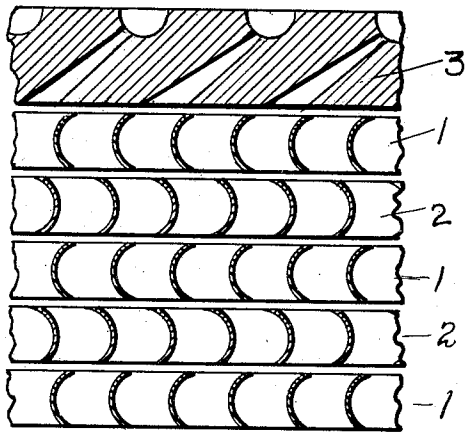
E. FISHER, JR.
BLADE FOR TURBINES.
APPLICATION FILED JULY 29, 1911.

1,097,752. Patented May 26, 1914.

Fig. 1.



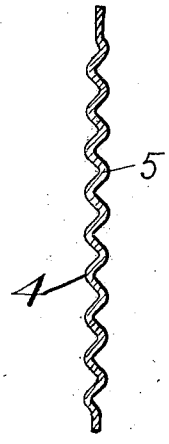


Fig. 2.

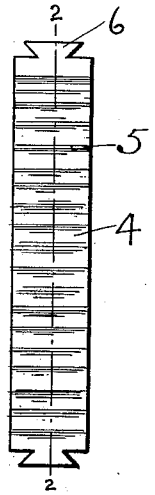


Fig. 3.

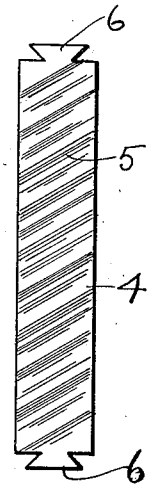


Fig. 4.

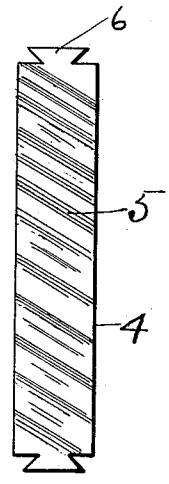


Fig. 5.

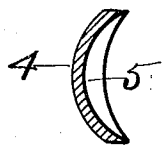


Fig. 6.

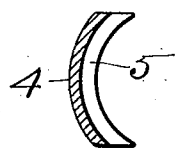


Fig. 7.

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UNITED STATES PATENT OFFICE.

EMANUEL FISHER, JR., OF PROVIDENCE, RHODE ISLAND, ASSIGNOR OF ONE-HALF TO FREDERICK S. PECK, OF PROVIDENCE, RHODE ISLAND.

BLADE FOR TURBINES.

1,097,752. Specification of Letters Patent. Patented May 26, 1914.

Application filed July 29, 1911. Serial No. 641,288.

To all whom it may concern:

Be it known that I, EMANUEL FISHER, JR., a citizen of the United States, residing at the city of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Blades for Turbine-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to blades, buckets, or other members against which the motive fluid impinges in turbine engines, and has for its object to provide a blade, bucket, or the like for an engine having a corrugated working surface.

It is found in practice that when ordinary plain concaved blades are used that the uneven expansion of the parts often causes them to crack or pull apart and break loose and when set free to do great damage to the engine. A corrugated blade is adapted to yield to some extent and accommodate itself to this uneven expansion, and to excessive strains and thereby effectually prevents breakage and so reduces the liability of wrecking the engine. Again, blades corrugated transversely to their length offer greater working resistance to the passage of the steam and render them more effective than blades with a plain working surface.

The invention further consists in forming the corrugations on the alternate series of fixed and moving blades on oppositely disposed angles, thereby offering a greater resistance to the direct passage of the steam and so materially increases the efficiency of the engine.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described and particularly pointed out in the appended claims.

Of the accompanying drawings: Figure 1— is a diagrammatic view looking at the ends of the alternate series of fixed and moving blades showing the general course of the fluid therethrough. Fig. 2— is a longitudinal section through the blade on line 2—2 of Fig. 3. Fig. 3— shows a face view of the blade showing the corrugations running transverse to the longitudinal axis of the blade. Fig. 4— illustrates the corrugations as set on an angle to the longitudinal axis of the blade. Fig. 5— illustrates the blade having corrugations set on an angle opposite to those illustrated in Fig. 4. Fig. 6— is a transverse section through a blade showing the middle portion of the transverse groove as being deeper than at its ends. Fig. 7— is a transverse section through a blade showing the groove as being of a uniform depth throughout its length.

Referring to the drawings, 1 and 2 designate the alternate sets of blades held in the rotor and fixed in the casing, respectively. The impelling fluid enters through the ports 3 and passes in a zig-zag course between these rows of blades in the usual way.

My invention relates particularly to the construction of the blade 4 itself, which is preferably made of metal adapted to be stamped, pressed, cast or otherwise formed with corrugations 5 across its working surface. These corrugations are for the purpose of preventing the blades from pulling apart and breaking by yielding and compensating for unequal expansion or excessive strains. I preferably form these blades of sheet metal and corrugate the same substantially transverse of their length. The ends of the blade may be held by dove-tailing as at 6, or otherwise in position, in corresponding slots in their respective supporting parts. By corrugating these blades they may be made out of comparatively hard and thin sheet metal and bent into the desired concave shape, instead of being obliged to be formed by drawing as is at present the case with the ordinary turbine blade. Then again, by being constructed of corrugated sheet metal the blade is much lighter and also much stronger for the same weight of metal, thereby practically eliminating the liability of breaking. The reduction in weight also has the advantage of reducing the action of centrifugal force upon these blades.

Another feature of my improved construction is that these corrugations also render the steam more effective and raise the efficiency of the engine. In other words, when the steam or other fluid impinges against the corrugated surface of a blade the grooves tend to offer a greater resistance to the steam rendering the blades more effective and efficient. Again, to increase the effective resistance offered by the blades I

preferably set these corrugations on a slight angle to the longitudinal axis of the blade, each alternate row of moving and fixed blades being corrugated in different directions, as illustrated in Figs. 4 and 5, whereby the steam instead of passing straight through, is turned slightly up and then down alternately or toward and from the axis of the engine, first in one, and then the other of the fixed and moving blades. In corrugating these blades the grooves may be deeper at their middle portion, as illustrated in Fig. 6, in which case the edges of the blade would be substantially straight. Or the corrugations may be the same depth throughout their length as in Fig. 7 in which case the edges of the blade would be scalloped.

By the word "corrugations" it is understood that I mean any depressions, channels or ribs formed in the front or back surface, or both, of the blades for receiving and conducting the fluid in any direction across the face of the same.

By the word "blade" in the specification and claims I include a bucket, or other member against which the motive fluid impinges.

Owing to the vast number of blades employed, often many thousands, in the construction of a turbine engine it will be seen that even a small saving in the weight of each blade, would amount to a great saving in the aggregate.

By my improved construction many advantages are obtained. First, the danger of breaking the blades and consequent wrecking of the engine is reduced to the minimum. Second, a greater efficiency is obtained from the engine in that the steam acts with greater effect upon the corrugated blades than upon blades having a plain surface. Then again, as the steam acts on these blades with a greater effect a less number of blades will be required to produce a given result. Consequently as the blades are lighter in weight and as there are less in number, the whole engine per given horse power may be much lighter in weight, stronger in construction and of greater efficiency than is now obtained by an engine having blades with plain surfaces.

I claim:

1. A blade for a turbine engine formed of corrugated sheet metal.

2. A blade for a turbine engine formed of corrugated sheet metal and concavo-convex in cross section.

3. A blade for a turbine engine provided with a plurality of alternate ribs and grooves set on an oblique angle to the axis of the blade across its working face.

4. A blade for a turbine engine formed of sheet metal having alternate ribs and grooves across its working face.

5. A blade for a turbine engine formed of sheet metal having alternate ribs and grooves set obliquely to the axis of the blade across its working face.

6. A blade for a turbine engine formed of sheet metal having alternate ribs and grooves across its working face, said blade being concavo-convex in cross section.

7. In a fluid engine a plurality of sets of alternate fixed and movable blades, each blade having ribs set on an oblique angle to its axis across its working face, said blades being adapted to be individually supported in spaced apart relation one with the other.

8. In a fluid engine, a plurality of alternate fixed and movable concavo-convex blades of sheet metal each having corrugated working faces.

9. In a fluid engine, a plurality of alternating fixed and movable concavo-convex blades formed of currugated sheet metal.

10. In a fluid engine a plurality of sets of alternating fixed and movable blades each blade being provided with ribs and grooves set on an angle across its working face.

11. In a turbine engine, a plurality of sets of alternating fixed and movable blades each of said blades being provided with corrugations disposed on an angle across its face the angle on the moving blades being different than that on the fixed blades.

12. In a turbine engine, a plurality of sets of alternate fixed and movable blades each of said blades being provided with ribs and grooves set on an angle to the longitudinal axis of the blade across its working face, the ribs on the moving blades being set on an angle to those on the fixed blades.

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

EMANUEL FISHER, JR.

Witnesses:
HOWARD E. BARLOW,
E. I. OGDEN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."