Nov. 25, 1924. 1,516,607

J. JOHANSON

HOLLOW TURBINE BUCKET AND METHOD OF MANUFACTURING SAME

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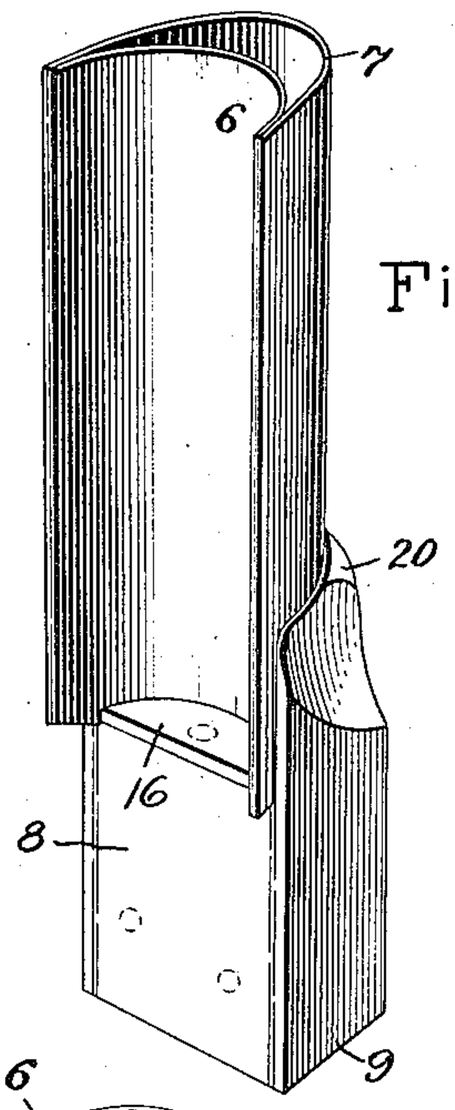


Fig. 1.

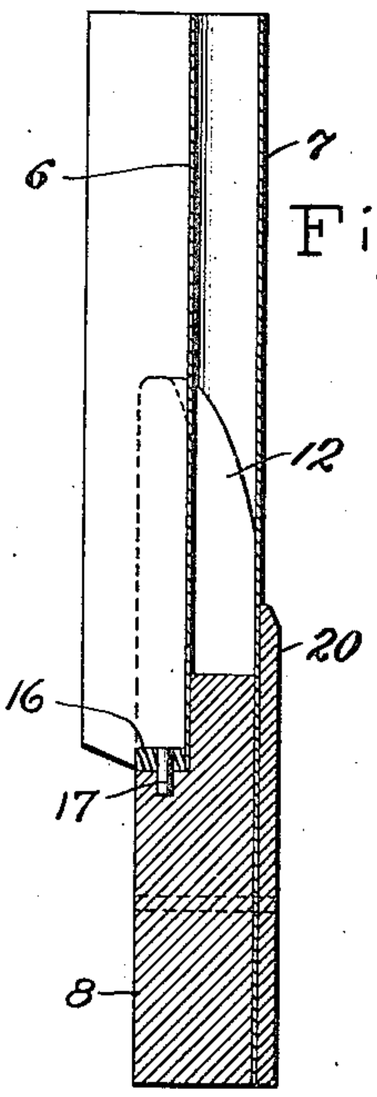


Fig. 2.

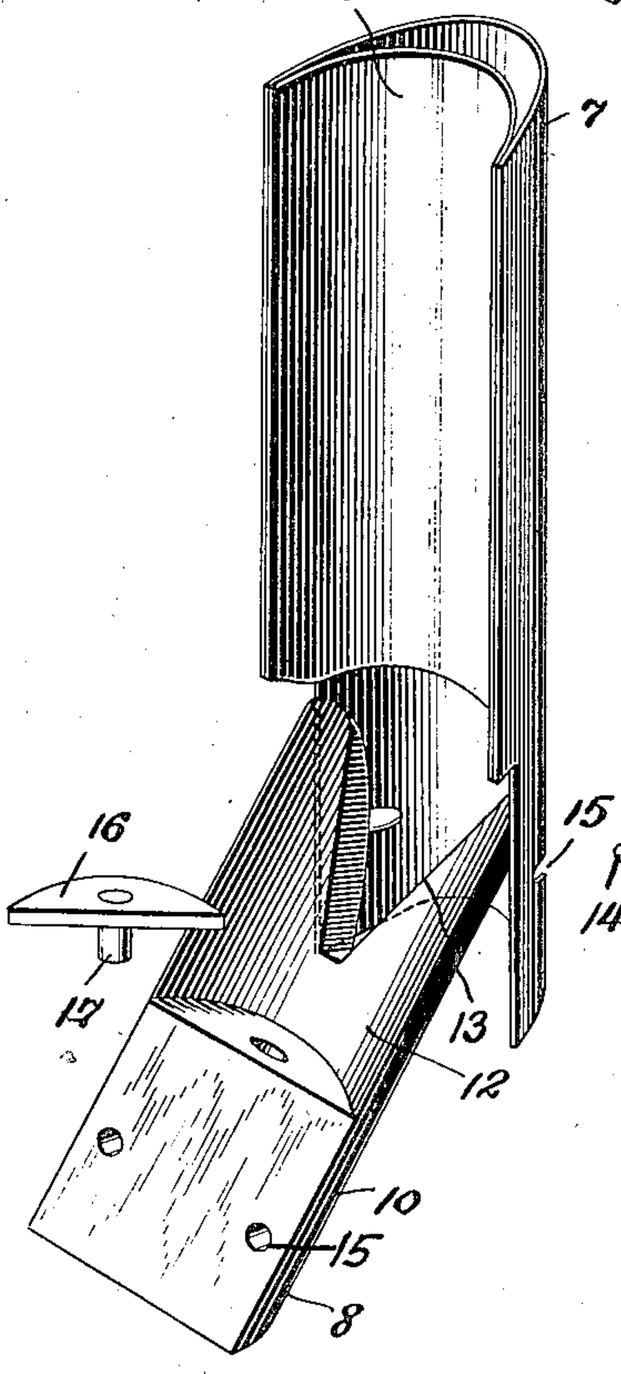
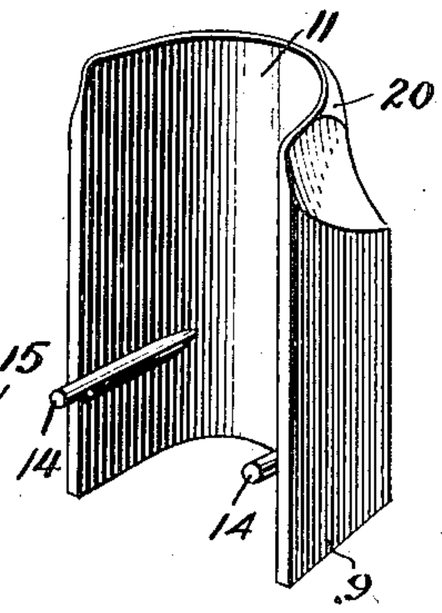


Fig. 4.



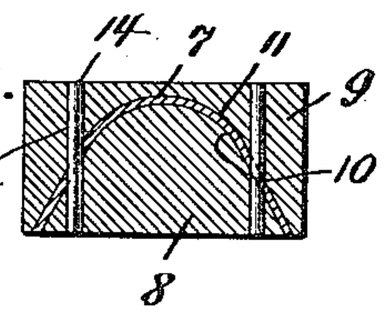


Fig. 3.

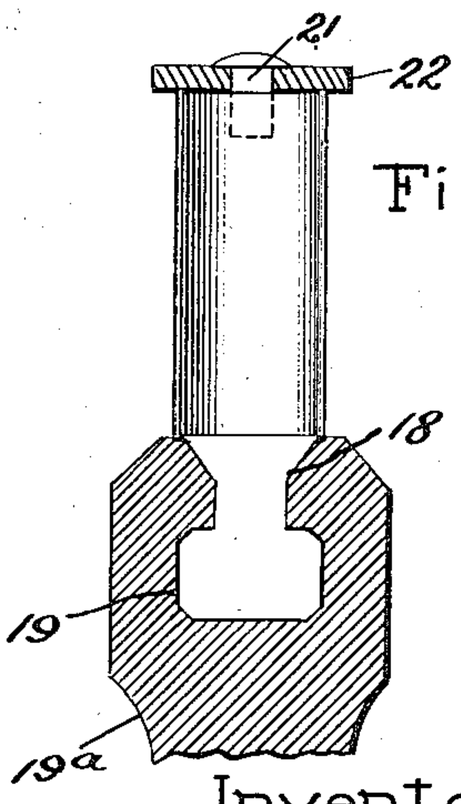


Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN JOHANSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

HOLLOW TURBINE BUCKET AND METHOD OF MANUFACTURING SAME.

Application filed July 30, 1923. Serial No. 654,523.

To all whom it may concern:

Be it known that I, JOHN JOHANSON, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Hollow Turbine Buckets and Methods of Manufacturing Same, of which the following is a specification.

It has heretofore been proposed to make turbine buckets hollow in order to reduce their weight and thereby decrease the centrifugal stresses but even with hollow buckets of light weight the centrifugal stresses become of considerable value as the buckets increase in length. The stresses are highest of course, at the roots of the buckets and gradually decrease toward the tips, the greatest stress being in the bases of the buckets. One of the problems in connection with such buckets has been to provide a practical structure having sufficient strength at its base or inner end to withstand the centrifugal stresses met with in modern turbine practice and the object of my invention is to provide an improved hollow turbine bucket structure which will meet this condition and an improved method of manufacturing the same.

For a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a perspective view of a partially completed turbine bucket embodying my invention; Fig. 2 is a vertical sectional view thereof; Fig. 3 is a sectional plan view through the base of the bucket; Fig. 4 is an exploded view of the parts used in manufacturing my improved bucket, and Fig. 5 is a view showing a completed bucket mounted on a rotor.

The front and back walls of the bucket may be formed of two curved pieces of sheet metal suitably united along their edges, 6 being the front wall and 7 the back wall. I may with advantage form walls 6 and 7 from Monel metal and they may be united along their edges in any suitable manner such as by soldering, brazing, welding or the like. The back wall 7 extends throughout the length of the bucket while the front wall terminates at the top of the base. The base is made up primarily of two main pieces, a front piece 8 and a back piece 9. The front piece 8 has a curved surface 10 which fits the inner surface of back wall 7 and the back piece 9 has a curved surface 11 which fits around the outer surface of wall 7. The lower end of wall 7 is thus held between the two base pieces 8 and 9. The front base piece 8 has a portion 12 which projects up between walls 6 and 7 and this projecting portion is preferably tapered in accordance with the falling off of the centrifugal stresses. This may be done by cutting a V-shaped notch in the projection as indicated at 13. The projection 12 forms a reinforcing member for giving strength to the inner end of the bucket.

In constructing a bucket embodying my invention I take a front and back wall 6 and 7 which have been suitably united to each other along their edges and put the front base piece 8 in position as best shown in Figs. 1 and 2, slipping the reinforcing projection 12 up between walls 6 and 7. I then put back wall piece 9 in position around the lower end of back wall 7 and fasten the parts together in what may be termed an initial or temporary manner by means of pins 14 which may be driven into holes 15. Or, the parts may be fastened in any other suitable manner. When thus assembled the lower edge of inner wall 6 takes against the flat top surface of base piece 8. I then apply to such top surface a holding plate 16 which may be fastened in position temporarily by any suitable means such as by means of the pin 17.

After the parts have been thus assembled I then unite them to form a unitary structure by means of fusion of metal such as by means of brazing, welding, soldering or the like. Preferably I unite the parts by copper brazing in the presence of a reducing atmosphere such as hydrogen. This may be done by placing the assembled structure in a suitable muffler or furnace containing an atmosphere of hydrogen, providing some copper adjacent to the surfaces to be united, and then heating the structure to a suitable temperature to fuse the copper which will thereupon enter the interstices between the parts and effect a union of them, forming in substance a unitary structure.

After the assembled parts have been thus united into a unitary structure, the base may be finished to any suitable contour for attaching it to a rotor or bucket-carrying

member. In Fig. 5 I have shown it provided with slots 18 to form a dove-tail for engagement with a groove 19 in the rotor this being a well-known form of bucket fastening means. In Fig. 5, the rotor or bucket carrying member is indicated at 19a. Preferably, pins 14 are so located that when the bucket bases are finished, the pins are removed with the waste material. The holes 15 and pins 14 do not therefore serve in any way to weaken the structure. The plate 16 serves to grip and hold the lower end of inner wall 6. The base member 9 preferably extends up along the back of wall 7 as indicated at 20 to brace the back of the bucket.

The bucket may be provided with a suitable tenon 21 for fastening in place a bucket cover 22, the tenon being fixed to the bucket by welding or in any other desired manner.

By the above described arrangement I provide a structure wherein the bucket proper comprising walls 6 and 7 is firmly anchored to the base and also a structure wherein the base and the portion of the bucket next to the base are amply strong to withstand the centrifugal stresses met with. At the same time by following my method of construction the bucket may be manufactured at a reasonable cost. The reinforcing projection 12 may be made as long as found desirable in any particular case and may be given a cross section such as to provide the desired strength. By its use I provide in substance the equivalent of a tapered bucket.

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

1. A turbine bucket comprising curved front and back walls united along their longitudinal edges, the back wall projecting below the front wall at one end, and a plurality of base pieces between which the projecting end of the back wall is held.

2. A turbine bucket comprising curved front and back walls united along their longitudinal edges, the back wall projecting below the front wall at one end, a front and back base piece between which the projecting end is clamped, and a reinforcing projection on the front base piece which extends up between said front and back walls.

3. A turbine bucket comprising curved front and back walls united along their longitudinal edges, the back wall projecting below the front wall at one end, a front and back base piece between which the projecting end is clamped, and a tapered reinforcing member which projects from the base piece up between said front and back walls.

4. A turbine bucket comprising curved front and back walls united along their longitudinal edges, and base pieces between which the lower ends of said walls are held, said walls and base pieces being united by fused metal.

5. A turbine bucket comprising curved front and back walls united along their longitudinal edges, and a plurality of base pieces between which the lower end of the back wall is held, said wall and back piece being united by fused metal.

6. A turbine bucket comprising curved front and back walls united along their longitudinal edges, a plurality of base pieces between which the lower end of the back wall is held, one of said base pieces being provided with a reinforcing projection, and said walls, base pieces and projection being united by fused metal.

In witness whereof, I have hereunto set my hand this 27th day of July, 1923.

JOHN JOHANSON.