Dec. 4, 1923. 1,476,229

E. SUESS

WATER TURBINE

Filed May 18, 1922

Fig. 1

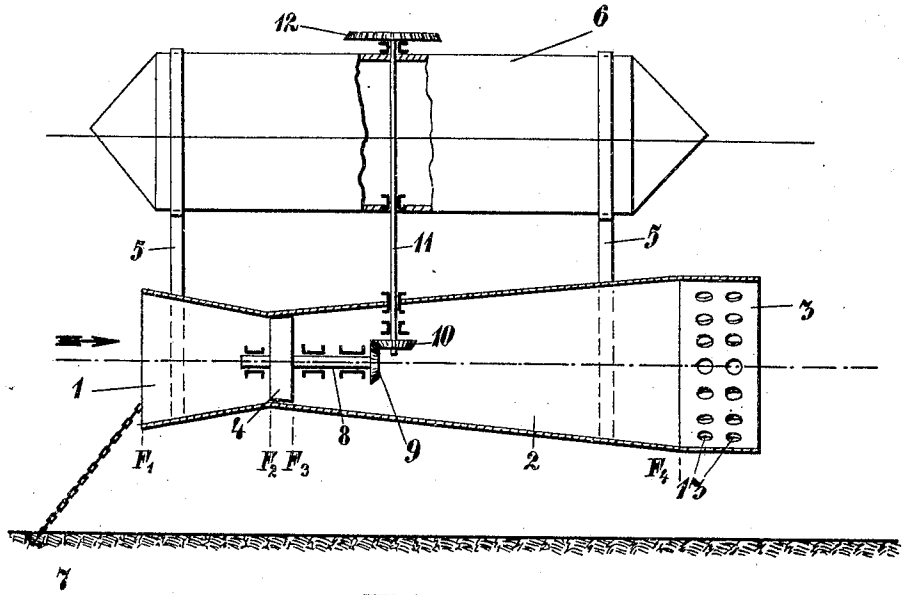
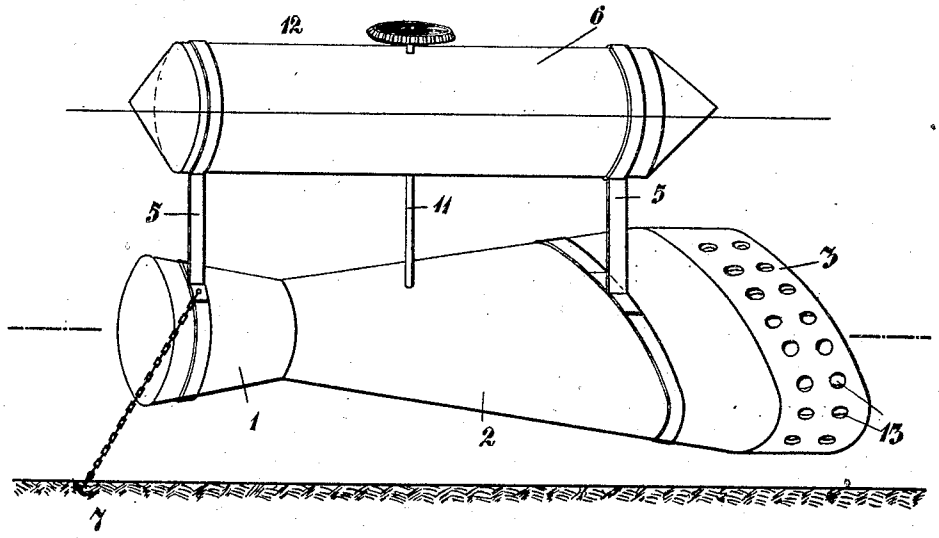


Fig. 2



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UNITED STATES PATENT OFFICE.

EDUARD SUESS, OF VIENNA, AUSTRIA.

WATER TURBINE.

Application filed May 18, 1922. Serial No. 561,959.

To all whom it may concern:

Be it known that I, EDUARD SUESS, a citizen of the Republic of Czechoslovakia, residing at Vienna, Austria, have invented certain new and useful Improvements in and Relating to Water Turbines (for which I have filed an application in Austria December 10, 1920), of which the following is a specification.

This invention relates to turbines for utilizing the energy of the current or flow of open waters.

Besides all kinds of water-wheels and paddle-wheels which are arranged in cylindrical casings located under water, the known arrangements for transforming the water-current into useful energy are based on the principle according to which a tubular casing, arranged under water, is provided with an admission-funnel and at the place where the greatest velocity of flow is present with one or more rotor-wheels. Whether in these known arrangements the casing is of cylindrical or double-funnel shape or a combination of these shapes, only the energy due to the shocks of the running water is utilized, which in most cases will result in such a comparatively small effect, that these arrangements were not extensively in use.

The present invention has for its object to utilize also the effect of the suction of the water-current in order to produce a sufficiently great effect and it consists in providing a casing, located under water, with inlet and outlet of different cross-sectional areas, e. g. to form the casing as suction-pipe, and mounting one or more rotor wheels at a suitable place in the casing. The effect of suction is increased by providing at the outlet end of the casing a pipe which is furnished with openings or holes, the said openings causing an effect of lateral suction. The one or more rotor wheels are mounted in the casing preferably in such a manner, that the cross-sectional area at the outlet end of the rotor wheel is larger than the cross-sectional area at the front side of the said wheel. In double-funnel-shaped casings it is also of importance that the length of the outlet funnel is greater than the length of the inlet funnel.

The accompanying drawing illustrates, by way of example, diagrammatic views of the turbine according to the present invention.

Fig. 1 is a sectional view, and

Fig. 2 a perspective view of the turbine.

The casing is formed by an inlet funnel 1, an outlet funnel 2 and a cylindrically shaped tube 3, a rotor wheel 4 being located at the contracted part of the casing. By means of rods or bars 5 the casing is rigidly connected to a float 6 and is anchored or moored at 7. The produced energy is taken off the turbine-shaft 8 by bevel-wheels 9 and 10, arranged on a vertical shaft 11. The latter passes through the float and is provided with a bevel-wheel 12 for the transmission of power. The cylindrically shaped tube 3 is provided with a number of openings or holes 13, through which the water streaming past at the outside produces a suctional effect on the smaller velocity of flow in the outlet funnel, which in the case of inlet and outlet of the same cross-sectional areas transforms the casing into a suction pipe, whilst in the case of inlet and outlet of different cross-sectional areas the effect of suction is increased. The effect of suction may be varied by covering some of the openings 13. The rotor wheel may run on a vertically arranged shaft if part of the outlet funnel 2 is bent downwardly. This latter arrangement will considerably simplify the construction.

In the illustrated embodiment the inlet area is circular and the larger outlet area elliptical, in order that the turbine may not require to be placed only in deep water. If desired the openings 13 may be located at the top and bottom of the elliptical outlet funnel, in which case the cylindrical tube 3 may be dispensed with.

F_1 designates the cross-sectional area of the inlet end of the inlet funnel, F_2 the cross-sectional area at the inlet end of the rotor wheel, F_3 the cross-sectional area at the outlet end of the rotor wheel and F_4 the cross-sectional area at the outlet end of the outlet funnel.

The increase in the velocity of the amount of water entering in a unit of time depends mainly on the proportion between the areas F_1 and F_2, and therefore this proportion is chosen in such a manner, that the greatest possible increase of the water velocity is produced at the place of admission into the rotor wheel. Points on this will be found in the theory of Bernoulli. Also provision is made that F_3 is greater than F_2, which is accomplished either by contracting the cross-section of the boss of the rotor wheel or as in the present case by mounting the

rotor wheel in a part of the casing which is expanding in the direction of flow, e. g. in the conical part of the outlet funnel.

On designating the velocity in the cross-sectional areas F_1 and F_4 with C_1 and C_4 respectively, the formula

$$\frac{C_1^2 - C_4^2}{2g}$$

represents that value, from which owing to the inequality of the areas F_1 and F_4 the amount of energy to be produced by the effect of suction will depend; g being the acceleration of the free fall.

Therefore the amount of the energy gained by this suctional effect will depend on the proportion between the cross sections F_4 and F_1. Experiments have shown that in rapidly flowing water, four or five times the energy is produced with a water turbine having the inlet and outlet cross-sectional areas in the proportion of 1 to 3 as compared with arrangements whose casings have the same inlet and outlet cross-sectional areas.

To this must be added the gained energy when increasing the suction effect by providing the cylindrical tube 3 which is furnished with openings. Thus a turbine according to the present invention will produce a far better effect than the known arrangements.

As regards the lateral suction the following may be stated:—In addition to the before-mentioned effect of suction, the water flowing past the sides of the turbine-casing may be utilized for producing energy. This is due to the fact, that the amount of water Q will leave very slowly the outlet-opening, while the surrounding water flows past with the full current speed.

Therefore when attaching a perforated cylinder to the end of the turbine-casing, an ejector-effect will be produced, which will suck the water through the openings with a speed v_e.

The speed v_e may be expressed by the equation

$$v_e = \frac{v'^2}{2g} - \frac{v^2}{2g} = \frac{1}{2g}(v'^2 - v^2) \quad \ldots\ldots (17),$$

wherein v' is the outside speed of the stream, v the speed at the admission of the amount of water Q into the perforated cylinder, which is very small owing to the cross-sectional relation.

On designating the area of an opening with F_e and if n represents the number of openings, the amount of water sucked by the ejector-effect will be

$$Q_e = \xi n \times F_e \times v_e = \frac{\xi \times n}{2g} F_e (v'^2 - v^2) \quad \ldots (18).$$

Therefore the amount of water passing out at the outlet-area of the perforated cylinder will be

$$Q_a = Q - Q_e \quad \ldots\ldots\ldots\ldots (19).$$

According to the law of continuity $Q_a = F_a \times C_a'$ and therefore the speed of the outflowing water will be

$$C_a = \frac{Q_a}{F_a} \quad \ldots\ldots\ldots\ldots (20).$$

The outlet-speed C_a has been reduced by the effect of the rows of perforations and therefore the hydraulic effect will be nh, and thus the effect of suction dealt with in section II has become more advantageous.

I claim:—

1. A water turbine comprising an under-water casing composed of a conical inlet and of a conical outlet, said outlet being of larger cross section than said inlet, the outlet and inlet being united at the narrow ends and a rotor wheel at the narrowest part of the outlet.

2. A water turbine comprising in combination an under-water casing and a rotor wheel in said casing, the outlet of said casing being of larger cross section than the inlet, and a cylindrical extension at the outer end of said outlet, having outflow holes for the water, so that a lateral suction effect is produced which augments the suction effect due to the larger cross section of said outlet.

In testimony whereof I affix my signature in presence of two witnesses.

EDUARD SUESS.

Witnesses:
CARL LOUDEN LORE,
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