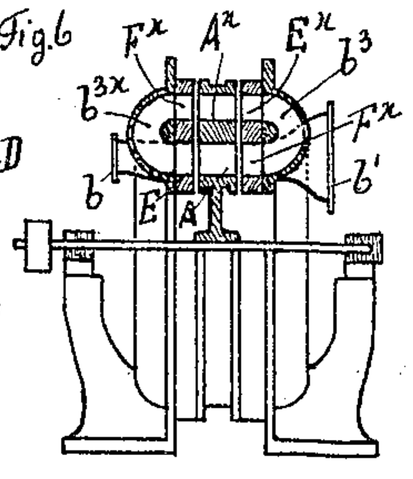


Fig 7

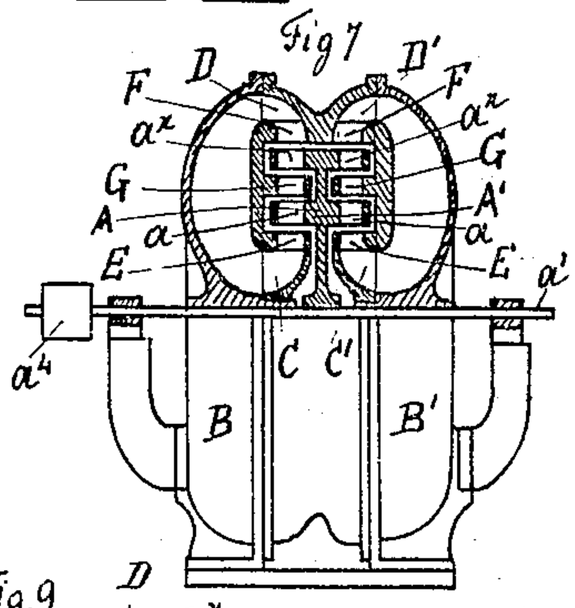


Fig. 8

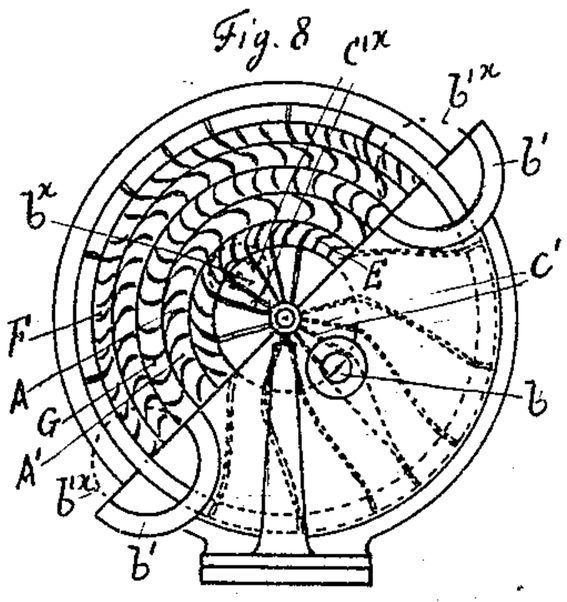


Fig.9

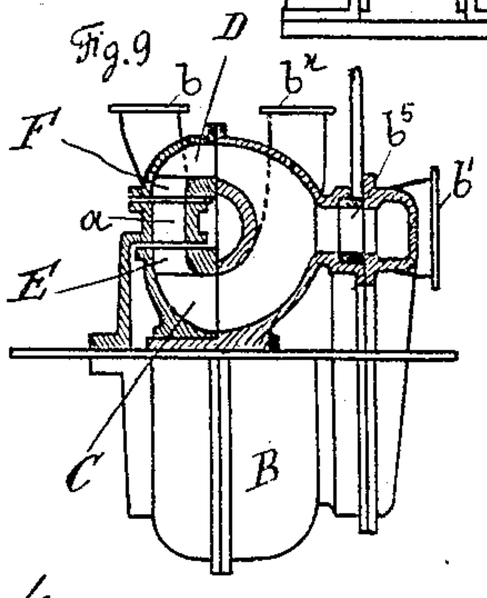


Fig. 10

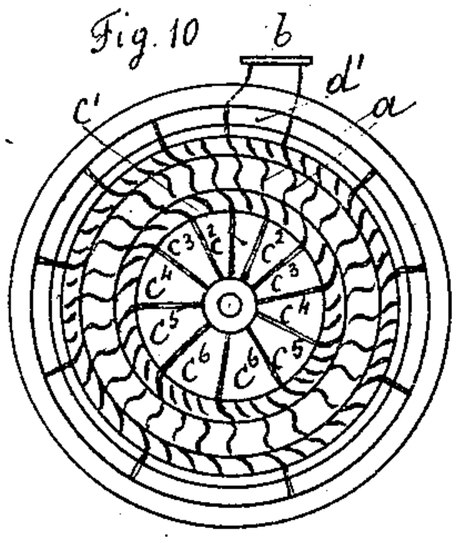
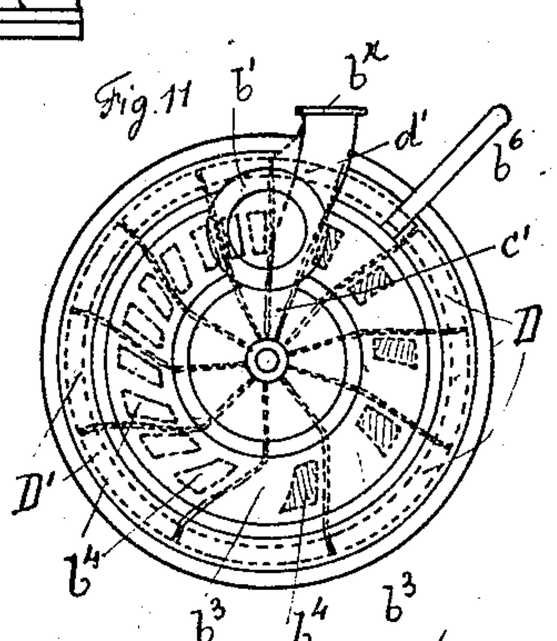


Fig.11



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2 SHEETS—SHEET 2.

Fig. 12

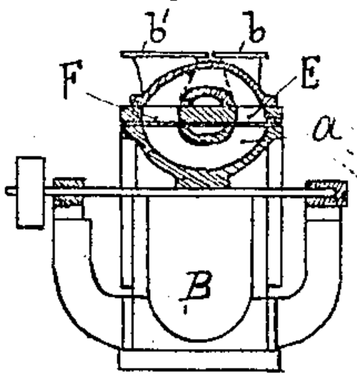


Fig. 13

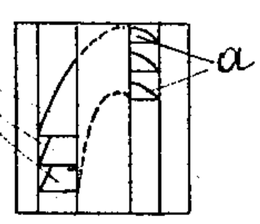


Fig. 14

Fig. 15

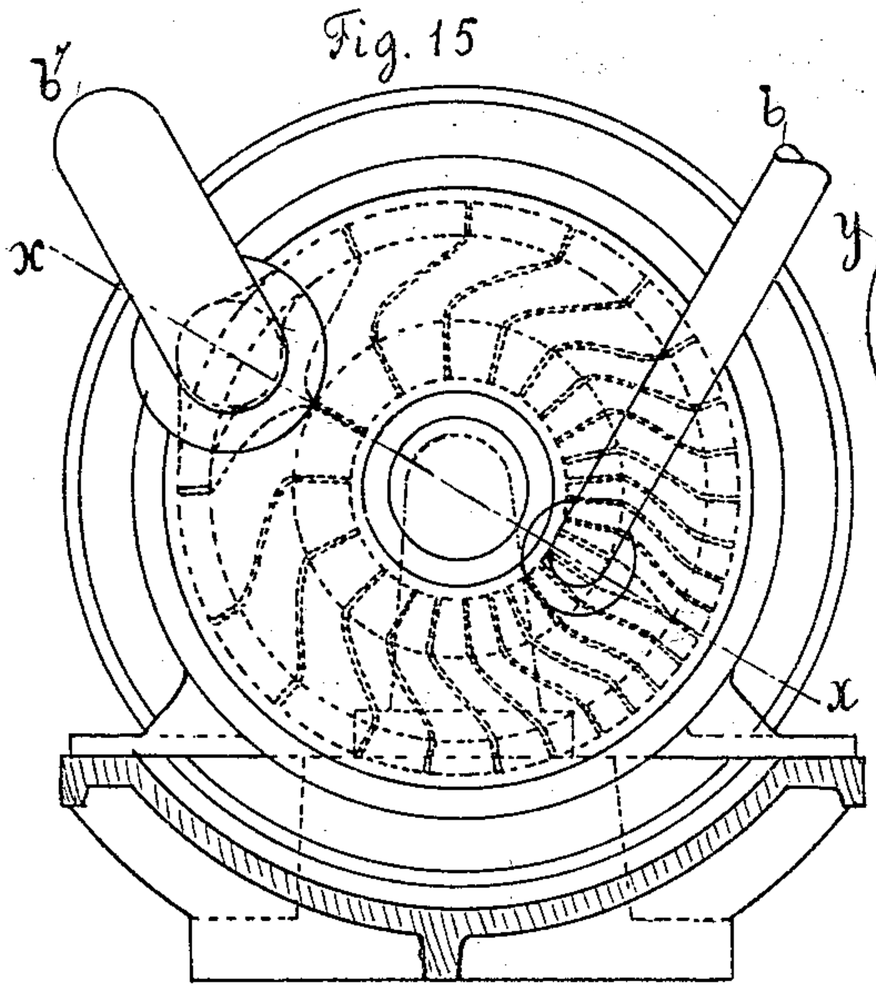
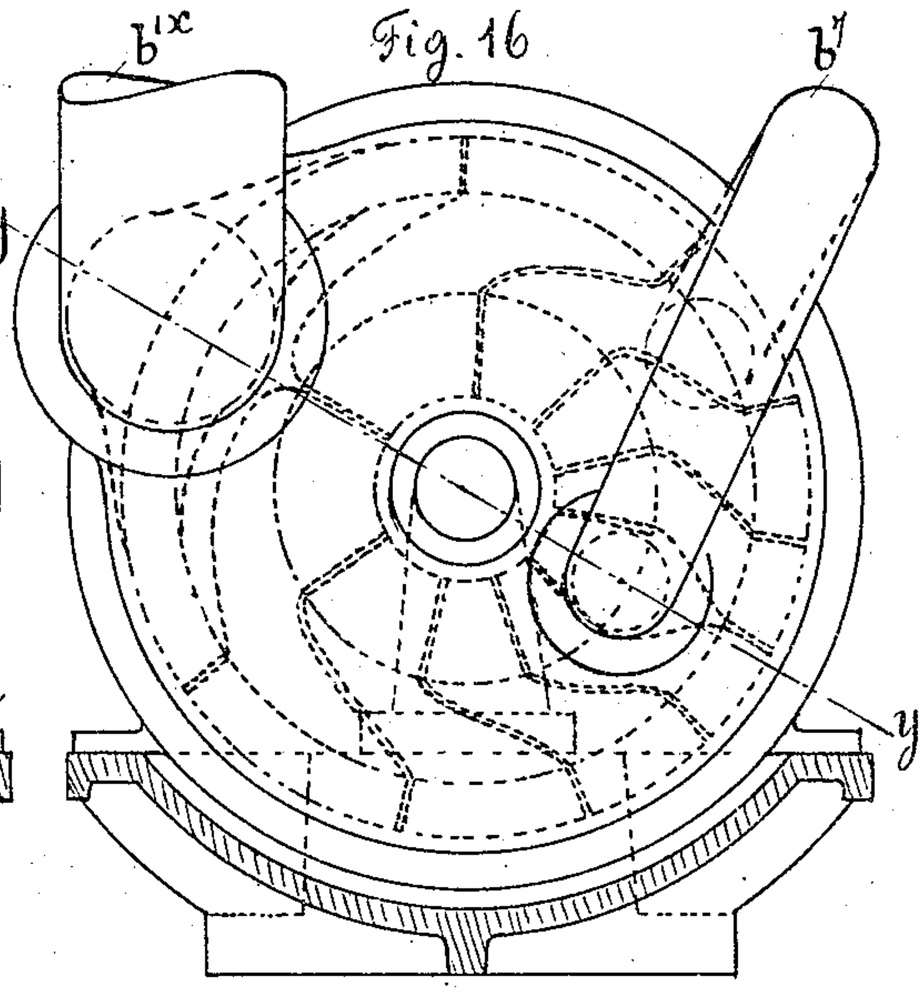


Fig. 16



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No. 791,949. Patented June 6, 1905.

UNITED STATES PATENT OFFICE.

GUSTAVO SCHEUBER, OF BIELLA, ITALY.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 791,949, dated June 6, 1905.

Application filed September 24, 1902. Serial No. 124,638.

To all whom it may concern:

Be it known that I, GUSTAVO SCHEUBER, mechanical engineer, a subject of the King of Italy, residing at Biella, Italy, have invented certain new and useful Improvements in or Relating to Turbines and the Like; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to turbines and the like, and has particular reference to those adapted for gaseous fluid—such as gas, air, or steam; and it has for its chief object to obtain a practicable slow-speed machine suitable for ordinary purposes and to increase the efficiency of the turbine or similar machine without unduly multiplying the number of its buckets or floats.

According to my invention instead of allowing the working fluid to have access to all the area of the rotary wheel at a single admission I cause said fluid to be repeatedly admitted to and withdrawn from the said wheel in such manner that it only passes through a limited or determined number of the buckets of said wheel at each admission. For this purpose I provide the turbine or similar machine on the inlet side of its rotary wheel with one or more series of fluid-admission compartments and fixed guide-vanes adapted to coöperate with corresponding fixed vanes and compartments on the outlet side of said wheel. One or other determined number of compartments of the admission series is in communication with the source of fluid-supply. The other compartments thereof are respectively in communication with consecutive sections of the opposite series, from which latter they receive the partially-expanded (or compressed) fluid that has already passed through the preceding compartment or compartments. The last compartment of the outlet or exhaust series, or of each outlet or exhaust series where more than one are employed, is in communication with the exhaust pipe or aperture. The aforesaid compartments are of successively-increasing capacity toward the exhaust-outlet.

In order that the said invention may be clearly and readily carried into effect, I will now proceed to describe the same more fully with reference to the accompanying drawings, in which—

Figure 1 is a part-sectional side elevation of an outward radial flow steam-turbine or similar machine embodying the features of my invention. Fig. 2 is a transverse section thereof; and Fig. 3, an end elevation thereof, the base or stand being omitted in Fig. 2. Figs. 2 and 5 are diagrams showing the scheme of the various compartments. Figs. 4 to 16, inclusive, illustrate various modified forms of steam-turbines or similar machines embodying the features of my invention.

Similar letters of reference indicate similar parts throughout the several views.

Supposing the machine to be intended for use as a turbine, A is the rotary turbine-wheel, and B the fixed case or cover thereof. C is the inlet series of sections or compartments, and D the outlet series. E is the inlet guiding-wheel, and F the outlet guiding-wheel.

Referring more particularly to Figs. 1 to 4, the turbine-wheel A, provided with buckets $a\ a$, is mounted upon a shaft a', that rotates in bearings $a^2\ a^3$ and carries a driving pulley or pulleys a^4 in the usual way. The case or cover B is divided on the inlet side of the turbine-wheel A into the compartments $c'\ c^2\ c^3\ c^4\ c^5\ c^6$ of the series C by means of the partitions $c\ c$. On the other or outlet side of the wheel the said case or cover is divided, by means of partitions $d\ d$, into the compartments $d'\ d^2\ d^3\ d^4\ d^5\ d^6$, constituting the series D. The steam-supply pipe b admits live steam from the boiler into the compartment c', said compartment being open to the adjacent buckets of the fixed guiding-wheel E, formed by the vanes $e\ e$. Two of the said vanes make joint with the opposite walls or partitions $c\ c$ of the compartment c', as shown, so as to permit none of the steam from the compartments to escape except through the buckets that are situated between them. The steam then passes through a certain number of buckets $a\ a$ of the turbine-wheel, where it is partially expanded. The steam then passes through the adjacent

buckets *f f* of the outlet guiding-wheel F, which conduct it to the first compartment *d'* of the outlet series D. This compartment is of greater capacity than the compartment *c'* to allow for expansion of the steam and is in communication by one of the passages or channels b^3 b^3 with the second compartment c^2 of the inlet series C. After leaving the last-named compartment the steam is again conducted in the same manner as before to and through a number of the buckets *a a*, said number of buckets, however, being greater than that previously entered by the steam. From compartment d^2 the steam is conducted to compartment c^3, and so on throughout the series until it finally emerges in an exhausted condition from the compartment d^6 by means of the pipe *b'*. It will be seen on reference to the drawings that the walls or partitions *d d*, that separate the compartments of the series D from each other, make joint with the adjacent vanes of the outlet guiding-wheel F.

In the modified form of arrangement shown in Figs. 4 and 5 the steam flows in an axial direction through the turbine-wheel A and flows in a similar manner through the guiding-wheels E and F, which are accordingly arranged laterally with respect to the turbine-wheel. b^3 represents one of the passages by which the steam is conducted from one compartment of the outlet series to the next compartment in succession of the inlet series.

According to the modification shown in Fig. 6, which represents an axial-flow turbine having two crowns or series A and $A^\times$ of buckets, I employ two inlet guiding-wheels E and $E^\times$, the outlet guiding-wheel F communicating, by means of the passages b^3, with the inlet guiding-wheel $E^\times$ and the outlet guiding-wheel $F^\times$ communicating, by means of passages $b^{3\times}$, with the inlet guiding-wheel E.

Figs. 7 and 8 show a radial-flow turbine having two wheels A and A' mounted upon a common shaft *a'* and each contained in a separate case B and B', respectively. Each of said cases B and B' is provided with individual supply and exhaust pipes, there being no intercommunication between said cases. Two supply-pipes *b* $b^\times$ and two exhaust-pipes *b'* $b'^\times$ are employed for each of said cases, the arrangement being such that the steam that enters the case through the pipe *b* is apportioned equally between the compartments *c' c'* and after passing in opposite directions through twin series of compartments emerges through pipes *b'*, while the steam that enters through pipe $b^\times$ is apportioned in like manner between the compartments $c'^\times$ $c'^\times$ and eventually escapes through the twin exhaust-pipes $b'^\times$ $b'^\times$. Each of the wheels A and A' is provided with two crowns of buckets *a* and $a^\times$ and with three fixed guiding-wheels E, G, and F, the intermediate one, G, being adapted to serve the double purpose of outlet guiding-wheel from the buckets *a a* and of inlet guiding-wheel to the buckets $a^\times$ $a^\times$.

Figs. 9, 10, and 11 are respectively a sectional side elevation, transverse section, and end elevation of a reversible radial-flow turbine embodying the features of my invention. The vanes *a a* of the turbine-wheel have a double curve, and the action of the guiding-wheels E and F is interchangeable. The inlet-pipes *b* $b^\times$ being also interchangeable in their action are of equal diameters and are controlled by a four-way valve. When the turbine-wheel is intended to revolve with the sun, the steam is admitted by the pipe *b* and exhausted by the pipe *b'*, the flow being radially inward. When the wheel is intended to revolve in the opposite direction or against the sun, the steam is admitted by the pipe $b^\times$ and flows in the opposite direction, being finally exhausted by the aforesaid pipe *b'*. In this instance, as in that illustrated in Figs. 7 and 8, the case B contains two inlet series of compartments *c* and *c'* and two outlet series of compartments D and D'. In the present instance, however, the series *c'* and D' are alternative to those *c* and D instead of being used simultaneously therewith, as is the case in the examples shown in Figs. 7 and 8. The passages b^3 b^3 affording communication between the inlet and outlet compartments C D and the passages b^4 b^4 affording communication between the inlet and outlet compartments *c'* and D' are controlled by a common perforated plate b^5, adapted to close one set, b^3, of passages or the other set, b^4, according to the position into which it is adjusted by the lever b^6.

Fig. 12 shows a mixed-flow turbine having radial flow through the guiding-wheels and through the turbine partly radial partly axial flow. Fig. 13 is a plan of a portion of the periphery of the turbine-wheel, showing three of the buckets *a*.

Figs. 14, 15, and 16 are respectively a sectional side elevation and opposite end elevations of a radial-flow turbine having a high-pressure wheel A contained in the casing B and a low-pressure wheel A' contained in the casing B'. Each of these wheels is provided independently with the fixed guiding-wheels E and F, and a pipe b^7 conveys the steam from the last compartment of the outlet series in the casing B to the first compartment of the inlet series in the casing B'.

It will be seen on reference to Figs. 15 and 16 that each casing B and B' has two inlet series of compartments and two outlet series, *x x* being the dividing-line in casing B and *y y* being the dividing-line between the series in casing B'. In this regard this arrangement somewhat resembles that shown in Figs. 7 and 8, the compartments on opposite sides of each dividing-line being served by common inlet-pipes *b* and b^7, so that the steam from each of said pipes is divided on reaching the turbine.

In this instance, however, the steam reunites on reaching the exhaust-pipes b' $b'^{\times}$, respectively.

It is important to observe that according to my invention the steam always enters the rotary turbine-wheel from one side only of the latter and emerges therefrom upon the other, said steam flowing continuously through and around the wheel without changing its direction in what may for convenience be termed an "imperfect spiral line" until it passes to exhaust.

The single turbines, Figs. 1 and 9, may for the purpose of equilibrating the axial pressure of the steam be disposed with a double-crown wheel in similar manner as on Figs. 7 and 14.

Although I have described my invention with particular reference to a turbine, it will be obvious that my improved machine may by an inversion of its action be employed as a blower or an air-compressor, in which event the pipe b' in the various examples illustrated will of course serve as the suction-pipe and the pipe b as the expulsion-pipe.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A turbine or similar machine having relatively fixed guide-vanes, and having on the inlet side of its rotary wheel, fluid-admission compartments and fixed guide-vanes, and corresponding fixed vanes and compartments on the outlet side of said wheel, the compartments of the outlet portion being greater than those of the inlet, and a predetermined number of compartments of the admission series being in communication with the source of supply and the others in communication with consecutive sections of the opposite series.

2. A turbine or similar machine comprising a fixed case and a rotary turbine-wheel therein having a series of inlet-compartments, a series of outlet-compartments of greater capacity than the inlet-compartments, an inlet guiding-wheel, an outlet guiding-wheel, a supply-pipe for admitting live steam to the inlet-compartments which latter are open to the adjacent buckets of the inlet guiding-wheel, one series of compartments breaking joint with those of the other, the compartments of the one portion being greater than those of the other and a portion of the compartments of the admission series being in communication with consecutive sections of the opposite series from which latter they receive the partially-expanded fluid.

3. The combination of a casing, a wheel mounted and rotatable within said casing, a series of buckets formed on said wheel, a series of partitions set in the casing dividing the hollow annular space therein on each side of the wheel into separate chambers together with a series of vanes set in the chambers and adapted to control the direction of the steam passing from said chambers to the buckets in the wheel, each chamber on one side of the wheel overlapping the adjacent ends of two chambers on the other side of the wheel the chambers of the outlet portion being greater than those of the inlet.

4. In a turbine, a rotary wheel provided with a series of vanes, a casing surrounding said wheel and formed of complemental sections each of which is provided with an annular steam-casing having open sides in proximity to the vanes of said wheel and inlet and outlet vanes arranged in said open sides for effecting successive expansions of the steam in its traverse between said casings and through the vanes of the wheel.

5. In a turbine, a wheel provided with a series of vanes, a casing surrounding said wheel and comprising complemental sections, each of which is provided with an annular steam-casing, one of said casings being provided with a steam-inlet and the other being provided with an exhaust, said casings having their inner sides open adjacent to the vanes of the wheel, stationary inlet and outlet vanes arranged in the open sides of said casings for effecting successive expansions of the steam during its passage from said casings and through the vanes of the wheel, and division-walls arranged in said casings and forming a connected series of spiral compartments around the periphery of the wheel for advancing the steam in successive steps from the inlet to the exhaust.

6. In a turbine, a wheel provided with an inner series and an outer series of vanes, steam-casings arranged at the sides of said vanes and having their inner sides open, a series of inlet and outlet vanes arranged in the open sides of said casings opposite to the inner and outer series of the vanes of the wheel, whereby the steam is successively expanded during its passage from said casings and through the vanes of the wheel and division-walls arranged in said casings and forming a connected series of spiral compartments for advancing the steam successively around said compartments.

7. A turbine comprising a fixed casing and a rotating turbine element therein having a series of inlet-chambers, a series of outlet-chambers of greater capacity than the inlet-chambers, a series of admission-blades, a series of exhaust-blades, a supply-pipe for admitting live steam to the inlet-chambers which latter are open to the admission-blades, one series of chambers breaking joint with the other, the chambers of the one portion being greater than those of the other and a portion of the chambers of the admission series being in communication with consecutive sections of the opposite series from which latter they receive the partially-expanded fluid.

8. In a turbine of the class described, a rotating element provided with a series of blades, a casing surrounding said element and formed

of complemental sections each of which is provided with an annular steam-casing having open sides in proximity to the blades of said rotating element, and admission and release blades arranged in said open sides for effecting successive expansions of the steam in its traverse between said casings and through the blades of the rotating element.

9. In a turbine of the class described, a rotating element provided with a series of blades, a casing surrounding said element and comprising complemental sections each of which is provided with an annular steam-casing, one of said casings being provided with a steam-inlet, and the other being provided with an exhaust, said casings having their inner sides open adjacent to the blades of the rotating element, stationary admission and exhaust blades arranged in the open sides of said casing for effecting successive expansions of the steam during its passage from said casings and through the blades of the rotating element, and division-walls arranged in said casings and forming a connected series of spiral chambers around the periphery of the rotating element for advancing the steam in successive steps from the inlet to the exhaust.

10. In a turbine of the class described, a rotating element provided with an inner series and an outer series of blades, steam-casings arranged at the sides of said blades and having their inner sides open, a series of admission and release blades arranged in the open sides of said casings opposite to the inner and outer series of the blades of the rotating element, whereby the steam is successively expanded during its passage from said casings and through the blades of the rotating element, and division-walls arranged in said casings and forming a connected series of spiral chambers for advancing the steam successively around said chambers.

In witness whereof I have hereunto set my hand in presence of two witnesses.

GUSTAVO SCHEUBER.

Witnesses:

H. P. SMITH,

MICHELE DE DRAGO.