No. 883,892. PATENTED APR. 7, 1908.

W. KIESER.

NOZZLE FOR TURBINES.

APPLICATION FILED OCT. 25, 1906.

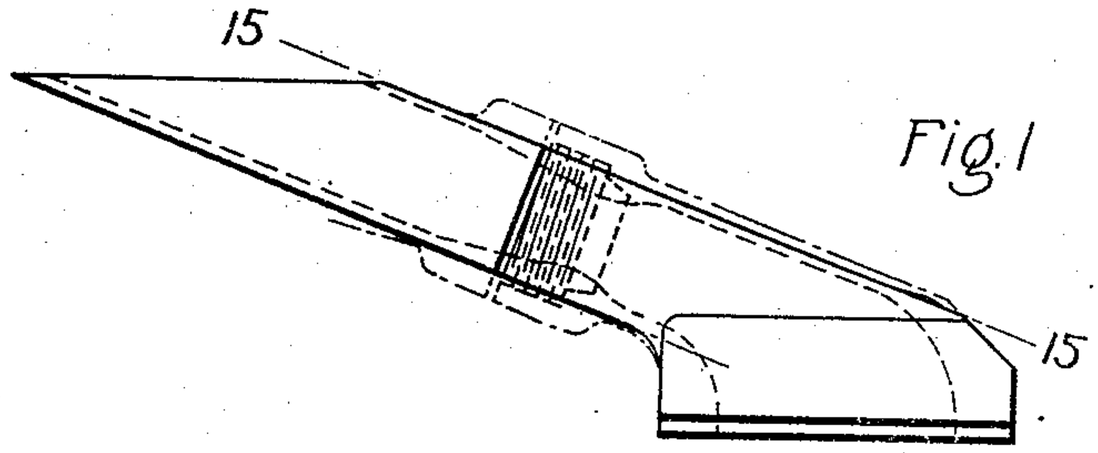


Fig. 1

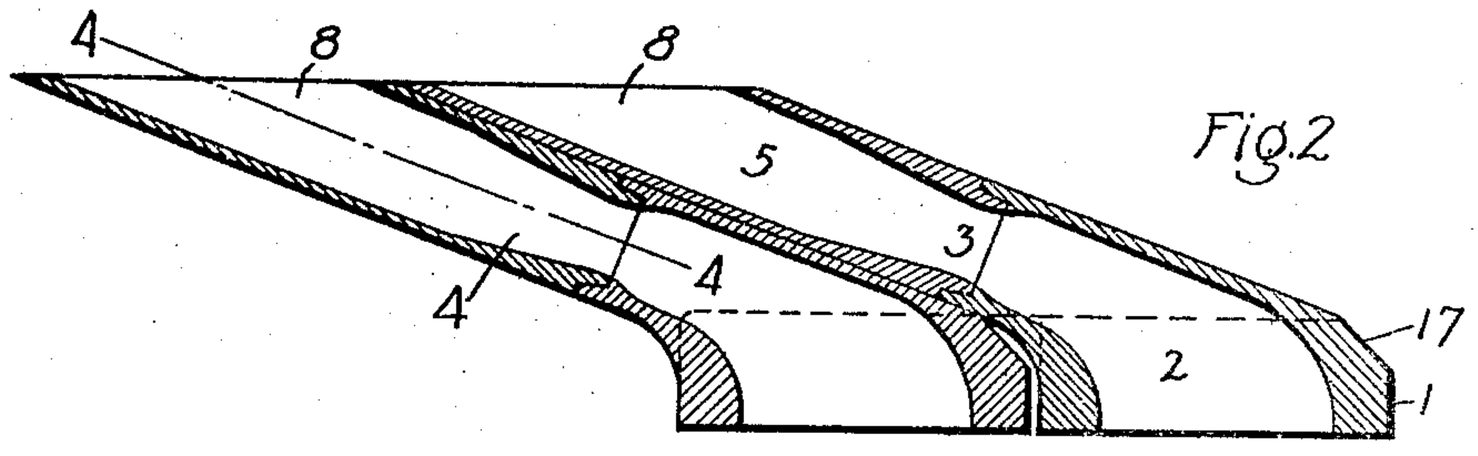


Fig. 2

Fig. 3

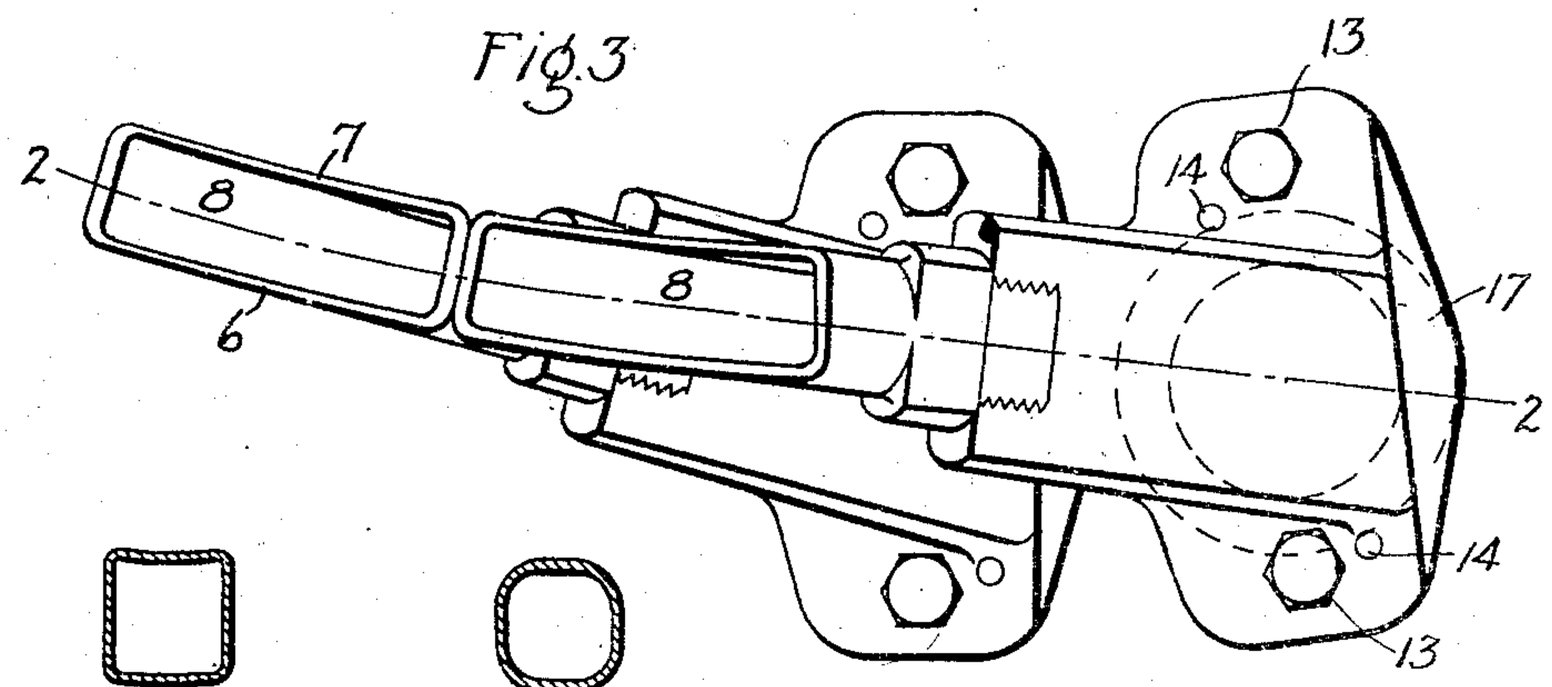


Fig. 5

Fig. 6

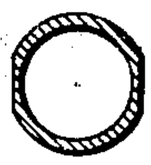


Fig. 7

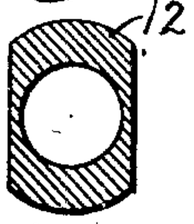
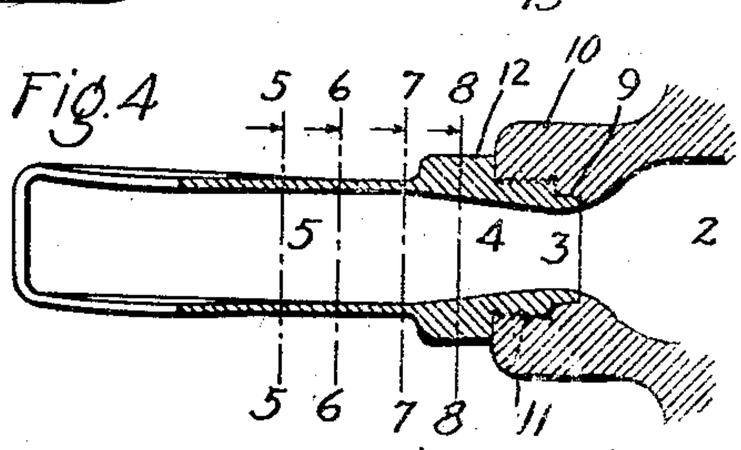


Fig. 8

Fig. 4



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UNITED STATES PATENT OFFICE.

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NOZZLE FOR TURBINES.

No. 883,892. Specification of Letters Patent. Patented April 7, 1908.

Application filed October 25, 1906. Serial No. 340,511.

To all whom it may concern:

Be it known that I, WALTER KIESER, a citizen of Switzerland, residing at Berlin, Germany, have invented certain new and useful Improvements in Nozzles for Steam or Gas Turbines, of which the following is a specification.

The present invention relates to turbine nozzles such as are used in elastic fluid turbines to discharge the motive fluid against the wheel buckets.

The object of the invention is to provide a substantial nozzle structure that efficiently converts the pressure of steam or other elastic fluid into velocity and delivers it at the proper angle to the bucket wheels which convert the velocity into mechanical power.

A further object is to provide a nozzle that may be finished by machine operations, thus eliminating the expense and inaccuracy due to manual operations; and a nozzle that may be readily assembled with other nozzles in a group in which individual nozzles may be inserted or removed without disturbing others.

In the accompanying drawing, illustrating one of the embodiments of my invention, Figure 1 is a top view of a single nozzle; Fig. 2 is a section of two adjacent nozzles on the line 2—2 of Fig. 3; Fig. 3 is a side view of two abutting nozzles; Fig. 4 is a section on the line 4—4 of Fig. 2; and Figs. 5, 6, 7 and 8 are sections on lines 5—5, 6—6, 7—7 and 8—8 of Fig. 4.

The nozzle illustrated has a base 1 containing a bowl 2 of suitable shape. Steam or other elastic fluid from a given source of supply, enters the well-rounded bowl 2 under a predetermined pressure and passes through the throat 3 to the tapering portion 4. This tapering portion connects the throat 3 with the portion 5 which has a substantially rectangular cross-section.

The drawing shows the nozzles as arranged to deliver elastic fluid in an axial flow turbine having a series of buckets projecting radially from the circumference of the bucket wheel. The walls 6 and 7 of the nozzle discharge openings 8 are shaped to the same arcs as the top and bottom of the buckets, while the ends of the other two walls are substantially radial and in contact with the adjoining nozzles. These abutting walls are made as thin as possible so that the fluid issuing from the adjacent nozzles in a group forms a practically solid or undivided column. This construction and arrangement of the discharge openings also insures a direct and efficient delivery of a column of fluid to the buckets which fills all of the bucket spaces directly in front of it. Eddy losses are thus avoided, such, for example, as occur when spaces are left between the adjacent ends of the buckets, or where the walls 6 and 7 are made straight and the corners project beyond the edge of the bucket rim.

The bowl 2 may be regarded as the receiving member of the nozzle, and the portions 3, 4 and 5 as constituting the discharging member. To obtain efficient operation, the interior of the discharging member must be accurately and smoothly finished to predetermined dimensions. In many nozzles with which I am familiar, both members form one integral structure, and owing to the inaccessibility and the changing shape of the interior of the nozzle, finishing by machine operations is impossible. The interior must, therefore, be finished by hand, a process which is very expensive and which results in many departures from the essential accuracy of the dimensions. To overcome the objections just noted, I make the base of cast metal and separate from the discharging member. The latter member is preferably made from some suitable malleable metal or alloy in tubular form. While in this form it may be readily and accurately finished on both its outside and inside by ordinary machine operations, such as turning, boring, reaming, etc. This finished tubular member has a projection 9 with an adjacent screw thread 11. Beyond the screw thread is an enlarged portion 12 to receive a wrench or other tool for screwing the discharge member to the base. The thin tube beyond part 12 is shaped or pressed into its final substantially rectangular cross-section by a machine having suitable dies. The discharge face of the nozzle is subsequently cut off at a proper angle to make it parallel to the bucket wheel. The projection 9 engages a correspondingly shaped seat in the base. This projection is so related to the other parts of the member that the workman, when assembling the nozzle, has only to see that it is properly seated to bring the parts into accurate alinement. The engagement of the projection with its seat is easily determined by inspection. The base is secured to some suitable part of the turbine by means of bolts 13 or

other fastenings, and may be fixed in exact relation to the buckets by dowel pins 14.

The parts thus far described have the outline shown in full and dot-and-dash lines in Fig. 1, and in section in Fig. 4. If only one nozzle is to be used this outline may be preserved, but if a group of two or more nozzles is to be employed, as is customary, the surface of the nozzle must be cut away on the lines 15—15 and 16—16 and the base cut away at 17 to permit the nozzles to be grouped or nested in closely overlapping relation as shown in Figs. 2 and 3.

It is to be understood that the number of nozzles, admission or stage, may be varied to suit the requirements of any given case, and that they may be used with horizontal, vertical or other types of turbines as desired. Where several nozzles are grouped in the manner shown, they may be regarded as constituting a single discharging device delivering one wide stream of fluid to the buckets.

In operation, steam or other elastic fluid flows from the bowl through the throat into the portion beyond, and its pressure is converted into velocity. In the nozzle shown, this velocity is augmented by the expansion of the steam or other fluid in the tapering or diverging portion 4. This portion being round in cross-section offers the least resistance to the flow of fluid, and the transformation from the round to the rectangular portion is so gradual that no objectionable eddies are produced. A small amount of expansion may also occur in passing from the conical portion 4 to the rectangular portion 5 which has a uniform cross-section. The fluid is delivered to the wheel buckets at high velocity by the portion 5.

While the nozzle shown provides for expansion, my invention may be used in the construction of non-expanding nozzles, in which the velocity is due to the passage of fluid from a region of high pressure to one of lower pressure, by making the portion 4 of uniform cross-section and changing the dimensions of the rectangular part to suit. This form of nozzle also makes it possible to easily replace damaged discharge members with new members, or to substitute a member having a different ratio of expansion, if desired. Also any nozzle may be removed from a group by unscrewing the bolts 13 and be subsequently replaced without disturbing the other nozzles.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In an elastic fluid turbine, the combination of a metal base having a well-rounded bowl formed therein, means for attaching the base to a part of the turbine, and a detachable portion for discharging the motive fluid to the buckets, which is pressed into shape and screw-threaded to the base.

2. A nozzle for elastic fluid turbines comprising a base having a screw-threaded opening therein and a tapering seat adjacent the screw thread, with a discharge member having a tapering projection and a screw thread adjacent the projection which engages the first mentioned screw thread to secure the member to the base and hold the projection in engagement with the seat.

3. A nozzle for elastic fluid turbines, comprising a base, an expansion portion and a discharge portion of substantially rectangular cross-section forming an integral detachable member, and means for securing said member to the base.

4. In an elastic fluid turbine, a fluid discharging device comprising a plurality of parallel abutting and overlapping nozzles having their discharge orifices arranged to discharge fluid to the wheel buckets and having their abutting surfaces lying in a plane parallel to the axes of said orifices.

5. In an elastic fluid turbine, a group of nozzles having thin-walled discharging members delivering fluid to the wheel buckets arranged in parallel relation, with the adjacent walls of the members in abutting relation throughout their length, to form a compact structure delivering a substantially solid column of fluid to said buckets.

6. In an elastic fluid turbine, a group of nozzles having thin-walled discharging members at an angle to the wheel buckets and arranged in parallel, overlapping relation with the adjacent walls of the members in abutting contact throughout the length thereof, to form a compact device discharging a substantially solid column of fluid to said buckets.

7. In an elastic fluid turbine, a fluid discharging device comprising a plurality of abutting and overlapping nozzles having thin-walled discharge orifices arranged on an arc corresponding to that of the wheel buckets, with the axes of the orifices at an angle to the face of the wheel, and having the surfaces of their abutting walls parallel to the axes of the orifices.

In witness whereof, I have hereunto set my hand this sixteenth day of October, 1906.

WALTER KIESER.

Witnesses:

ALEX. F. MACDONALD,

JOHN A. MCMANUS, Jr.