No. 731,009. PATENTED JUNE 16, 1903.

G. ZAHIKJANZ.

TURBINE.

APPLICATION FILED SEPT. 9, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

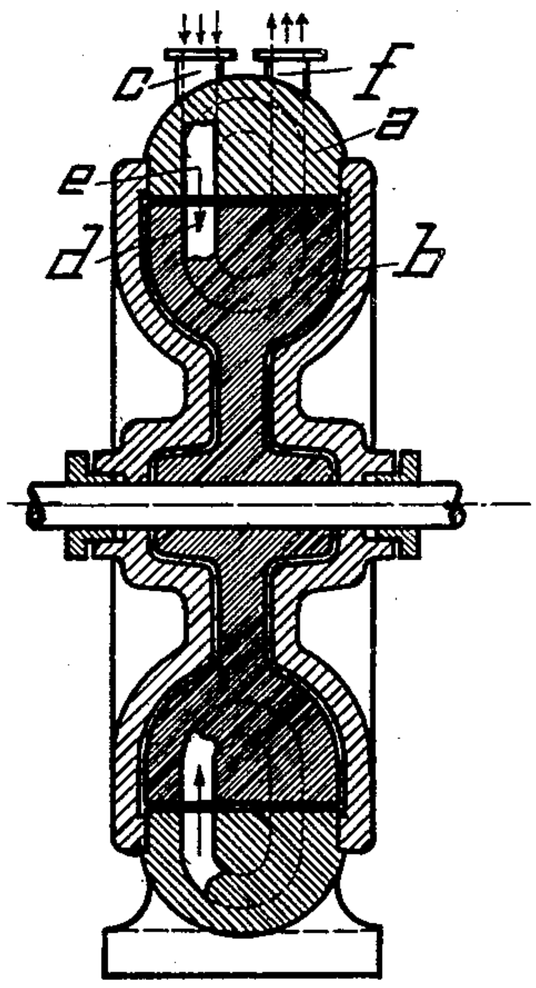


Fig. 2.

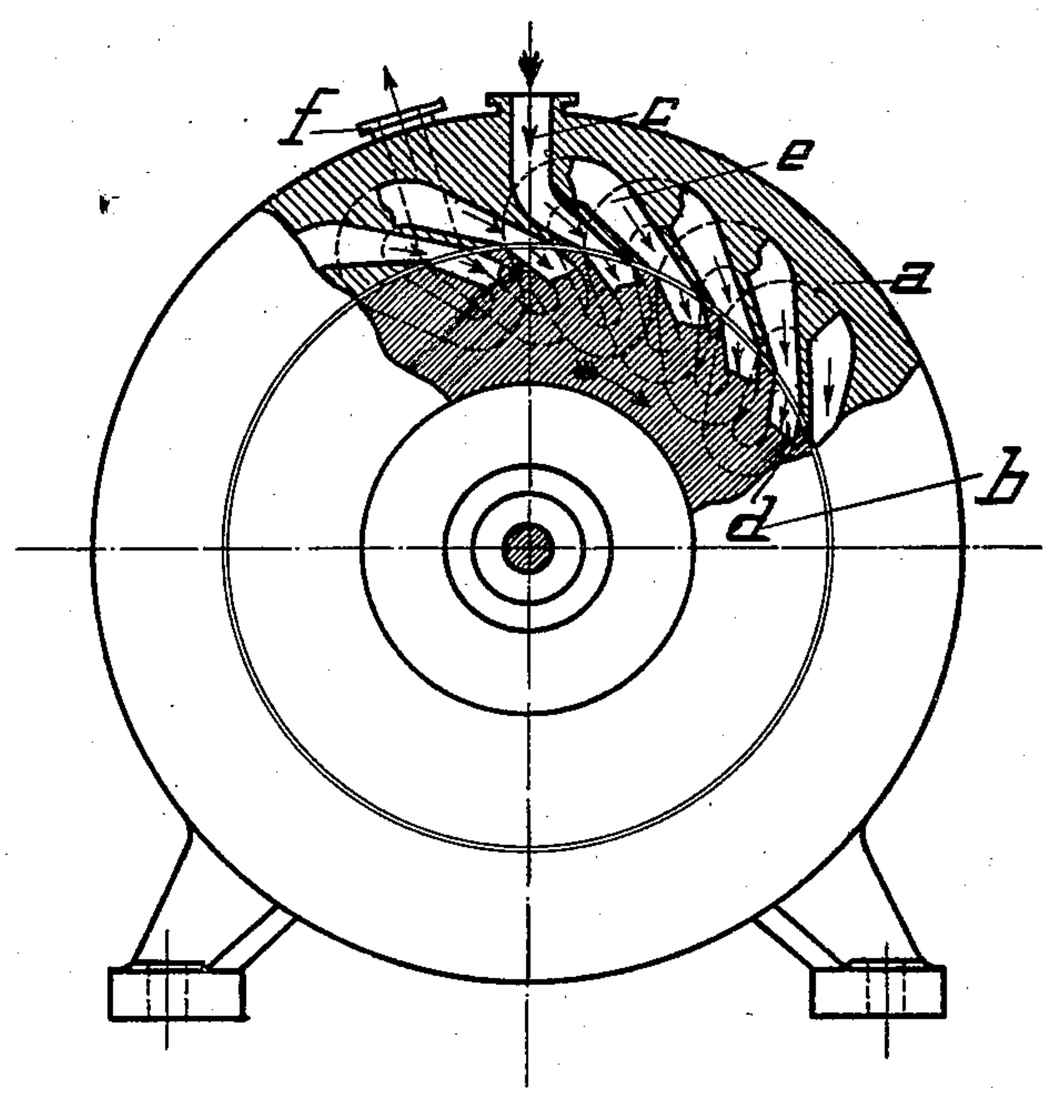
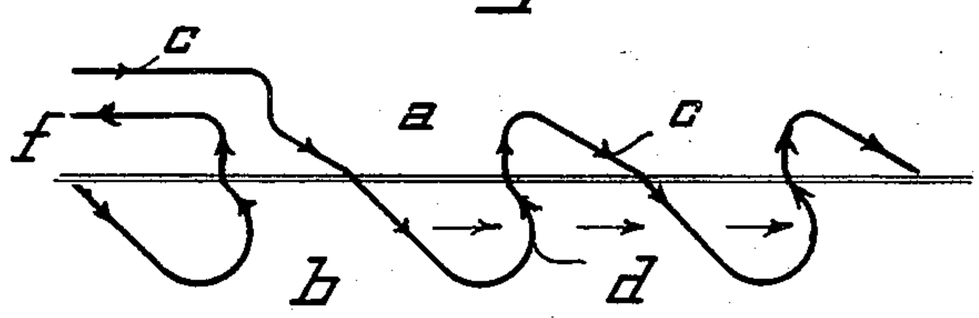


Fig. 3.



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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 4.

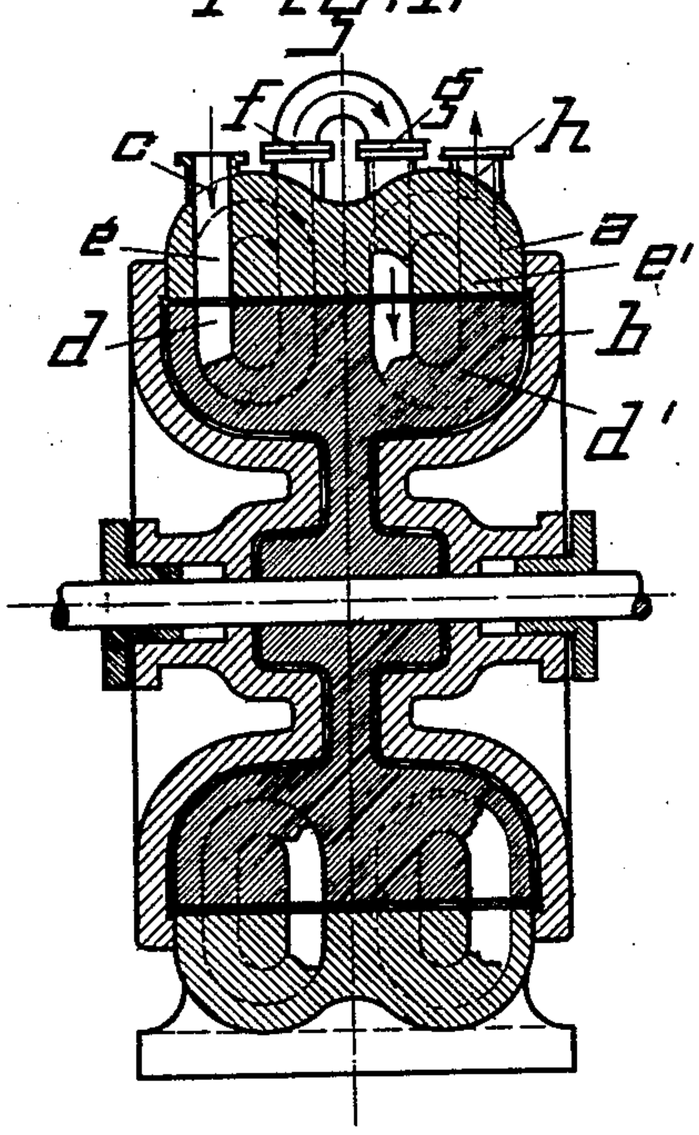


Fig. 5.

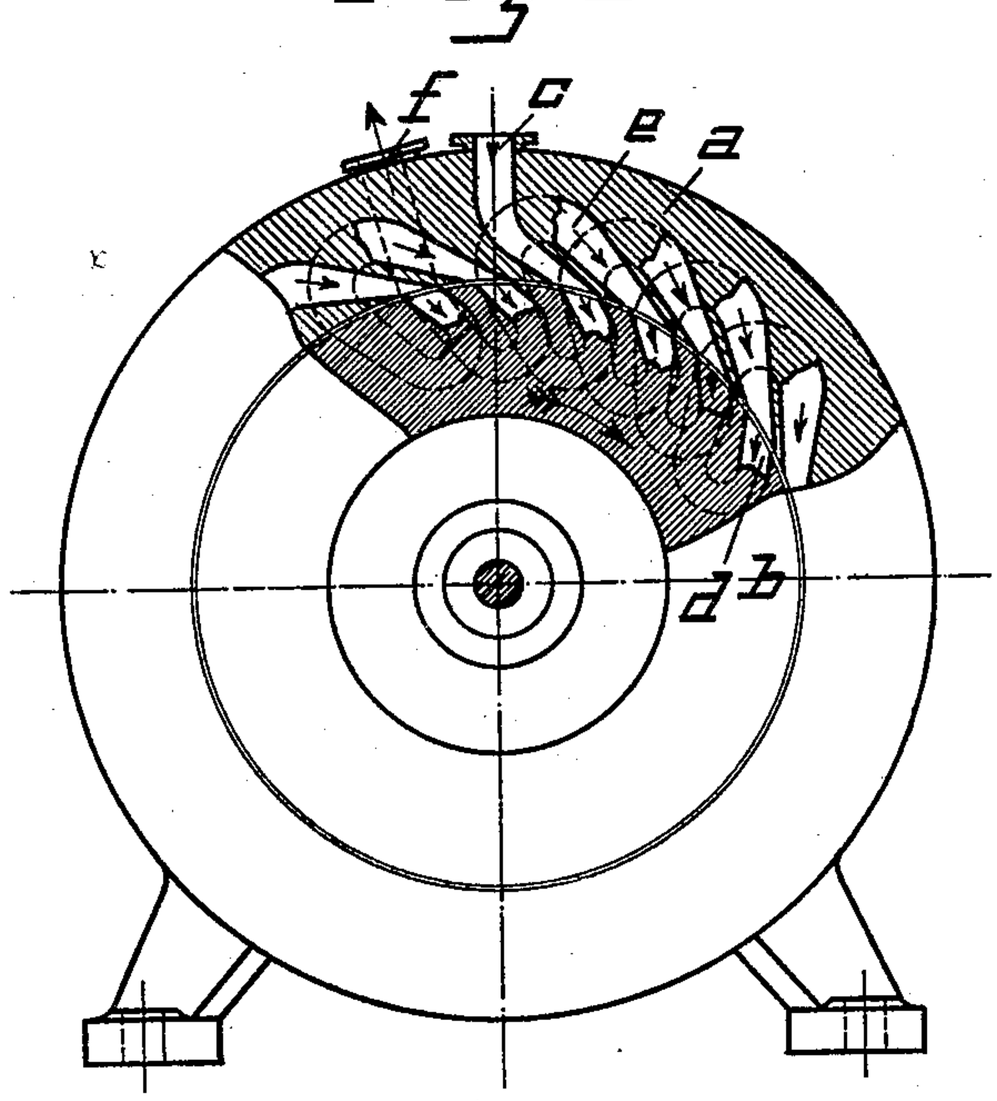
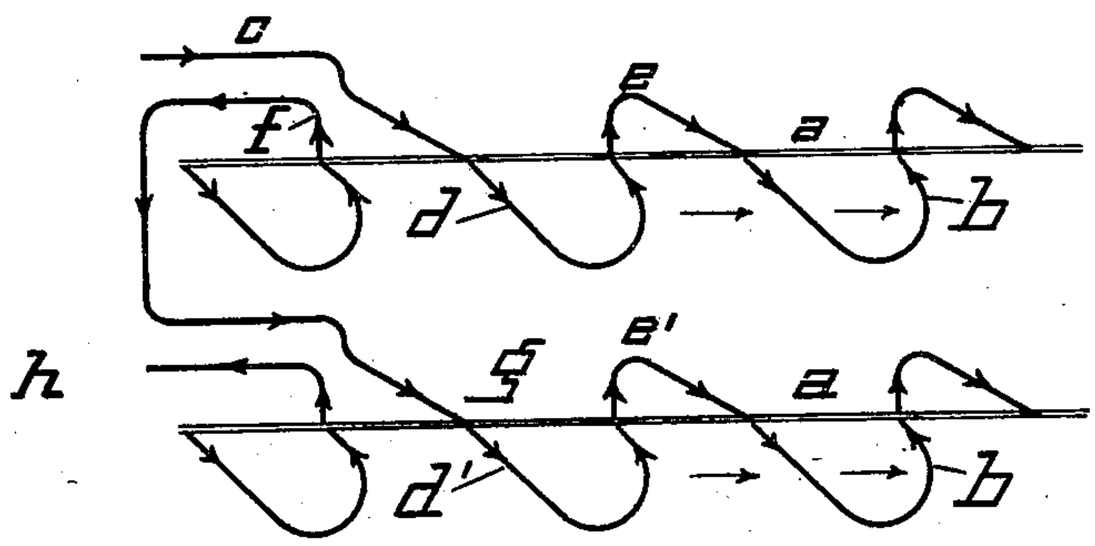


Fig. 6.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 7.

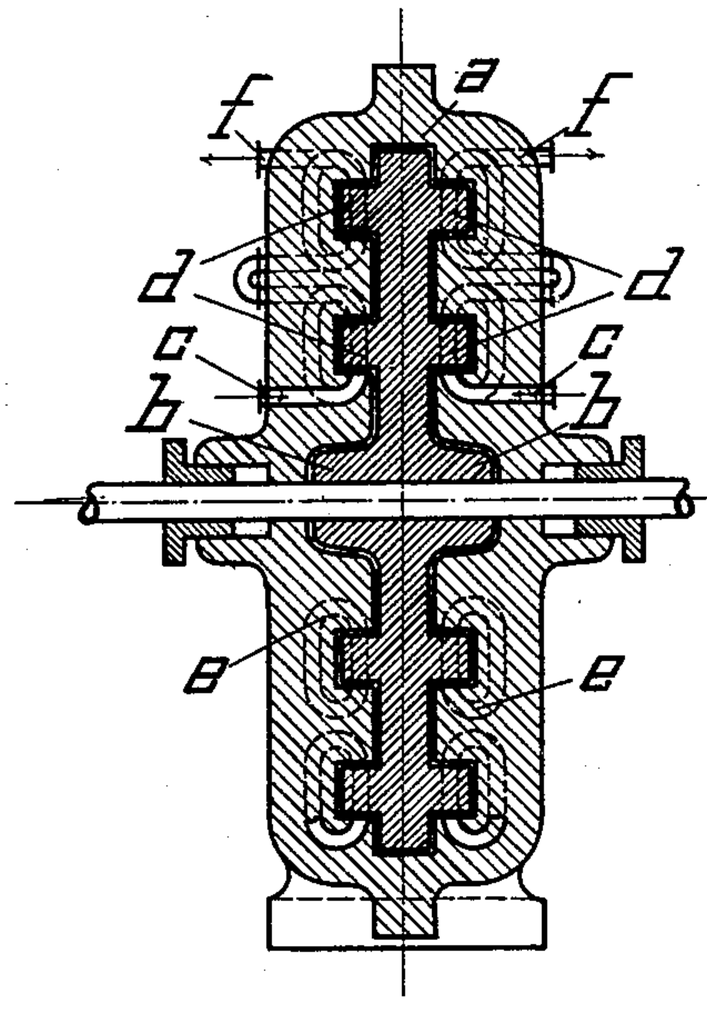


Fig. 8.

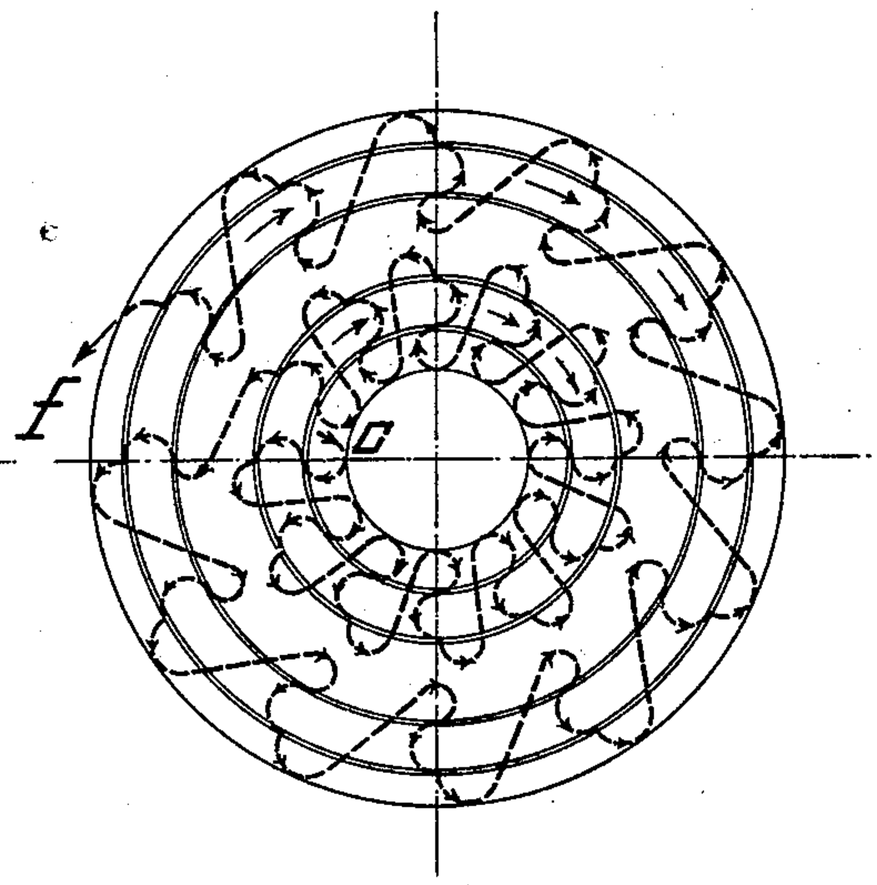


Fig. 9.

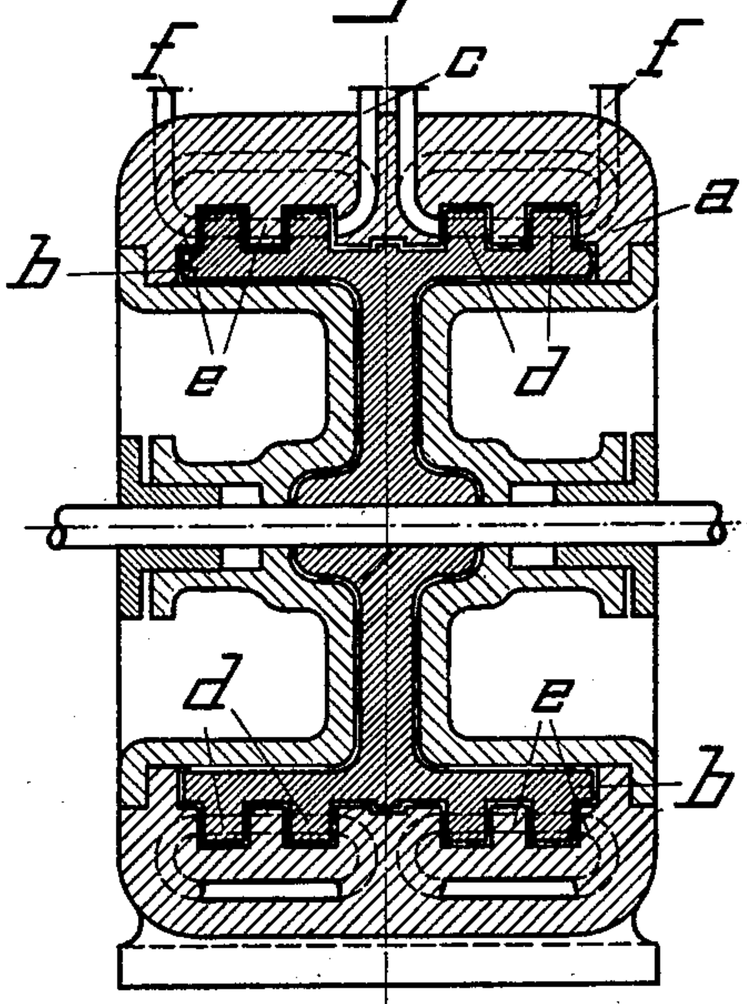
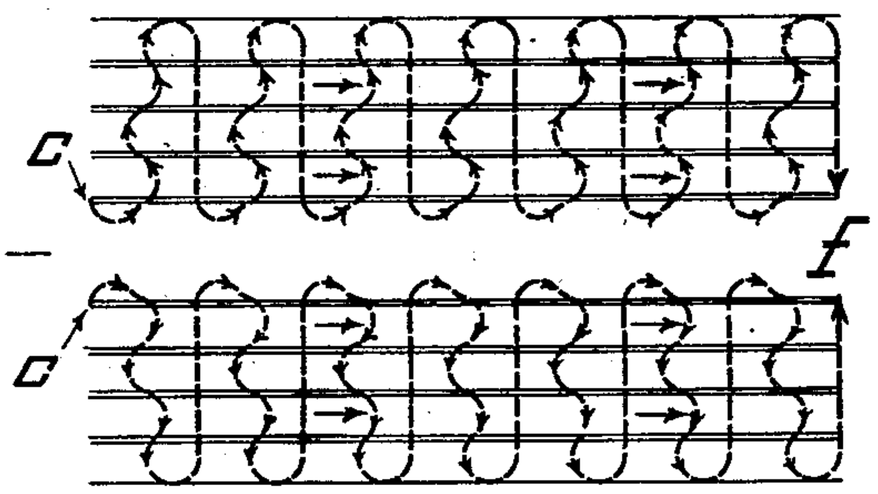


Fig. 10.



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APPLICATION FILED SEPT. 9, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 11.

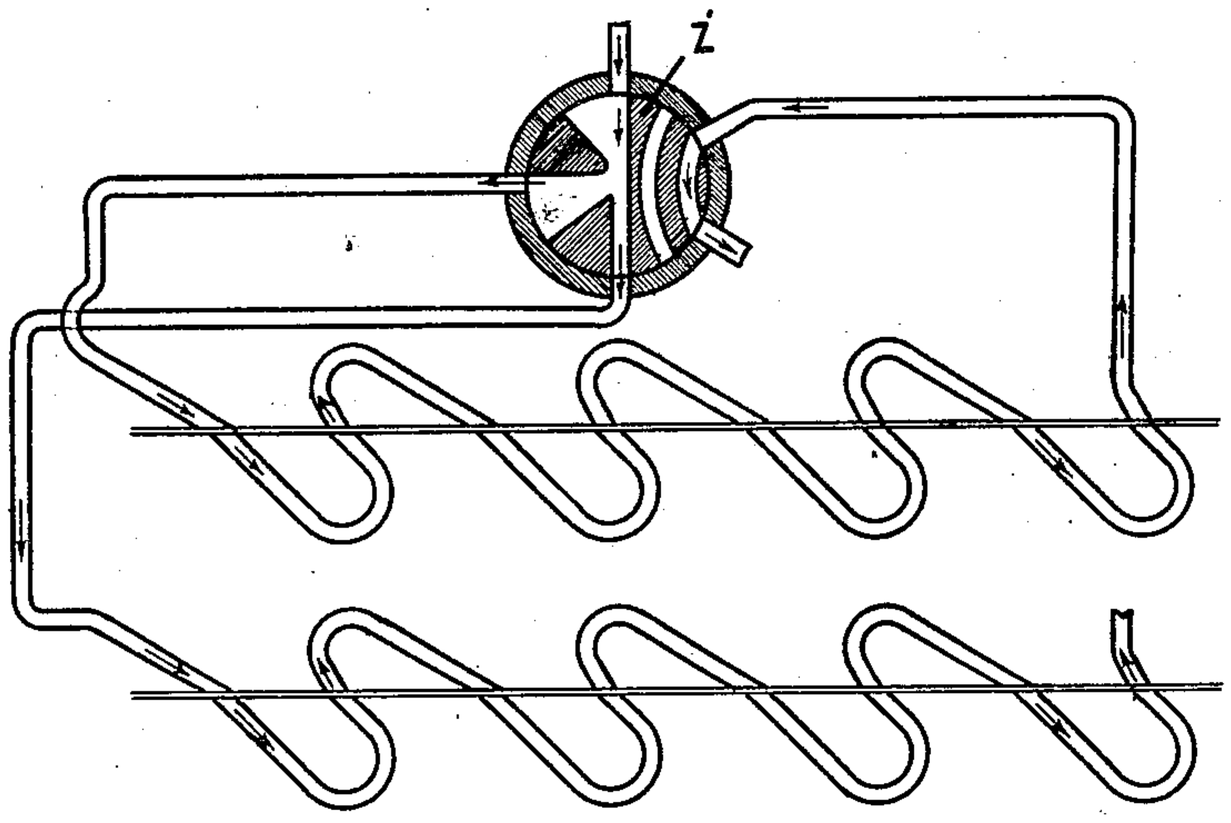
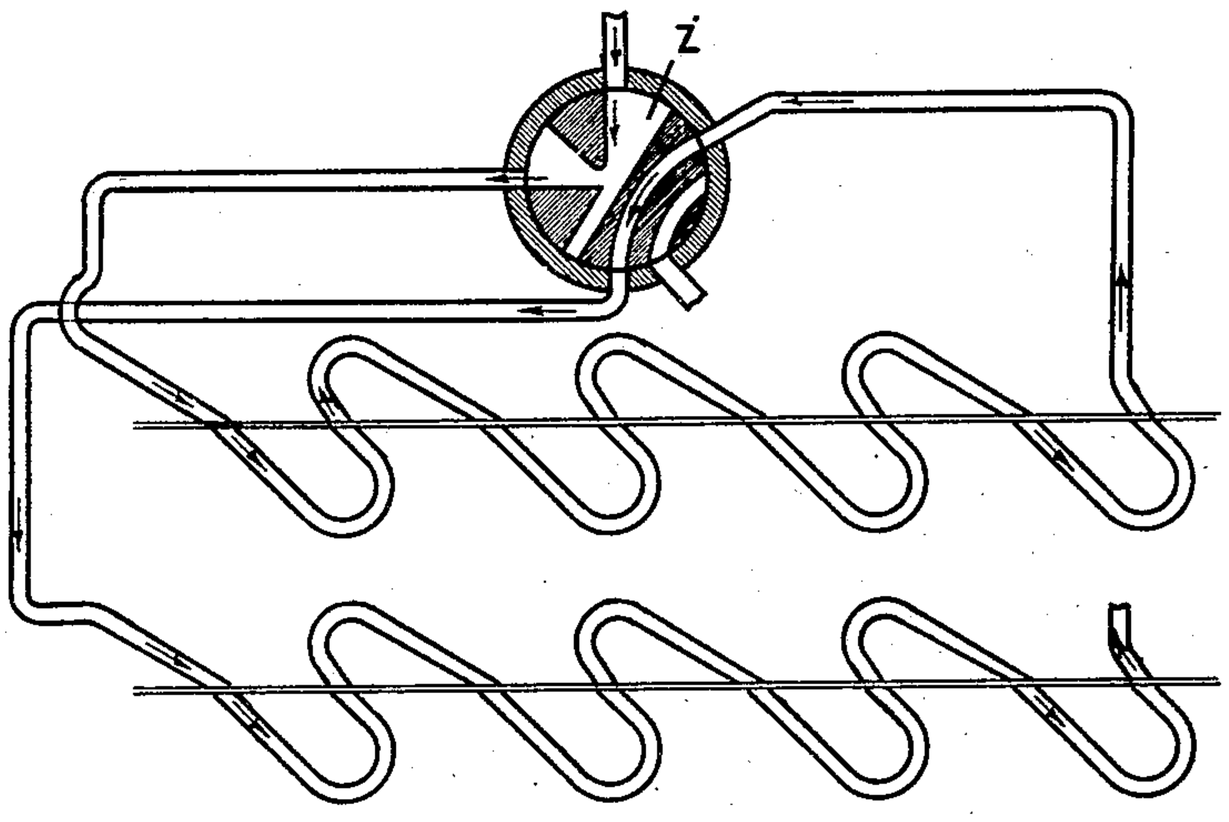


Fig. 12.



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No. 731,009. Patented June 16, 1903.

UNITED STATES PATENT OFFICE.

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TURBINE.

SPECIFICATION forming part of Letters Patent No. 731,009, dated June 16, 1903.

Application filed September 9, 1902. Serial No. 122,675. (No model.)

To all whom it may concern:

Be it known that I, GABRIEL ZAHIKJANZ, a subject of the Czar of Russia, residing in the city of Berlin, Empire of Germany, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to turbines intended to be driven by steam, gases, vapors, or liquid under pressure, and has for its object to provide a construction enabling me to decrease the rotary speed, to better utilize the driving energy, and to reduce the size of the machine.

The invention will be fully described hereinafter and the features of novelty pointed out in the appended claims.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is an axial section of the single-system form of my improved turbine. Fig. 2 is a side view thereof with parts in section. Fig. 3 is a diagram illustrating the flow of the steam or other driving medium. Fig. 4 is an axial section of the double-system form of my invention. Fig. 5 is a side view thereof with parts in section. Fig. 6 is a diagram showing the course of the driving medium. Fig. 7 is an axial section of the radial form of my invention. Fig. 8 is the corresponding diagram. Fig. 9 is an axial section of the series system of my turbine. Fig. 10 is the corresponding diagram, and Figs. 11 and 12 illustrate an arrangement by means of which the two systems of channels in a double-system turbine may be connected in parallel or series.

My turbine, as all turbines, consists of two parts, one of which rotates, while the other is stationary or may also be arranged to rotate. In the examples illustrated by the drawings it has been assumed that only one part of the turbine rotates.

In Figs. 1, 2, and 3, *a* indicates the stationary member or guide-casing of the turbine, and *b* the rotary member or motor-wheel. *c* is the first guide channel or inlet. This channel ends at an acute angle to the periphery of the wheel and is adapted to discharge the steam into a U-shaped rotary channel *d*, which has its curvature in the direction the wheel is to rotate and both its ends at an acute angle to the periphery of the wheel, and when one end of a channel *d* coincides with the end of the first guide-channel *c* the other end of the channel *d* coincides with one end of the second guide-channel *e*. This is likewise U-shaped and coincides at its other extremity with one extremity of the following rotary channel, and so on. Thus a system of tubular windings is formed consisting each of a guide-channel and a rotary channel and having all their respective inlets in one circle and the outlets in another circle. It will be observed, particularly with reference to Figs. 2 and 5, that the distance between the ends of a channel *d* in the member *b* is smaller than the distance between the ends of a channel *e* in the other member *a*. Thus when the outlet end of a channel *d* registers with the inlet end of a channel *e* the outlet end of said channel *e* registers with the inlet end of the next succeeding channel *d*, and thus the driving medium may pass successively through the several channels. The mode of operation of this turbine is as follows: The steam or any other medium under pressure enters through the inlet *c* into the coinciding orifice of the rotary channel *d*, traverses its curvature while exerting in the direction of rotation a certain pressure owing to its relative velocity, and flows out of the other orifice of the rotary channel into the coinciding orifice of the guide-channel *e*, in which the medium restores its loss of velocity from the available pressure, and flows out of its other orifice into the coinciding orifice of another rotary channel, and so goes on circulating throughout the whole periphery of the turbine and escapes through the last guide channel or outlet *f*. Thus the driving agent is compelled to go a path in the nature of a coil or spiral tube, whereby its whole pressure is gradually transformed into kinetic energy and the latter gradually utilized as motive power in the rotary channels.

The turbine above described having only a single system of windings may conveniently be called a "single-system" turbine. Now by providing a turbine with two or more such

systems of windings I form a two or multiple system turbine, wherein the systems may be connected in parallel or in series. Thus Figs. 4, 5, and 6 show a double-system turbine in which the two systems, as shown by the diagram, are connected in series. The steam after flowing through one system of channels *c d e f* passes over into the inlet *g* of the other system *g d' e' h* and passes out at the exhaust *h*. The channels of the second system may be made wider than those of the first system in accordance with the expansion to obtain compound action, or instead of one system with wide channels two or more systems with narrow channels may be used in parallel.

Figs. 7 and 8 show the radial disposition of my multiple-system turbine, the systems being arranged concentrically on each side of the turbine and on either side connected in series, as shown by the diagram Fig. 8.

In the systems above described each winding contains one pair of channels—a guide and a rotary channel. Now the windings may be made to contain each two or more pairs of channels. Thus I obtain a turbine with one or more systems of series windings. Figs. 9 and 10 show such a turbine with two systems of windings, each winding comprising two pairs of channels. The two systems may be connected in series or parallel.

When employing a turbine with two systems of windings, it may sometimes be advisable to have the driving agent pass through both systems in parallel, while at other times it may be desirable to cause the steam to flow through said systems successively. This may be done by means of any suitable device—as, for instance, by means of a cock or valve *i*, Figs. 11 and 12, having a plurality of passages, which in one position, Fig. 11, will allow the steam to pass directly to both series of coils, while in the other position, Fig. 12, the steam will have direct access to one coil only and will pass to the other coil after escaping from the first coil.

I desire it to be understood that my invention is not restricted to the particular constructions shown, but that various modifications may be made within the limits indicated by the appended claims.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a turbine, the combination of two members one rotatable relatively to the other, said members being formed with U-shaped channels, the distance between the orifices of one channel being greater in one member than in the other, and said orifices being adapted to register so that the channels will form a spiral or coil path for the driving agent.

2. A turbine comprising two sections or members one rotatable relatively to the other and each provided around its entire periphery with channels adapted to register with each other and forming together a spiral passage or coil in the nature of a complete ring surrounding the turbine-axis.

3. A turbine with two or more systems of tubular windings, each winding comprising one guide and one rotary channel, the systems forming independent spiral paths for the driving medium and being connected with each other.

4. A turbine with two or more systems of spiral channels, forming spiral tubular paths, the channels of one path being wider than those of another.

5. A turbine comprising two sections or members one rotatable relatively to the other and each provided with a series of channels, the inlet and the outlet of the same channel being located not only in different radial planes but in different transverse planes, relatively to the axis of rotation, the channels of the two members being adapted to register with each other and to form together a spiral passage or coil.

6. In combination with a multiple-system turbine having a plurality of spiral paths for the driving agent, a controlling-valve which in one position connects the said paths in series, and in another position connects them in parallel.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

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Witnesses:

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WOLDEMAR HAUPT.