

G. H. PLAINE.
TURBINE.
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1,050,488.

Patented Jan. 14, 1913

Fig. 1.

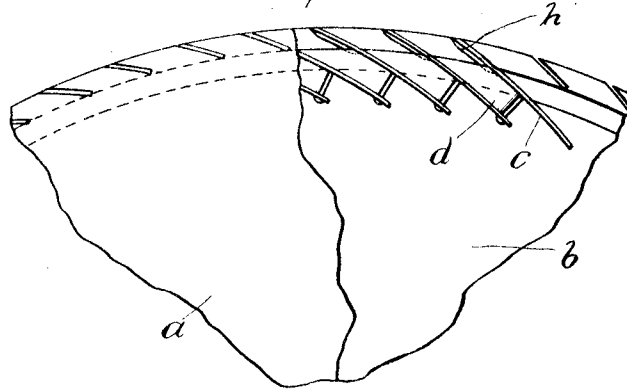


Fig. 2.

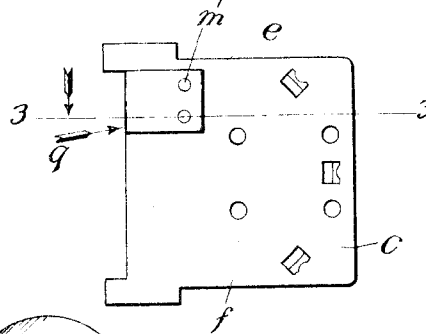


Fig. 4.

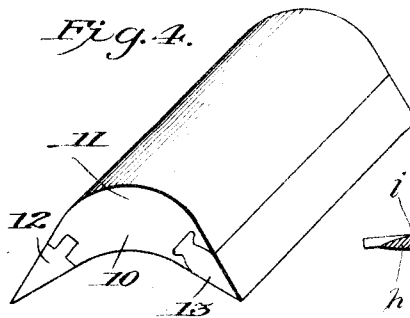
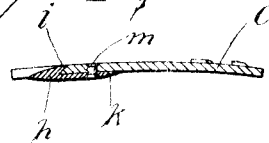


Fig. 3.



WITNESSES

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TURBINE.

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To all whom it may concern:

Be it known that I, GEORGE H. PLAINE, a subject of the King of England, and a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Turbines, Centrifugal Pumps, and the Like, of which the following is a specification.

Experience with fluid actuated turbines and centrifugal pumps has shown that any sharp edge, for example, such as the receiving or return edge of a steam turbine blade, when subjected to the action of a fluid at high velocity will be worn away from the erosive effect of the fluid. In other words, that edge of the blade in the rotor where the actuated fluid enters the bucket will gradually be eaten away, with the result that the efficiency of the apparatus is impaired. It is in the majority of cases impractical to make these blades or buckets of a material sufficiently hard and tough to resist erosion, either because of the expense of such material, or its insufficient strength to resist mechanical and centrifugal forces, or the difficulty in satisfactorily working it into those sections necessary for certain parts of the buckets or guide vanes of fluid actuated turbines and the rotors and diffusion vanes of centrifugal pumps, fans, etc. Consequently, it has been customary and necessary to entirely discard a wheel after the bucket plates have become worn and replace it by an entirely new structure. This means a very heavy expense both to the manufacturer and the user.

It is the purpose of my invention to provide a simple, convenient and inexpensive method of repairing a wheel after the buckets or similar parts have been worn away.

One embodiment of the invention is illustrated in the drawings in which—

Figure 1 is a side view of part of a rotor or bucket wheel, one of the side plates being partially broken away to show construction. Fig. 2 is a bottom view of one of the bucket plates. Fig. 3 is a section view on the line 3—3 of Fig. 2 looking in the direction of the arrow. Fig. 4 is a view of a different type of bucket provided with a shoe at both the delivery and receiving edges.

The wheel illustrated is adapted for use in what is known as the Terry type of steam turbine, but it is to be clearly understood that the invention is adapted for use in con-

nection with the turbines of various makes and types, and also in connection with centrifugal pumps, fans and like machinery, and it is to be understood that the terms which I employ are used merely for purposes of description and not as limitations.

Referring to Fig. 1 *a* denotes one of the side plates of the wheel, and *b* the other side plate, between which are arranged the bucket plates *c* one above the other in step formation and with a curved plate *d* interposed between the bucket plates to form the rear wall of the bucket.

Referring to Fig. 2 *e* denotes the receiving side of the bucket plate, that is to say, that side at which the steam enters the bucket and *f* the delivery side, and it is the front edge of the plate at the receiving side *e* indicated by the arrow *g* which is worn away by the erosive action of the actuating fluid.

In accordance with my invention I cut away the front edge of the receiving side of the plate *e* as indicated in Fig. 3, preferably leaving this front edge slightly beveled, and provide a shoe *h* made of material which is relatively more resistant to the action of the actuating fluid than the main body of the plate *e*. This shoe has an undercut groove *i* to fit accurately the bevel, and a rearwardly extending tail piece *k* which lies against the underside of the bucket plate *e*. Rivets *m*, or other suitable securing means, are provided to hold the shoe in place. The wheel can be originally provided with these shoes, or if a solid bucket plate is first used, it can be cut down on the receiving side when it is worn away and these shoes fitted to it. In this way it is possible to make this receiving edge of the bucket plate of different metal or different temper or degree of hardness of the same metal which will withstand the erosive action of the actuating fluid to a very much greater extent than will the material from which the main part of the plate *e* is made, and when the shoe wears away, it can be removed and replaced by a new one very readily. Another advantageous feature of this construction is that the tail *k* reduces the depth of the entering part of the receiving side of the chamber, having a choking or jet effect, as it passes into the chamber, allowing it to expand, and increasing the efficiency of the apparatus. Of course, the forward end of the shoe is shaped to

correspond to the forward end of the plate and at just the right inclination or angle to properly receive the steam with a minimum amount of friction. As has been hereinbefore stated, the invention is adapted for use in turbines of various types and also in centrifugal pumps and other machinery where an erosive action may occur. The use of my invention will obviate the present necessity of scrapping complete wheels or complete blades which are perfectly good except for the slight wear at the receiving side of the bucket plates. These wheels may cost a big percentage of the total cost of the machine, and as at present made are absolutely useless after they have become worn.

In the claims it is to be understood that the term "bucket plate" is intended to include any plate, guide, vane, diffusion vane or the like, which receives the actuating fluid and deflects its course of travel.

In Fig. 4 I have illustrated another form of bucket in which the receiving edge is subject to erosive or corrosive action and the delivery edge to corrosive or erosive action and in such a structure I form each edge of suitable material which will better resist this action of the actuating fluid than the main body of the blade. The drawing shows a bucket 10 have the main body part 11, a shoe 12 at its receiving edge of different material or of the same material but of different temper, and a shoe 13 at the delivery edge similarly made. A bucket thus constructed will wear much longer than as they are now made and provision can be made, if desired, for the removal or replacement of the shoes when they show any wear after a long continued use.

I claim as my invention:

1. A bucket plate adapted for use in devices of the character described the receiving edge of said plate being relatively more resistant to the action of the actuating fluid than the main body of the plate.

2. A bucket plate adapted for use in devices of the character described the receiving side of the plate adjacent to the edge being of greater thickness than the balance thereof.

3. A bucket plate adapted for use in devices of the character described the receiving edge of the plate being provided with a shoe which is made of material relatively more resistant to the action of the actuating fluid than the main body of the plate, and means for securing the shoe in place.

4. A bucket plate adapted for use in devices of the character described the receiving edge of the plate being provided with a shoe made of material which is relatively

more resistant to the action of the actuating fluid than the main body of the plate, and means for removably securing the shoe in place.

5. A bucket plate adapted for use in devices of the character described, the edge of said plate being cut away at the receiving side and provided with a beveled edge, a shoe of material which is relatively more resistant to the action of the actuating fluid than the material of the plate, and means for securing the shoe in place.

6. A bucket plate adapted for use in machines and devices of the character described, the edge of said plate being cut away at the receiving side and provided with a beveled edge, a shoe of material which is relatively more resistant to the action of the actuating fluid than the material from which the plate is made and having an undercut groove to fit the beveled edge of the plate, a tail piece on said shoe lying against the under face of the plate, and means for securing said shoe in place.

7. A bucket plate adapted for use in machines and devices of the character described, the edge of said plate being cut away at the receiving side, and provided with a beveled edge, a shoe of material which is relatively more resistant to the action of the actuating fluid than the material from which the plate is made, an undercut groove in said shoe lying against the under edge of the plate, and means for securing said plate in place.

8. A bucket plate, adapted for use in devices of the character described, comprising a main-body portion and receiving and delivery edges formed from material which is relatively more resistant to the action of the actuating fluid than the main body of the plate.

9. A bucket plate adapted for use in devices of the character described, the edge of said plate being cut away at the receiving side, a shoe of material which is relatively more resistant to the action of the actuating fluid than the main body of the plate adapted to fit in said cut away portion and interlocking parts on said shoe and plate.

10. A bucket plate adapted for use in devices of the character described, the receiving edge of the plate being cut away, and a shoe of material which is more resistant to the action of the actuating fluid than the main body of the plate, adapted to fit in and fill the cut away portion, and means for removably securing it in place.

GEORGE H. PLAINE.

Witnesses:

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JOHN SAINSBURY.