

H. G. REIST.

MEANS FOR ATTACHING TURBINE BUCKETS TO WHEELS.

APPLICATION FILED MAR. 24, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

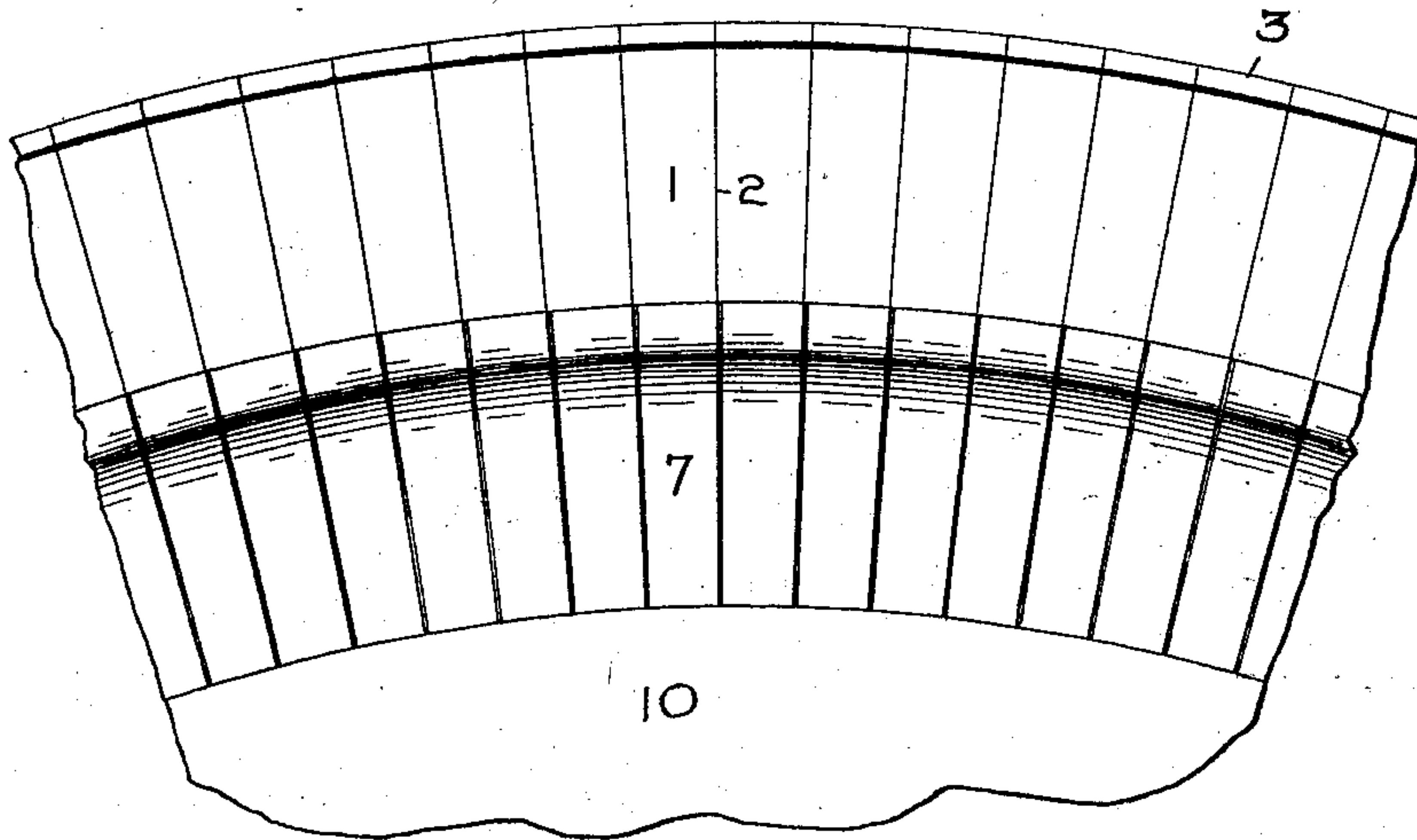


Fig. 2.

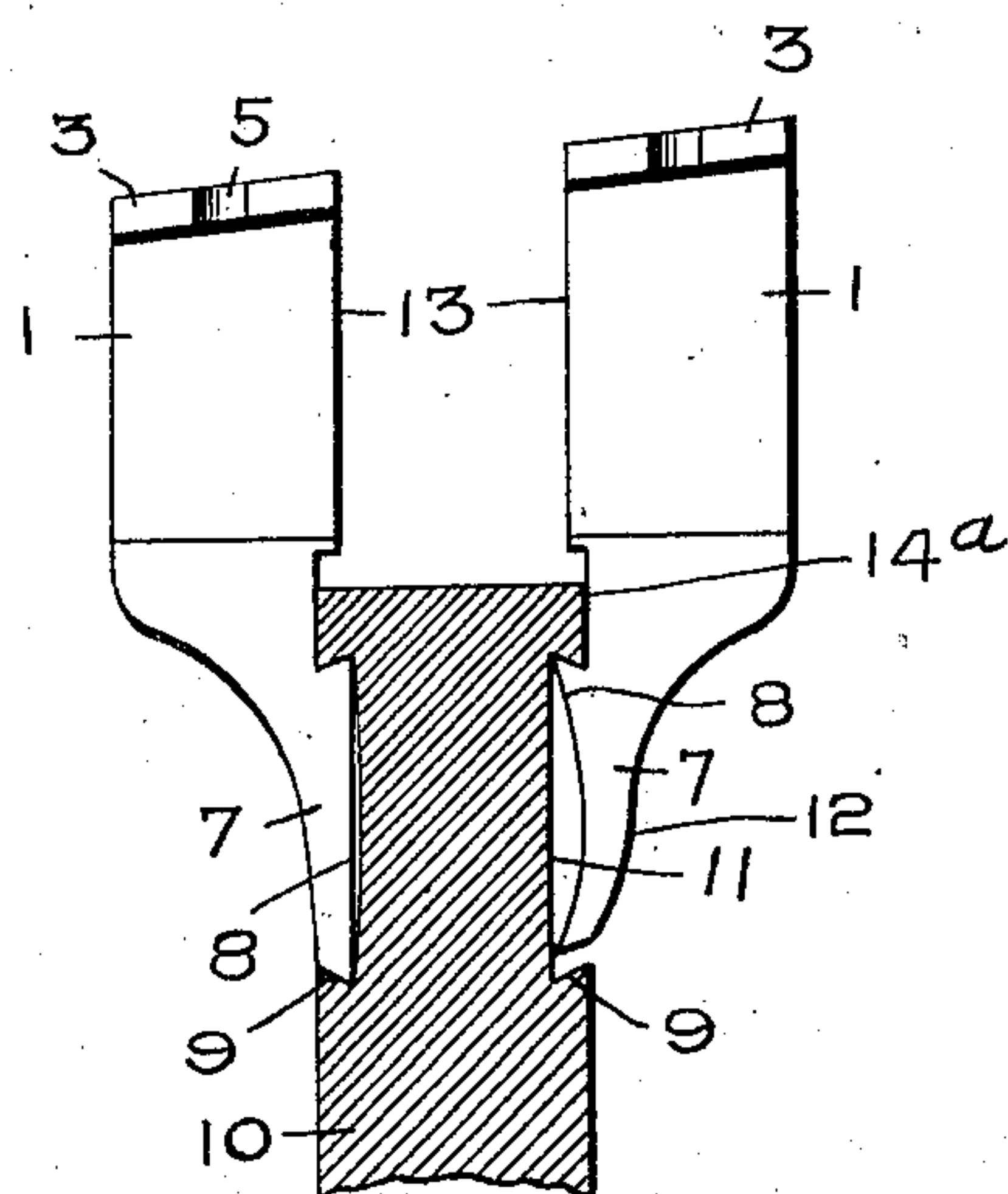
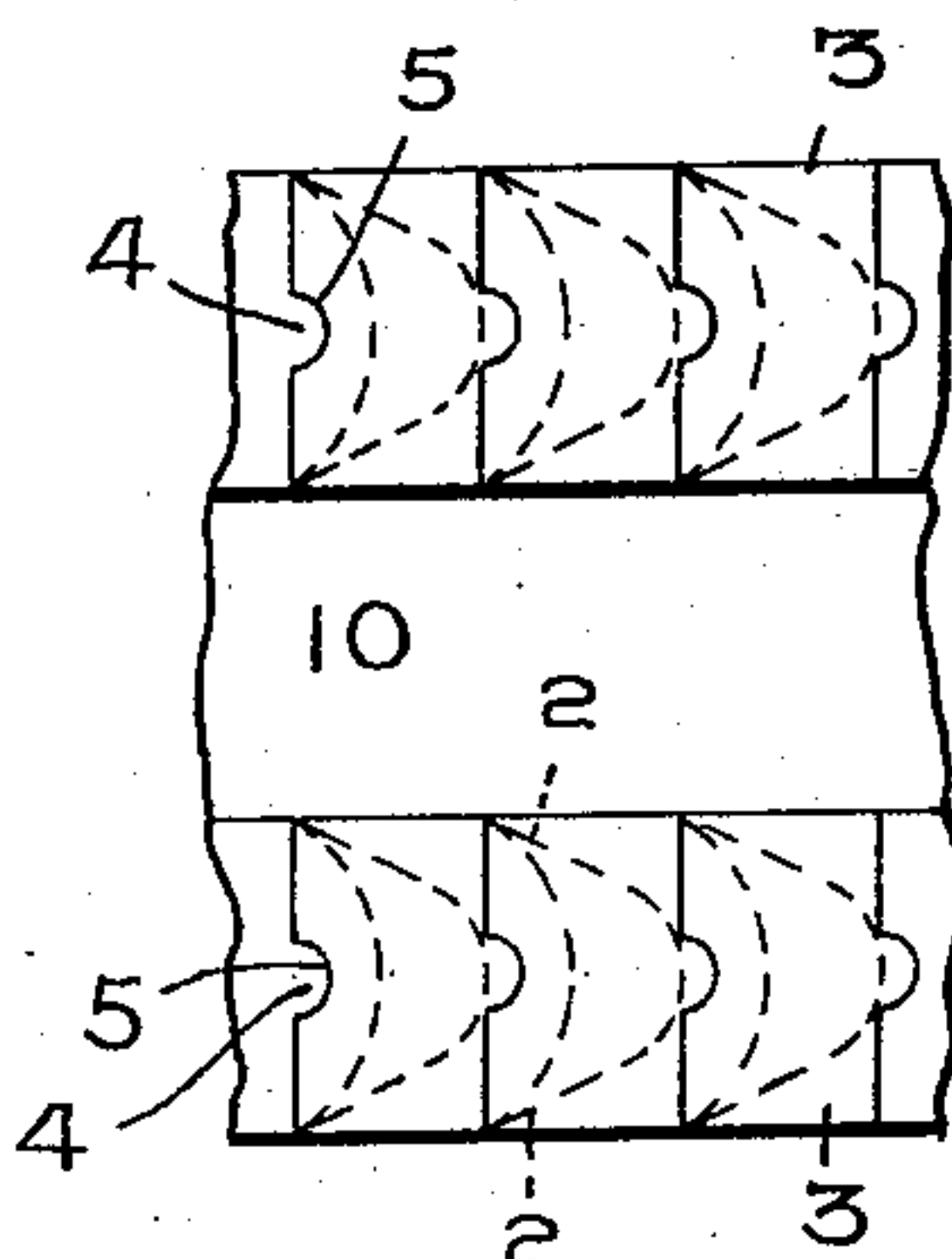


Fig. 3.



Witnesses:

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No. 746,161.

PATENTED DEC. 8, 1903.

H. G. REIST.

MEANS FOR ATTACHING TURBINE BUCKETS TO WHEELS.

APPLICATION FILED MAR. 24, 1903.

NO MODEL.

2 SHEETS—SHEET 2.

Fig. 4.

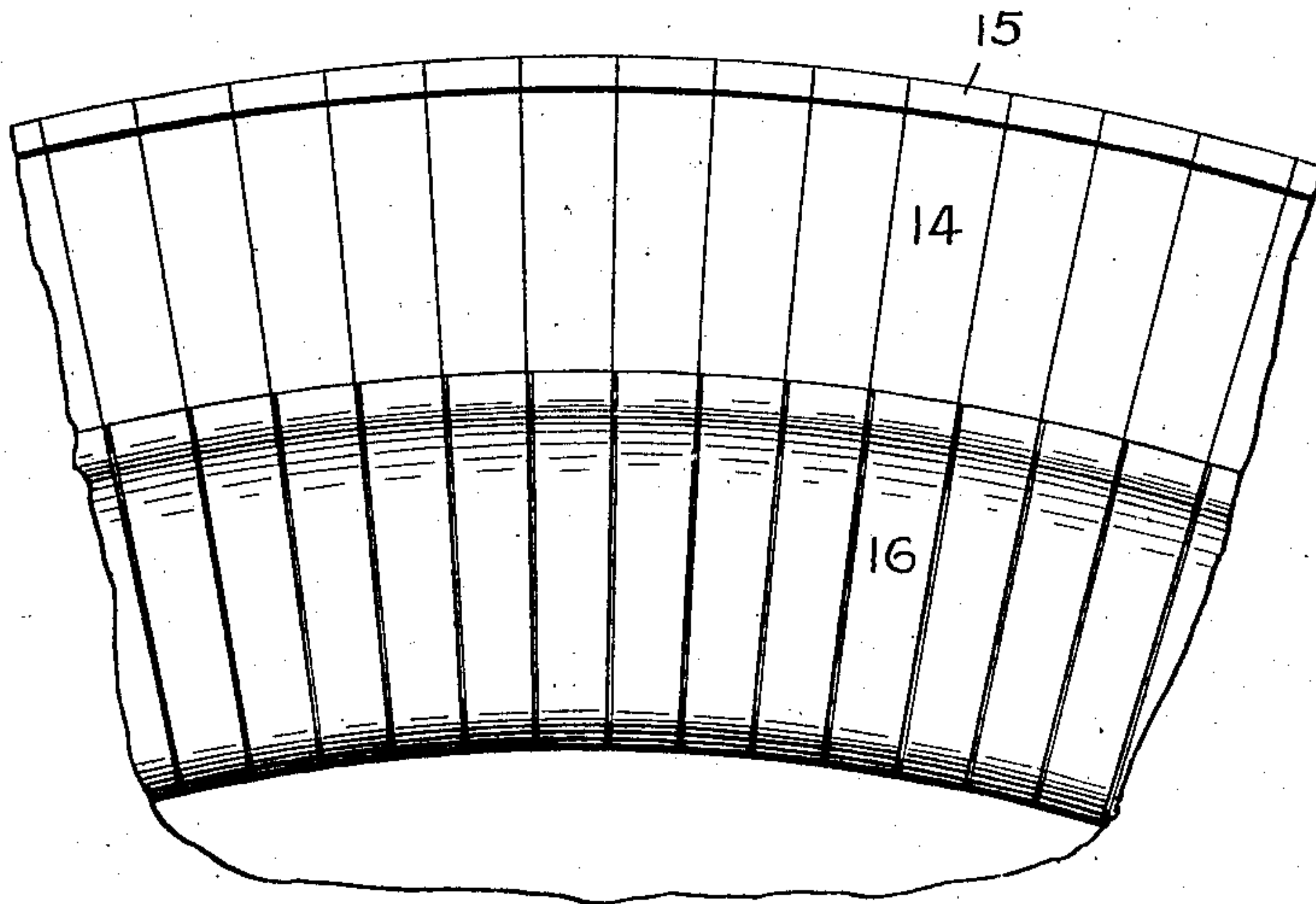


Fig. 5.

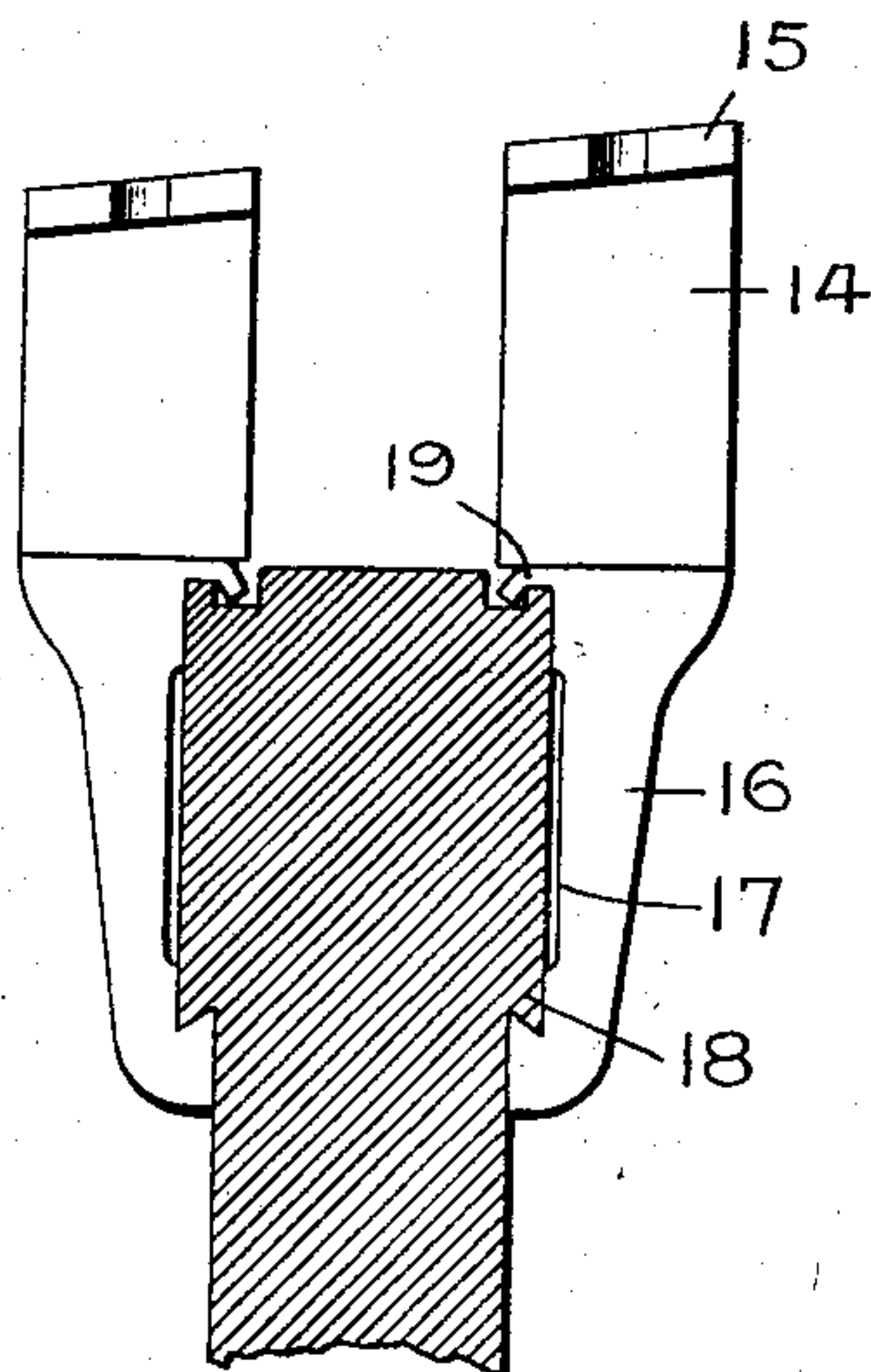
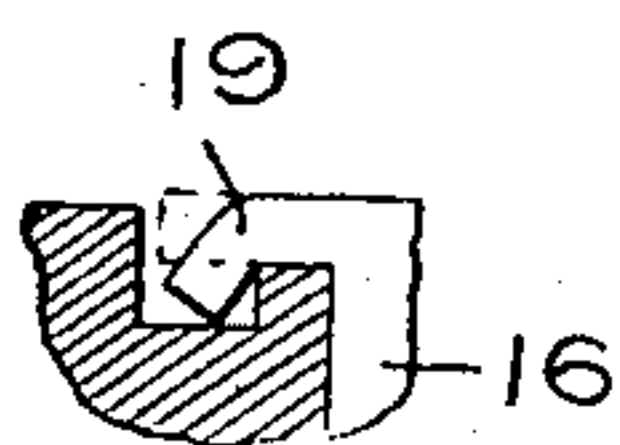


Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY G. REIST, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MEANS FOR ATTACHING TURBINE-BUCKETS TO WHEELS.

SPECIFICATION forming part of Letters Patent No. 746,161, dated December 8, 1903.

Application filed March 24, 1903. Serial No. 149,245. (No model.)

To all whom it may concern:

Be it known that I, HENRY G. REIST, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Means for Attaching Turbine-Buckets to Wheels, of which the following is a specification.

Owing to the great centrifugal strains to which turbine-wheel buckets are subjected it is important to provide means whereby they may be firmly secured in place. It is also important to decrease the cost of the buckets, as at present they form the most expensive part of the turbine.

My invention has for its object to improve the bucket construction of turbines by providing buckets of such a character that they may be made by some simple process, such as drop-forging or casting, and to provide means which are simple yet reliable and strong for securing them to the wheel or other support. I further aim to reduce the amount of machining or tooling to a minimum.

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

In the accompanying drawings, which illustrate an embodiment of my invention, Figure 1 is a side elevation of a part of a wheel or other support fitted with buckets. Fig. 2 is an axial section of a wheel having two rows of buckets. Fig. 3 is a plan view of a part of a wheel. Fig. 4 is a side elevation of a part of a wheel or other support, showing a slight modification. Fig. 5 is an axial section of said modification, and Fig. 6 shows the modified form of attaching means before being subjected to pressure.

1 represents a bucket which is preferably made of a drop-forging, although for certain classes of work it can be made by casting. It is provided with sharpened front and rear edges 2, as shown in dotted lines, Fig. 3. In order to aline the buckets, each one is provided with a cover 3, having a projection 4, which enters a corresponding notch or groove in an adjacent bucket-cover, and also with a notch or groove 5, to receive the projection 4 from the adjacent bucket-cover. While I consider it preferable to form the cover inte-

gral with each bucket, I do not wish to be understood as excluding the use of separable covers, for they can be used if desired. By forming the covers integral with the buckets they can be made very strong and light, which is a material advantage where the centrifugal strains are great. Each bucket is formed integral with a radially-extending shank 7, which gradually tapers in width from the bucket to its inner end. The shank is provided with a dovetail projection 8, which enters a corresponding groove 9, formed in the side of the web of the wheel or other support. A small space is left between adjacent bucket-shanks to permit the buckets to be assembled or removed without disturbing the other buckets. I have shown the buckets applied to the rotary element of a turbine; but they can be applied to a stationary element if desired. In forming the groove 9 in the support it is desirable to hollow it out slightly, as at 11, so as to allow for the spring in the shank when it is subject to pressure for the purpose of elongating it. When first made, the shank is slightly deformed in the direction of its length, as at 12, so that the distance between the ends of the dovetail projection 8 will be somewhat less than the distance between the contracted throat of the dovetail groove 9 in the support. This arrangement permits the bucket to be inserted in the groove, after which the deformity in the shank is cured by subjecting it to heavy pressure, which elongates it sufficiently to cause the dovetail projection to completely fill the space between the converging ends of the dovetail groove. The arrangement shown being intended for two rows of wheel-buckets, their centers are located on opposite sides of the plane of the wheel.

A double row of wheel-buckets is shown in the present form of my invention, between which the intermediate buckets are placed when the parts are assembled for operation in a turbine; but I may use only a single line of buckets if desired. In order to have the adjacent edges 13 of the buckets the proper distance apart, the shanks are cut away slightly, as at 14^a. This feature of cutting away the shanks is determined by the width of the peripheral face of the wheel and also by the width of the intermediate. It can be

eliminated without departing from my invention.

In Figs. 4 and 5 I have shown a slight modification of the invention, wherein the ends of the devices which secure the buckets to the wheel or support are caused to approach each other in order to grip the wheel. In this case, as before, the buckets are slightly deformed at the start and later are cured of this deformity by being subjected to pressure which gives to them the final form and seats them in their proper place.

14 represents a bucket having a thickened central portion and sharpened front and rear edges. It is preferably made of a drop-forging or casting and is provided with a cover 15, that is formed integral therewith or separate, as desired. It can with advantage be constructed as shown in the previous figures. Extending radially with respect to the bucket is a shank 16, with a groove 17 formed therein, having one beveled and one straight side, in which groove is located a dovetail projection 18, formed on the wheel. This dovetail projection extends circumferentially of the wheel or other support. The end or portion 19 of the bucket-shank has a straight under surface when originally formed, which end is afterward subjected to pressure when the bucket is mounted in place. This causes it to embrace the upper end of the dovetail-wheel projection 18 and hold the bucket securely in place. To put the matter in a different way, the bucket-shank is deformed, which deformity is afterward cured or the shank given its final form by subjecting it to heavy pressure. In this case, as before, the projections and grooves are of such a character that they will resist the centrifugal strains to which the parts are subjected.

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 combination, a support having circumferential gripping-surfaces formed thereon, with a plurality of devices adapted to be secured thereto, each of said devices being provided with a shank which is deformed in the direction of its length and engages with the gripping-surfaces when cured of its deformity.

2. In a turbine, the combination of the support having circumferential dovetail gripping-surfaces formed on the side face thereof, with a bucket having a shank which is deformed in the direction of its length and is adapted to engage said surfaces when cured of its deformity.

3. In a turbine, the combination of a support having circumferential gripping-sur-

faces on the side face thereof, with a plurality of buckets secured to the side thereof, each of said buckets having a notched cover secured thereto, and a deformed shank that is adapted to engage with said surfaces when cured of its deformity by pressure.

4. In a turbine, the combination of a support, a bucket adapted to be secured to the side thereof and having a deformed shank which is afterward cured of its deformity by subjecting it to pressure, and a dovetail groove and projection between the side of the support and the shank for securing them together.

5. In a turbine, the combination of a support having dovetail grooves on opposite sides thereof, buckets located on opposite sides of the support, and shanks for the buckets also located on the opposite sides of the support, that are adapted to enter and be forced into engagement with the dovetail grooves for retaining the buckets in place.

6. In a turbine, the combination of a support having a circumferential groove the side walls of which are inclined and the back wall dished or curved slightly, and a bucket having a shank with a projection having inclined walls, that is forced into engagement with the walls of the groove under pressure.

7. In combination, a support having a bucket-receiving surface formed on its side face, with a bucket having a shank which is deformed in the direction of its length and is caused to engage said surface when cured of its deformity, the center of the bucket being disposed on one side of the plane of the support.

8. In combination, a support having dovetail gripping-surfaces formed on the side thereof with a plurality of radially-extending buckets attached to the side face of the support, each bucket being provided with a deformed shank which engages both of the inclined surfaces of the dovetail when cured of its deformity by elongation.

9. In combination, a support having a groove formed in its side face which has a contracted throat, with a bucket having a deformed shank which enters the contracted throat of the groove when in its deformed state and is afterward cured of its deformity by elongation which causes it to engage the walls of the groove and be retained in place thereby.

10. In a turbine, the combination of a support having bucket-retaining surfaces, with a plurality of buckets mounted thereon, each bucket having a deformed shank, which, when cured of its deformity by elongation, is caused to engage the retaining-surfaces on the support.

In witness whereof I have hereunto set my hand this 23d day of March, 1903.

HENRY G. REIST.

Witnesses:

BENJAMIN B. HULL,
HELEN ORFORD.