No. 867,656. PATENTED OCT. 8, 1907.

M. HAEBERLEIN.

TURBINE.

APPLICATION FILED FEB. 27, 1907.

Fig: 1.

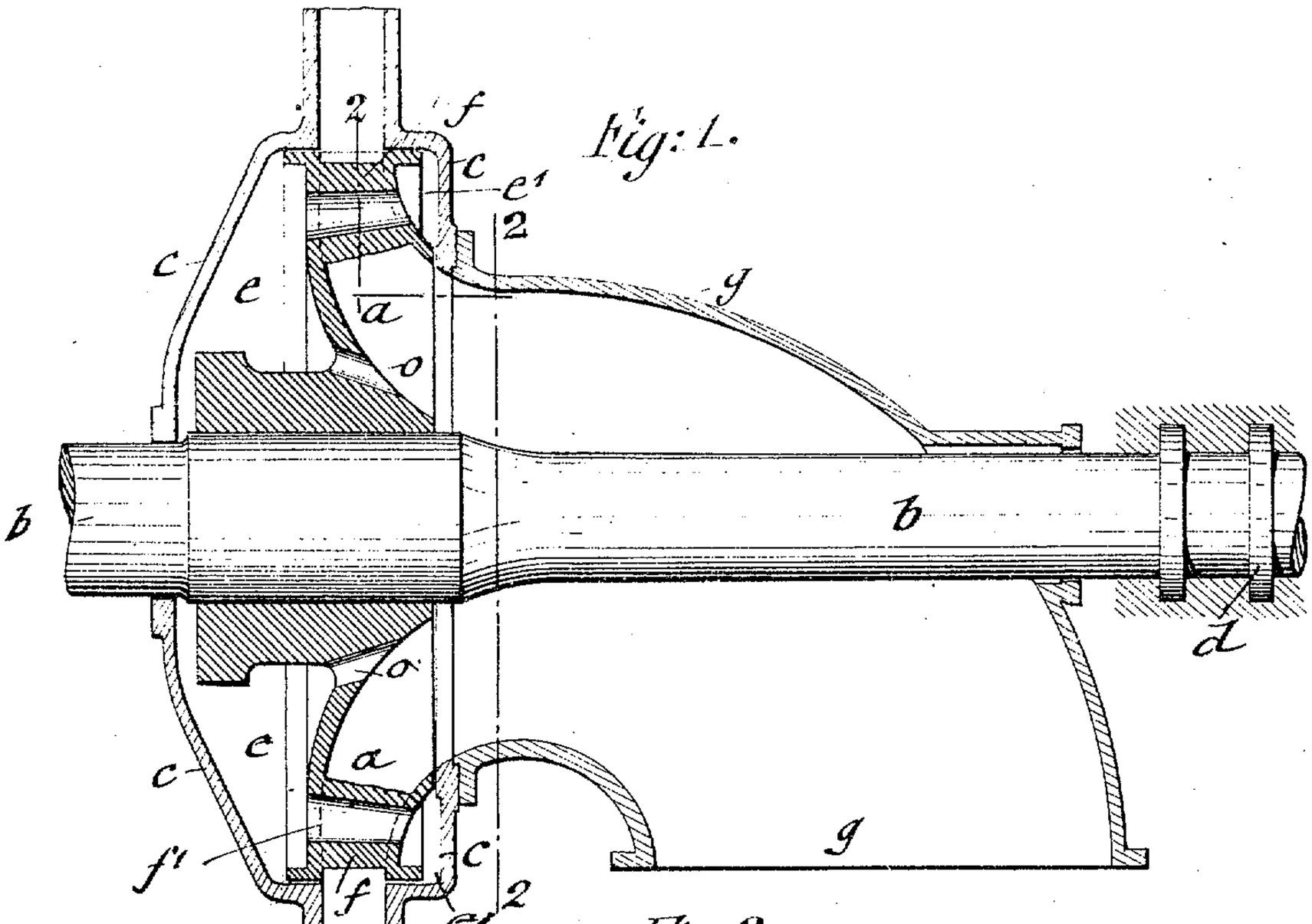
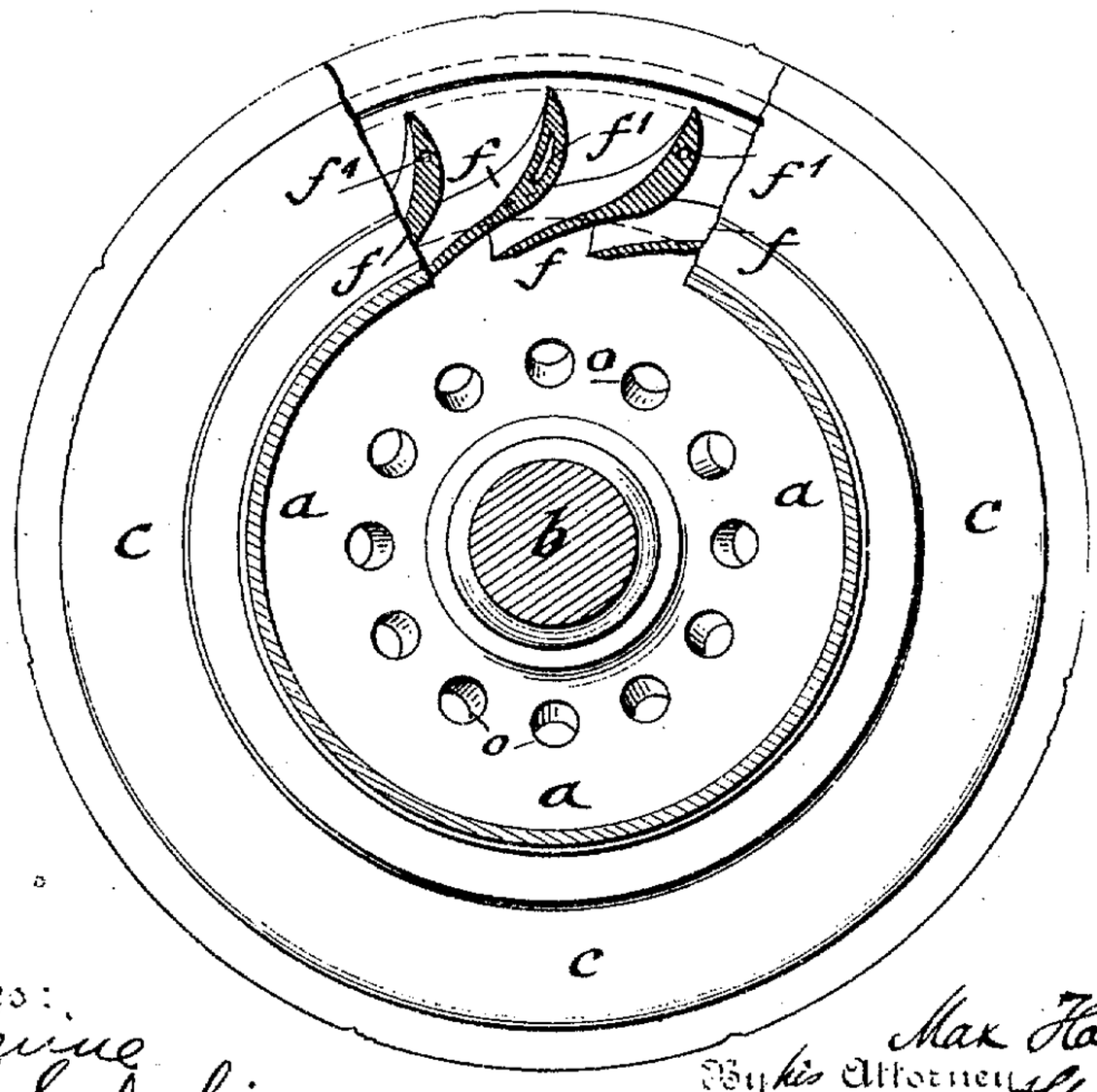


Fig: 2.



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TURBINE.

No. 867,656. Specification of Letters Patent. Patented Oct. 8, 1907.

Application filed February 27, 1907. Serial No. 359,687.

To all whom it may concern:

Be it known that I, MAX HAEBERLEIN, a citizen of the Empire of Germany, residing in New York, borough of Manhattan, in the county and State of New York, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

This invention relates to improvements in radial inward-flow reaction turbines and is intended to equalize the different pressures at any moment in the spaces between the runner-crowns and inclosing casing or heads of the turbine.

In radial inward-flow reaction turbines a certain quantity of water passes through the narrow annular spaces between the circumferential flanges of the runner and the casing of the turbine into the spaces at both sides of the runner between the runner and casing, and produces thereby uneven pressures on both sides of the runner, whereby an end thrust on the shaft is created.

The object of this invention is to obviate these uneven pressures and to minimize the pressure on the thrust-bearing, so as to prevent the heating and burning of the latter; and for this purpose the invention consists of a radial inward-flow reaction turbine in which the runner-vanes are provided with transverse openings or channels in their outer ends by which the water can freely pass from the space located between the runner-bottom and the head of the turbine at one side of the runner to the space between the runner and casing at the opposite side of the runner.

In the accompanying drawings, Figure 1 represents a vertical central section of a horizontal radial inward-flow reaction turbine with my improved runner, and Fig. 2 is a section on line 2, 2, Fig. 1.

Similar letters of reference indicate corresponding parts in the two figures.

Referring to the drawings, *a* represents the runner, *b* the shaft of the same, and *c* the casing of a radial inward-flow reaction turbine. The shaft is rotated in suitable journal-bearings and provided at one end with a thrust-bearing *d* for taking up the thrust exerted by the runner on its shaft. The hub of the runner is keyed to an enlarged section of the shaft *b*, and the web or bottom of the runner provided near the shaft with inclined openings or channels *o* through which the water passes from the space between the runner and the outer head of the casing to the suction-pipe *g*.

Between the runner *a* and the head of the casing *c* are formed annular spaces, a larger space *e* at one side and a smaller space e^1 at the opposite side. The water which passes around the circumferential flange of the runner into the smaller space e^1 passes through the narrow space that is formed between the casing and the inner edge of the runner into the suction-pipe, while the water which passes into the opposite space *e* passes through the inclined openings *o* in the runner-bottom. Owing to the difference in the size of the spaces or chambers and their arrangement, to the difference in the leakage, and to the difference in the centrifugal action of the water in the two chambers, it is impossible in practice to have a uniform pressure in the chambers. As a consequence there will be a pressure on the runner axially of the shaft in one or the other direction whereby an end-thrust is created.

For equalizing the pressure in the spaces *e* and e^1, the vanes *f* of the runner are provided with transverse channels f^1 near their outer ends as shown in Fig. 2, which channels are either bored into the vanes or formed by coring the same before casting. These transverse channels permit the water to pass from the space *e* into the space e^1, so that an equilibrium of pressure in the spaces *e*, e^1 is obtained and the axial pressure of the runner-shaft on the thrust-bearing almost entirely obviated and thereby the heating up of the thrust-bearing effectively prevented.

As all the vanes are provided with transverse channels, and as thereby a large number of connections between the spaces *e*, e^1, in addition to the inclined channels *o*, are supplied, the pressures in the spaces *e*, e^1 are equalized, so that a more uniform motion of the runner, without pressure on the thrust-bearing, is obtained.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. In a turbine, the combination, with the runner and runner-shaft, of a casing inclosing the runner and forming annular spaces of unequal size between the runner-crown and casing at opposite sides of the runner, the vanes of the runner being provided with transverse channels in their outer ends for equalizing the pressure in the annular spaces.

2. In a turbine, the combination, with the runner and its shaft, of a casing surrounding the runner-crown and the runner-shaft and forming annular spaces between the runner and casing at both sides of the runner, the runner-bottom being provided with inclined outlet-channels, and the vanes of the runner with transverse channels near their outer ends for equalizing the pressure in the annular spaces between the runner-crown and casing at opposite sides of the runner.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

MAX HAEBERLEIN.

Witnesses:
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