Nov. 22, 1927.

1,650,475

G. TREFZ ET AL

FREE JET TURBINE

Filed Dec. 21. 1925

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Fig. 1.

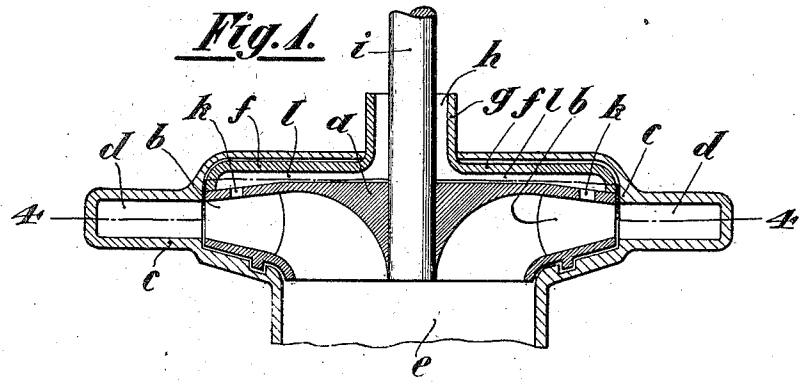


Fig. 2.

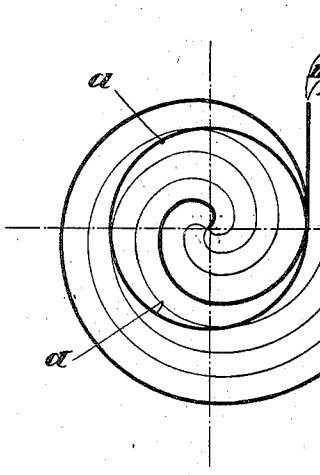
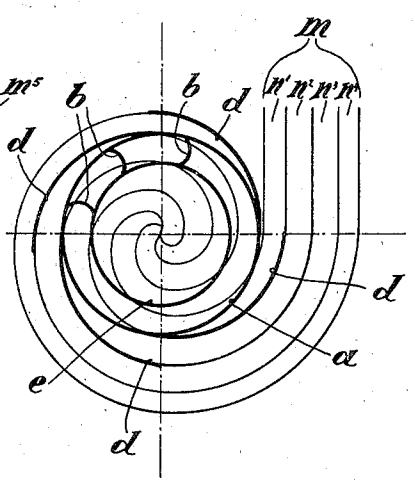


Fig. 3.



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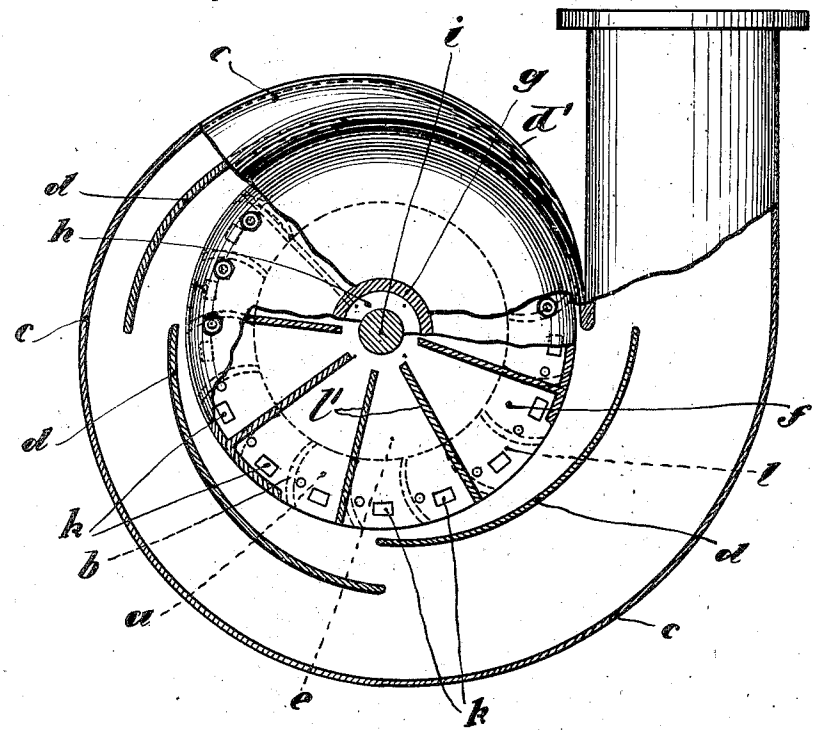
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Fig. 4.



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UNITED STATES PATENT OFFICE.

GUSTAV TREFZ AND FRIEDRICH TREFZ, OF GROSSASPACH, GERMANY.

FREE-JET TURBINE.

Application filed December 21, 1925, Serial No. 76,740, and in Germany August 22, 1925.

This invention relates to free jet turbines, and has for its main object to assure that the impact fluid enters over the whole periphery of the rotor with perfect equality as regards volume and direction, so that even if a single blade rotor is employed a perfectly uniform running and a uniform load on the turbine is obtained; a further object is to prevent the formation of a vacuum between the blades of the rotor in order to assure that the impact fluid runs away from the rotor after it has imparted energy thereto; a further object is to prevent choking of the rotor wheel by the impact fluid so as to prevent the turbine being converted into an excess pressure turbine, which, as is well known, obtains an inferior action owing to the unfavourable outlet angle; and a still further object is to assure a continuous influx of air between the rotor wheel blades so that the jets of impact fluid flow freely away, thereby assuring that the turbine acts as a true free jet turbine.

A construction according to the present invention comprises the combination with the rotor, of a casing adapted to constrain the impact fluid to move to the rotor as a compact spiral body, spiral deflectors being disposed in the casing so as to divide up the fluid body and divert predetermined portions thereof in such a way that equal quantities of the fluid flow in similar spiral streams to the rotor and enter the rotor simultaneously around its whole periphery, at the same angle, whereby every one of the rotor blades always receives the same impact whatever the angular position of the rotor.

The accompanying drawings illustrate a preferred construction embodying the present invention:

Fig. 1 is a diagrammatic axial section through the turbine;

Fig. 2 shows diagrammatically the course of the guided jets of water;

Fig. 3 shows the same with the corresponding guide blades and a few of the rotor blades; and

Fig. 4 is a horizontal cross-section through the turbine on the line 4—4 of Fig. 1.

The rotor wheel *a* of the turbine is provided in known manner with blades *b*, the wheel being mounted in a casing *c* adapted to constrain the fluid to flow in a compact spiral body to the turbine (see Fig. 2), spiral deflectors *d* (see Figs. 1 and 3) being provided within the casing in order to divide up the stream into predetermined portions corresponding to the number of spiral deflectors utilized, the casing including on one side the suction opening *e*.

In the construction shown four deflectors *d* are employed, and consequently the compact body of impact fluid (usually water) is divided into four contiguous spiral streams, indicated by the references m^1 to m^5, the consecutive references indicating the boundaries of the consecutive streams, for instance, the boundaries of the innermost stream are m^1 and m^2 and the boundaries of the outermost stream are m^4 and m^5. It will be noticed, therefore, that the streams are always in contact with one another—hence the compact body referred to—and that the streams never deviate from the spiral at any point, whereby the rotor blades *b* are continuously impinged upon in the desired direction. The outside stream of water flows adjacent the casing wall and thus the last deflector is shown as a portion of the casing wall *d'* in Fig. 4.

Referring particularly to Fig. 3, which clearly shows the division of the body of the water, each stream forming a jet of spiral form, the jets being identified by the references n^1 to n^4, which jets of necessity run parallel with each other and touch each other, each jet impinging on a quadrant of the rotor so that the four jets impinge simultaneously on the whole of the periphery of the rotor, so that there must be perfect uniformity at all points as regards volume and pressure, as the jets always enter the rotor wheel at the same distance from the axis thereof; thereby the impact never varies at any point, and is directed always at the same angle. It will be clear that the number of impact or admission jets may be varied, the number varying according to the size of the turbine wheel, and further, that the number of rotor blades is without limitation. It has, however, been found in practice that it is desirable that the width of the whole body of impact fluid measured in a plane normal to the axis, be about half the diameter of the suction opening *e* and this proportion of body of impact fluid to the opening is illustrated in the drawings.

Now in order to prevent such a turbine acting as an excess pressure turbine, the rotor is provided with openings *k* for the purpose of equalizing the pressure on each

side of the rotor; to this end a circular cover *f* is attached to the rotor wheel and is provided with a sleeve *g* extending over the turbine shaft *i* but spaced therefrom so as to provide an air passage *h* over the shaft; the cover *f*, it will be noticed, touches the periphery of the rotor wheel, but otherwise is spaced therefrom, thereby providing the chamber *l* between the wheel and its cover *f*; this chamber is, through the space *h*, connected to atmosphere, and therefore also atmospheric air can pass to and through the openings *k* to the other side of the blade when the pressure on that side falls below the pressure of atmosphere; this arrangement assures a continuity of flow of the impact water after energy has been imparted to the rotor blades. Instead of a single chamber a number of chambers may be provided. Fig. 4 is a section through the deflector and partly through the chamber *l* in which partitions *l'* are arranged therein to form a number of chambers.

By the arrangement described formation of a vacuum between the rotor blades is prevented from forming due to the suction action of the water jets in the rotor wheel cells, which vacuum will produce, together with the centrifugal force set up, an accumulation between the blades of the impact water, and therefore a choking of the rotor wheel, and if the rotor wheel is full the turbine would act as an excess pressure turbine and not as a free jet turbine, which undesirable conversion of motor working, therefore, is entirely prevented.

We claim:—

1. In a free-jet turbine, the combination with the rotor, of a casing; and a plurality of deflectors each spirally arranged in the casing in the path of the motive fluid so that the motive fluid shall be spirally directed into the rotor, whereby the single streams of motive fluid will form a constrained stream of similar spiral form upon the entire periphery of the rotor.

2. In a free-jet turbine, the combination with the rotor, of a casing; a cover in said casing arranged to form a chamber with the rotor, the cover being provided with a sleeve which surrounds the turbine shaft in spaced relation and through which the outside air communicates with the chamber; and a plurality of deflectors spirally arranged in the casing in the path of the motive fluid so that the motive fluid shall be spirally directed into the rotor, whereby the single stream of motive fluid will form a constrained stream of similar spiral form upon the entire periphery of the rotor.

3. In a free-jet turbine, the combination with the rotor, of a casing; a cover in said casing arranged to form a chamber with the rotor, the cover being provided with a sleeve which surrounds the turbine shaft in spaced relation and through which the outside air communicates with the chamber, and the rotor having openings adjacent the periphery communicating with the chamber so that the air can equalize the pressure on both sides of the blades; and a plurality of deflectors spirally arranged in the casing in the path of the motive fluid so that the motive fluid shall be spirally directed into the rotor, whereby the single stream of motive fluid will form a constrained stream of similar spiral form upon the entire periphery of the rotor.

4. In a free-jet turbine, the combination with the rotor, of a casing; a cover in said casing arranged to form a plurality of chambers, the cover being provided with a sleeve which surrounds the turbine shaft in spaced relation and through which the outside air communicates with the chamber; and a plurality of deflectors spirally arranged in the casing in the path of the motive fluid so that the motive fluid shall be spirally directed into the rotor, whereby the single stream of motive fluid will form a constrained stream of similar spiral form upon the entire periphery of the rotor.

In testimony whereof we affix our signatures.

GUSTAV TREFZ.
FRIEDRICH TREFZ.