

(No Model.)

C. A. PARSONS.  
STEAM TURBINE.

No. 549,010.

Patented Oct. 29, 1895.

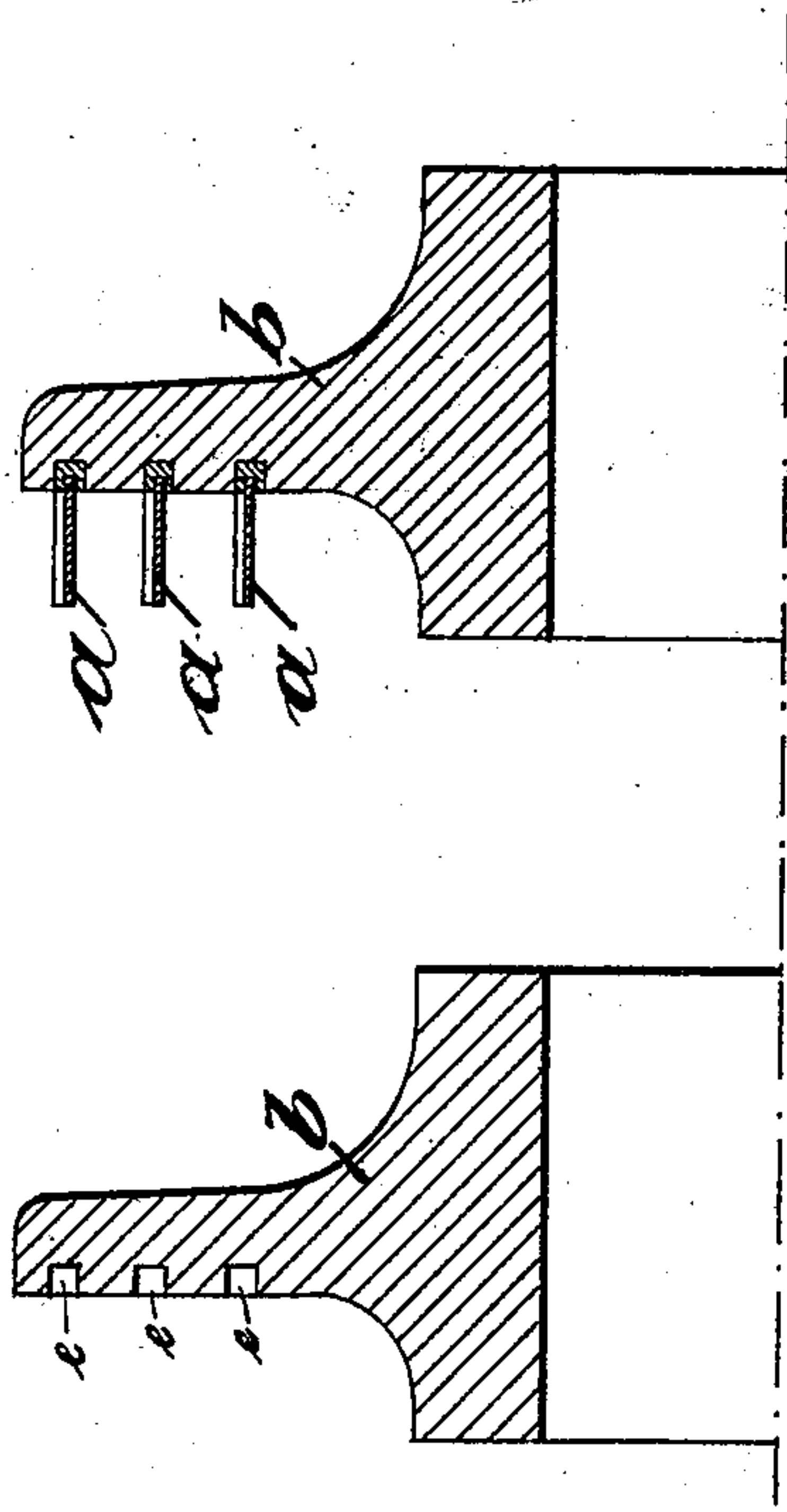
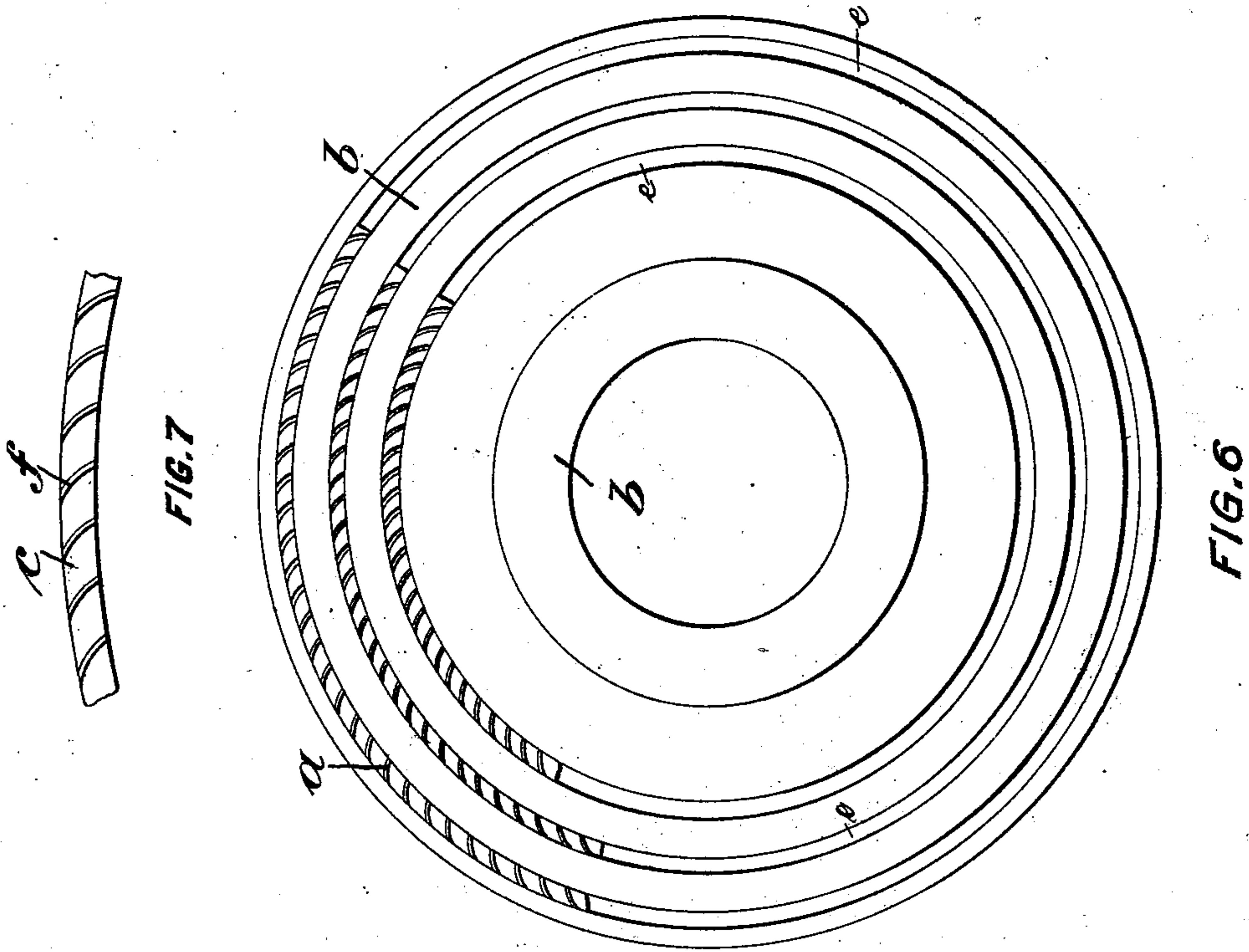


FIG. 5

FIG. 3

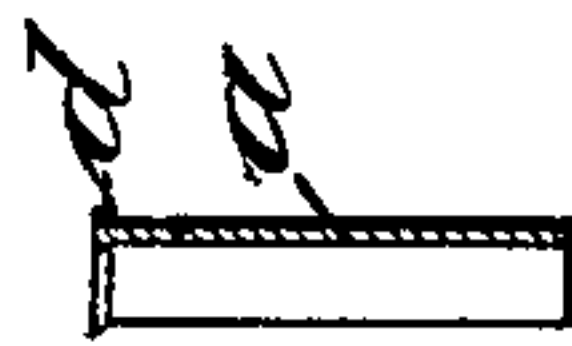


FIG. 2

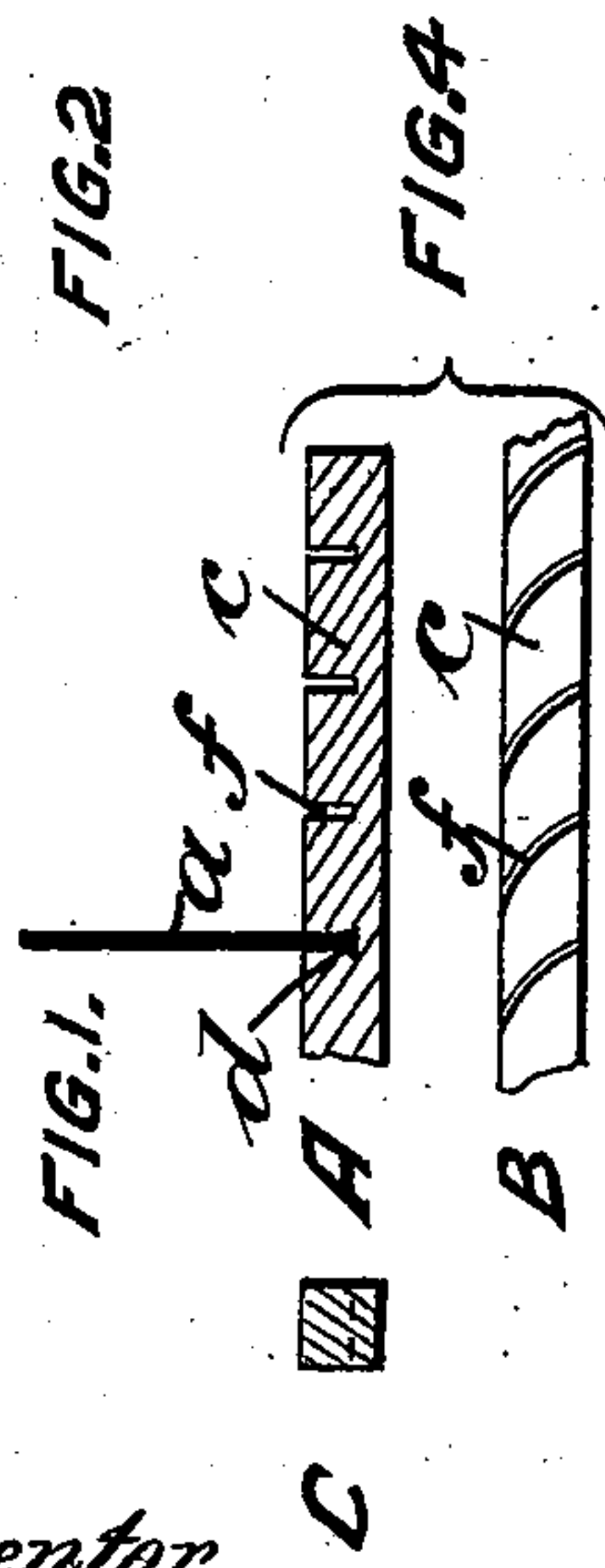


FIG. 1

FIG. 4

Witnesses.  
Geo. H. Rea.  
Robert Barrett.

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Charles A. Parsons.  
By James L. Noyes.

# UNITED STATES PATENT OFFICE.

CHARLES ALGERNON PARSONS, OF RYTON, ENGLAND.

## STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 549,010, dated October 29, 1895.

Application filed September 26, 1891. Serial No. 406,945. (No model.) Patented in England June 27, 1891, No. 10,940.

*To all whom it may concern:*

Be it known that I, CHARLES ALGERNON PARSONS, a citizen of Great Britain, residing at Ryton, in the county of Durham, England, have invented new and useful Improvements in Steam-Turbines, (for which I have obtained Letters Patent in Great Britain, No. 10,940, dated June 27, 1891,) of which the following is a specification.

The object of this invention is to effectually attach to a turbine disk turbine blades which have been separately formed.

The invention consists in new and improved means for calking or riveting the separate blades into grooves in a metal disk.

Referring to the accompanying sheet of drawings, Figure 1 is a sectional view of the blade. Fig. 2 is a sectional elevation. Fig. 3 is a section through half of a turbine disk, and Fig. 4 shows a section at A, plan at B, and end section at C, of a strip of metal cut to hold the blades and intended to be inserted in the grooves formed in the turbine disk. Fig. 5 is a section similar to Fig. 3, but showing the blades fixed in position. Fig. 6 is a front elevation of a complete disk, showing some of the blades fixed in position in the grooves indicated. Fig. 7 is a plan, on a larger scale, (same scale as Fig. 4,) showing part of a strip with its curved grooves ready to lay into the circular grooves in the disk, Fig. 6.

In forming the blades in accordance with my present invention from sheet metal, as brass, delta metal, copper, or steel, I cut the piece to form each separate blade *a* and curve each to the desired curve, as in Fig. 1, in a suitable die. I also head or upset one edge *d* of each blade *a*, as in Fig. 2, on the side to be attached to the disk or ring *b*. In the disks I turn or cut convenient grooves, as *e*, Fig. 3, and prepare to fit in these grooves strips of brass or other metal *c*, of the requisite softness and of rectangular section, which lie in and nearly fill the circular grooves *e*. On one side of these softer metal strips, Figs. 4 and 7, I cut a number of grooves *f*, corresponding in

number and outline with the number and curve of the blades *a*. These grooves *f* are made by special cutters arranged to move in a constrained curved path *d*, and each blade *a* drops into a groove *f*, its upset side or edge *d* forming the foot of the blade. One blade *a* is shown in position at A, Fig. 4, with its foot *d* at the bottom of a groove *f*. The strip *c*, which is at first formed straight, is bent to a circle and dropped into a groove *e*, more clearly shown in Fig. 6, and the metal between the blades *a* so placed in the groove *f* is then calked or fullered, and so the blades *a* with the strips *c* are firmly fixed in place in the grooves *e*. The grooves *f* in the metal strip *c* may be cut when the said strip is straight, and the strips may be curved afterward to fit the circular grooves *e* in the ring or disk or they may be curved before cutting. The calking fixes the blades *a* firmly in the soft brass *c* and binds the whole blades and strips tightly in the circular grooves *e*, and the spaces between the blades may afterward be adjusted or gaged to the desired opening. I thus form a ring of blades of great strength and of any desired curve.

In Fig. 5 the blades *a* are clearly shown embedded in the strips *c*, with the lower ends *d* calked in, and the strips *c* also firmly calked to fill the circular grooves *e* in the disk *b*.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

The combination with a turbine disk provided with a groove, of a grooved ring or strip fitting the groove in the turbine disk, and turbine blades secured in the grooves of said ring or strip, substantially as described.

In testimony whereof I have hereunto set my hand and affixed my seal in presence of two subscribing witnesses.

CHARLES ALGERNON PARSONS. [L. s.]

Witnesses:

EDWARD BELL,

THOMAS ARMSTRONG.