

(No Model.)

3 Sheets—Sheet 1.

M. R. RUBLE.
CENTRIFUGAL STEAM INJECTOR.

No. 467,655.

Patented Jan. 26, 1892.

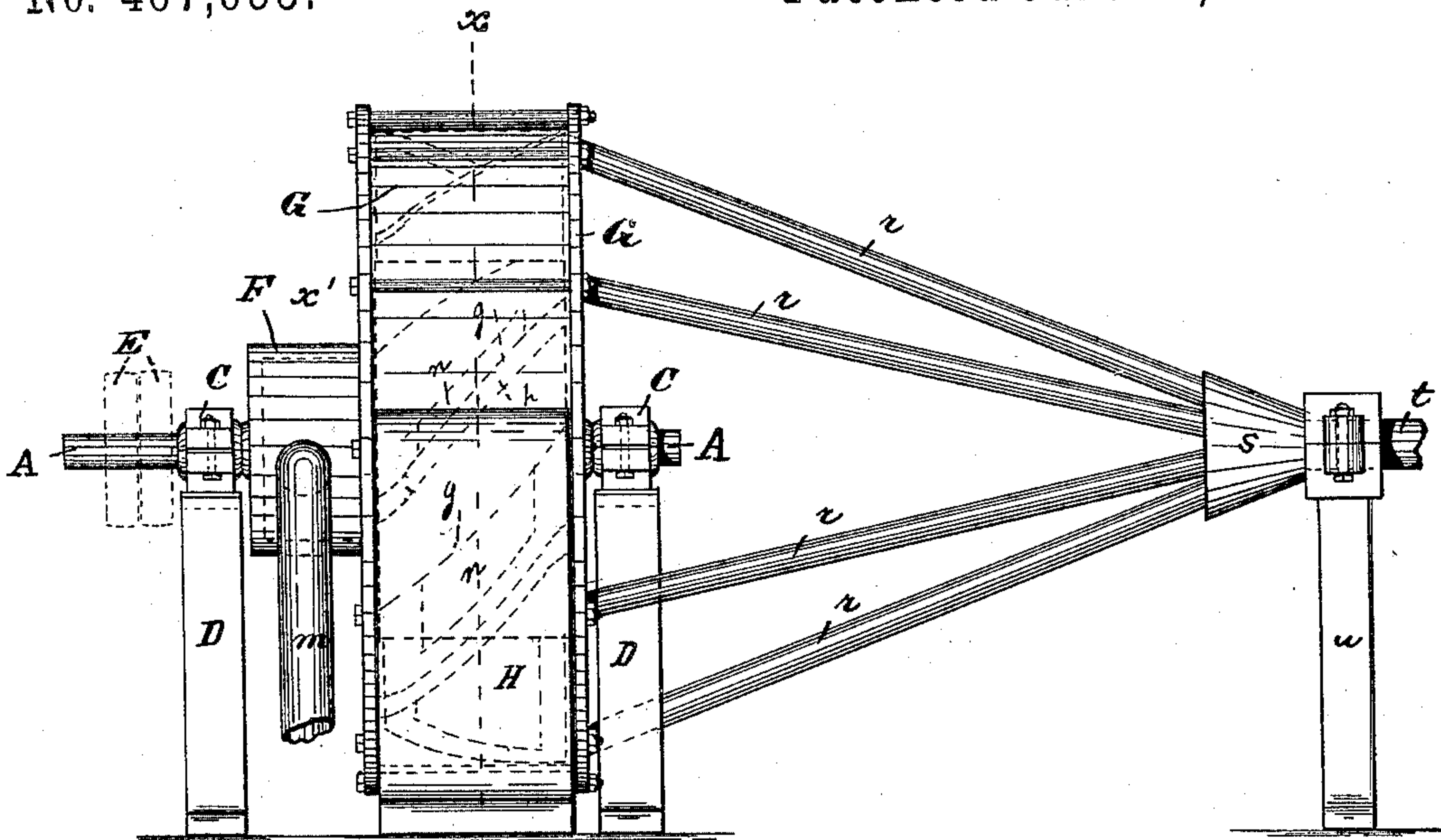


Fig. 1.

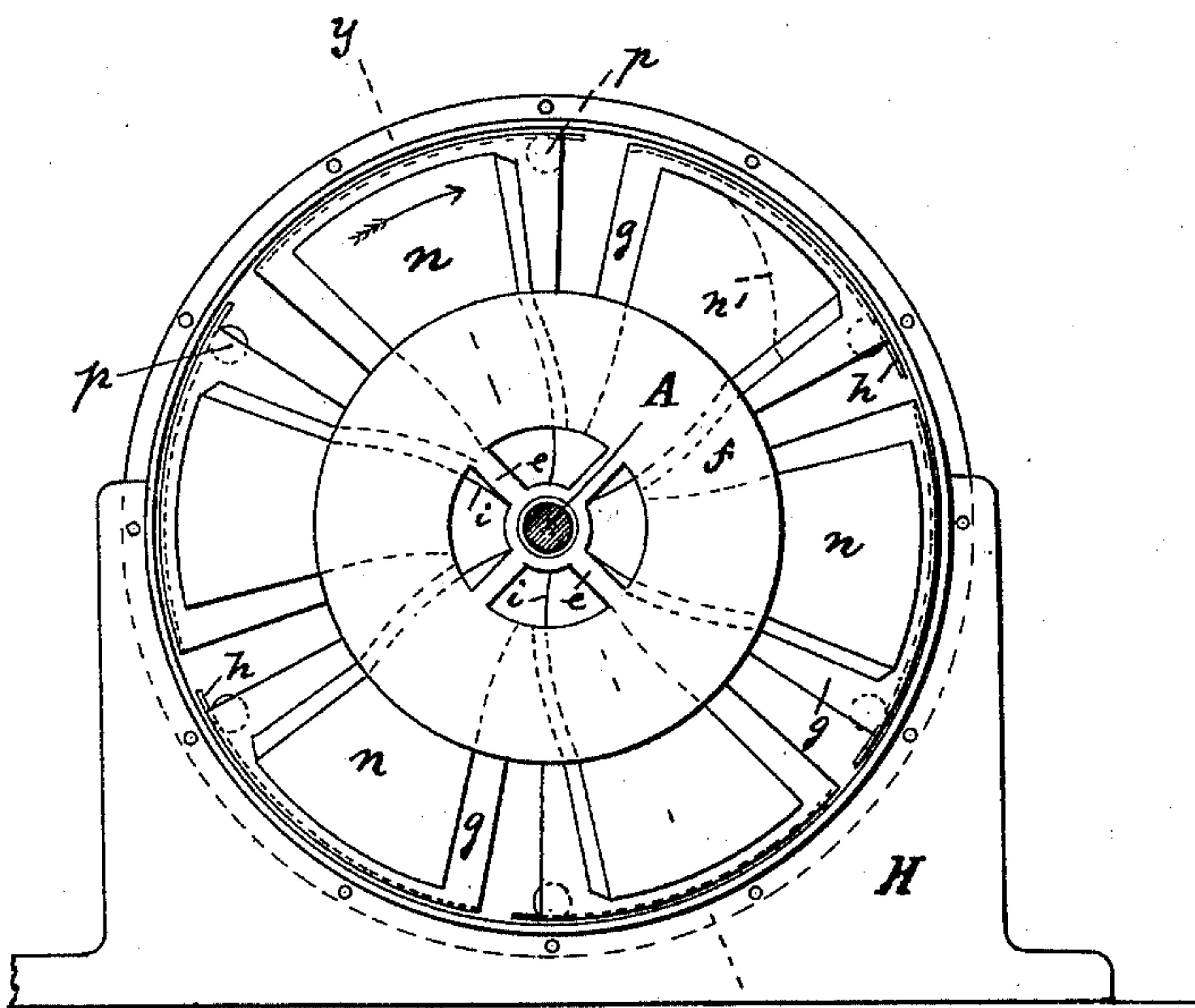


Fig. 2.

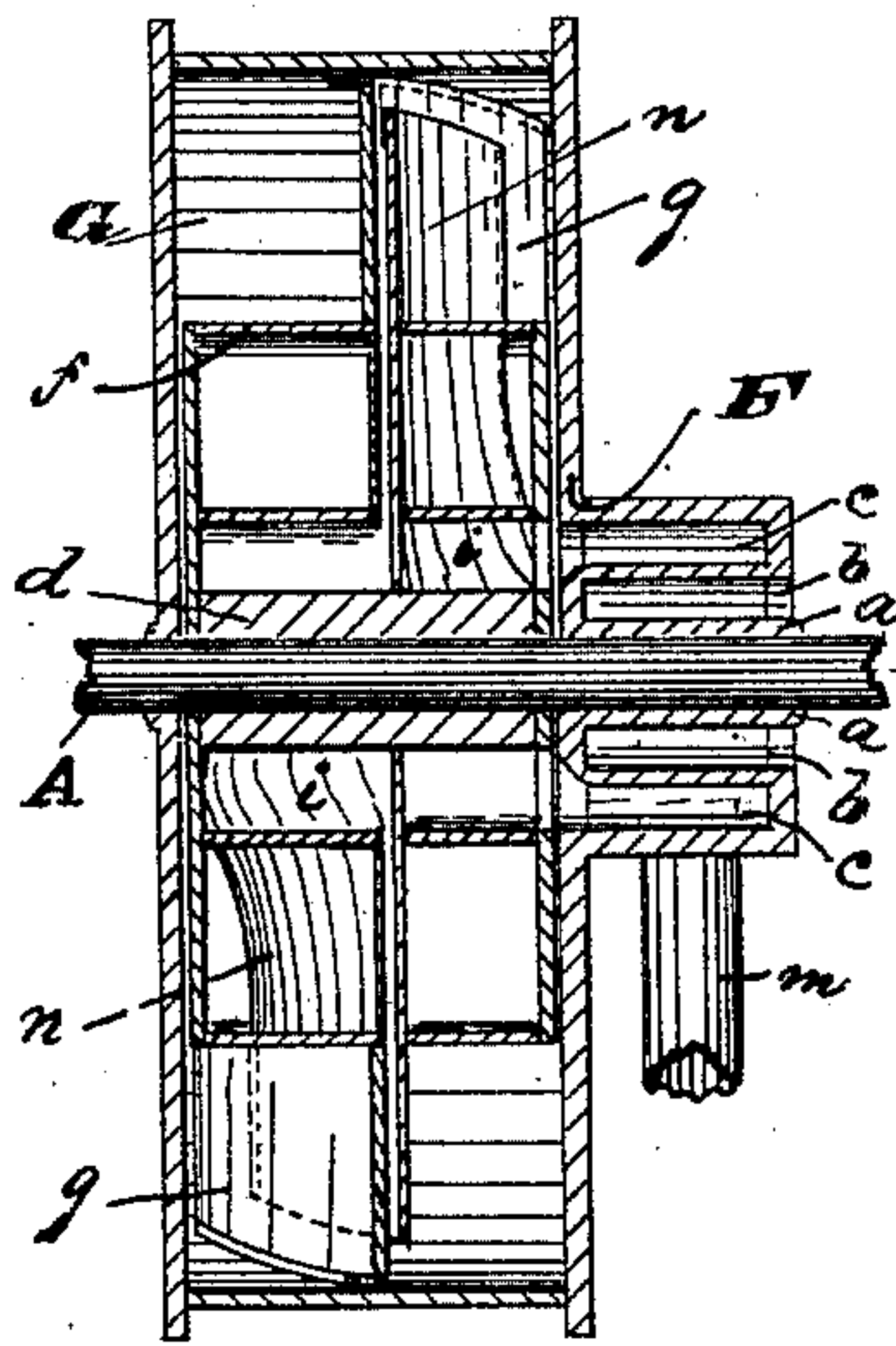


Fig. 3.

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-INVENTOR :

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BY *Partner & Co* ATTYS.

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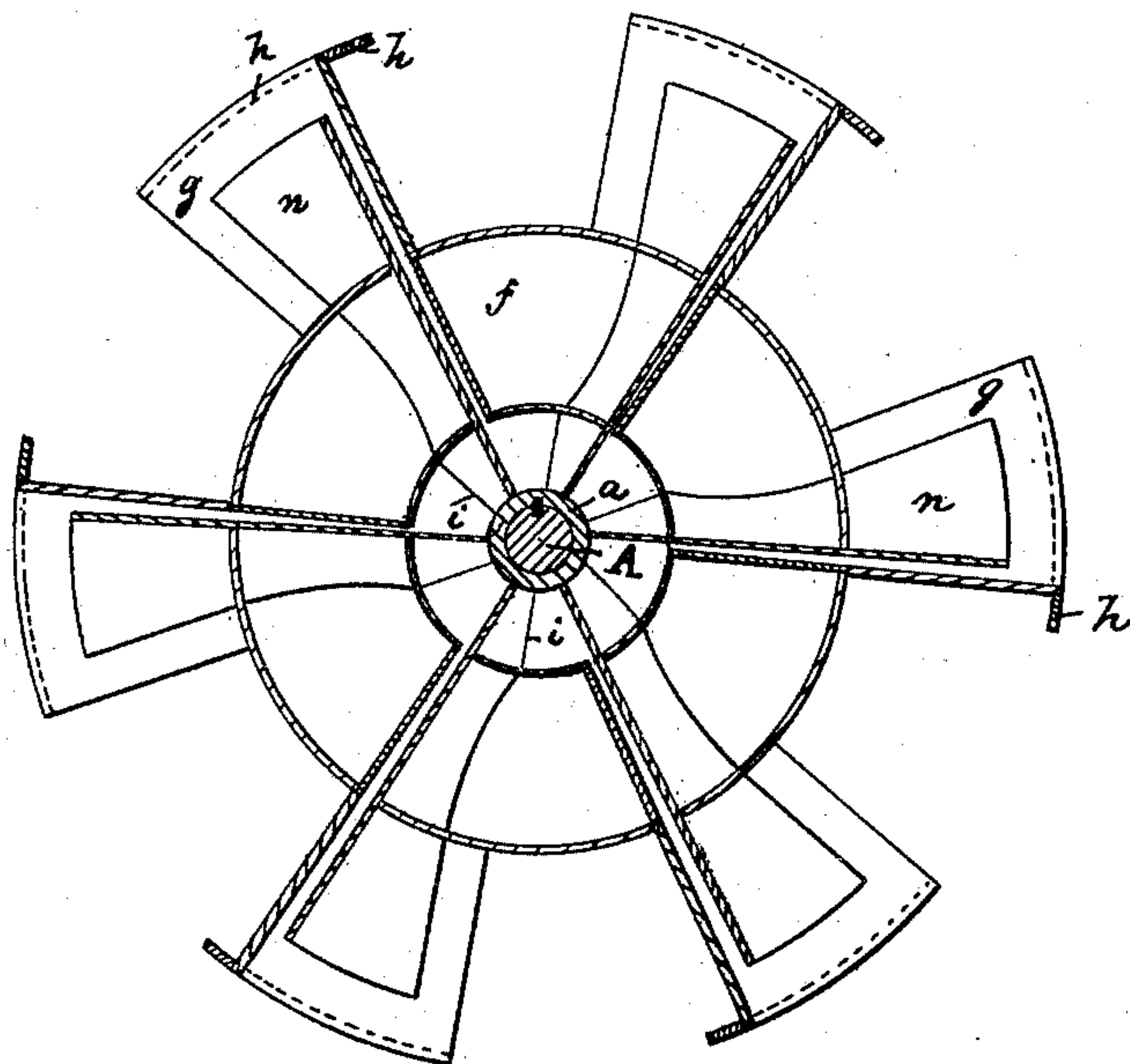


Fig. 4.

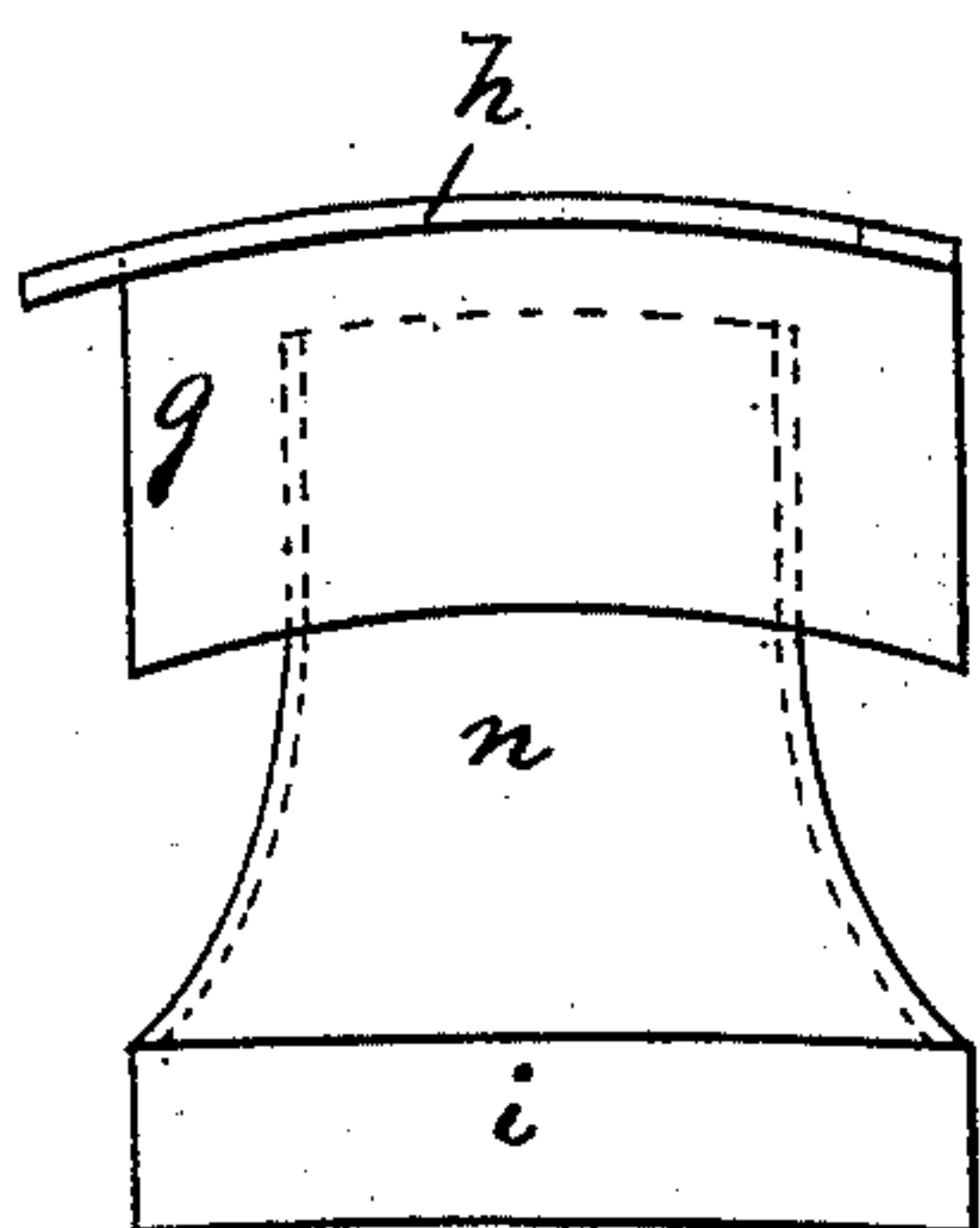


Fig. 5.

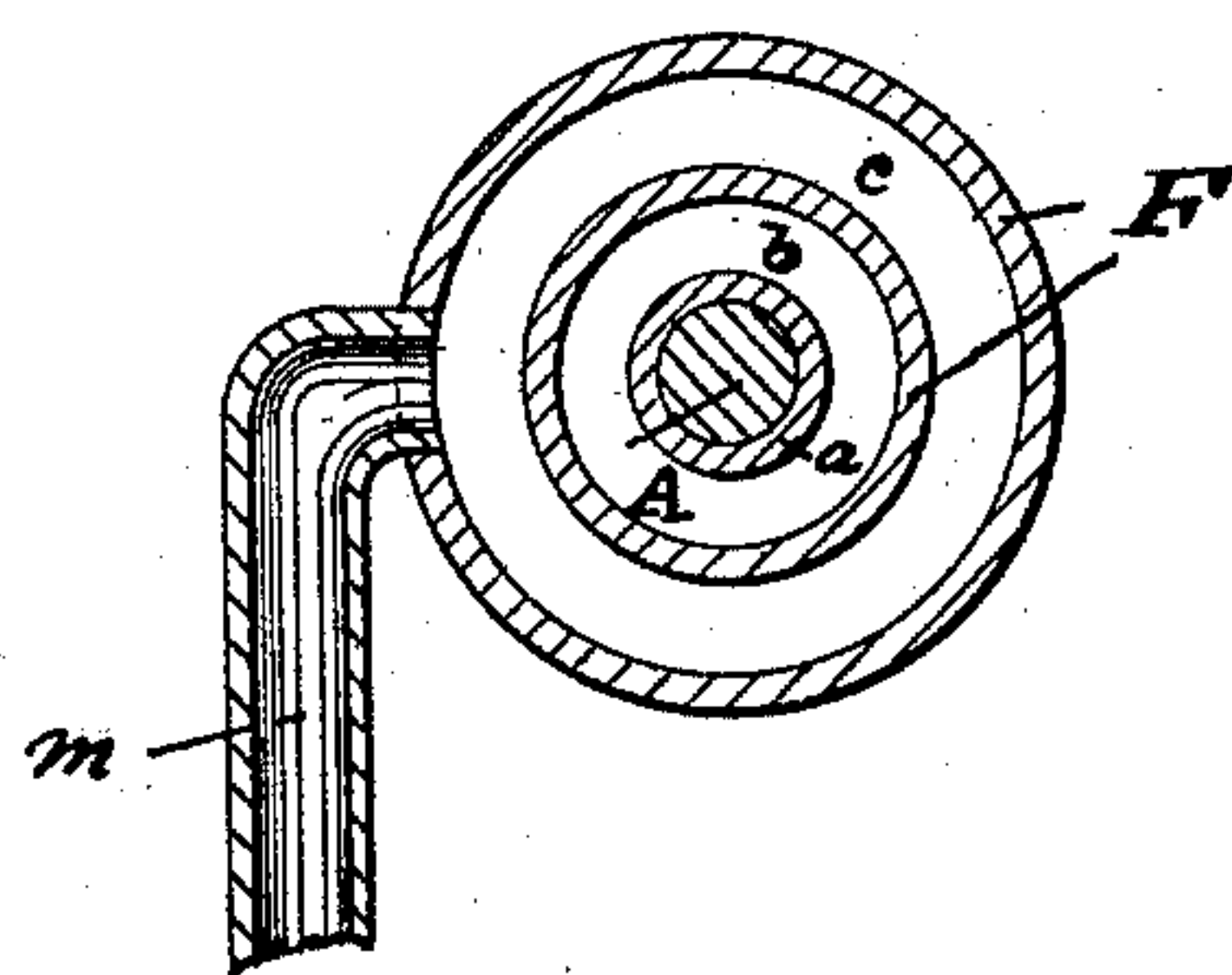


Fig. 6.

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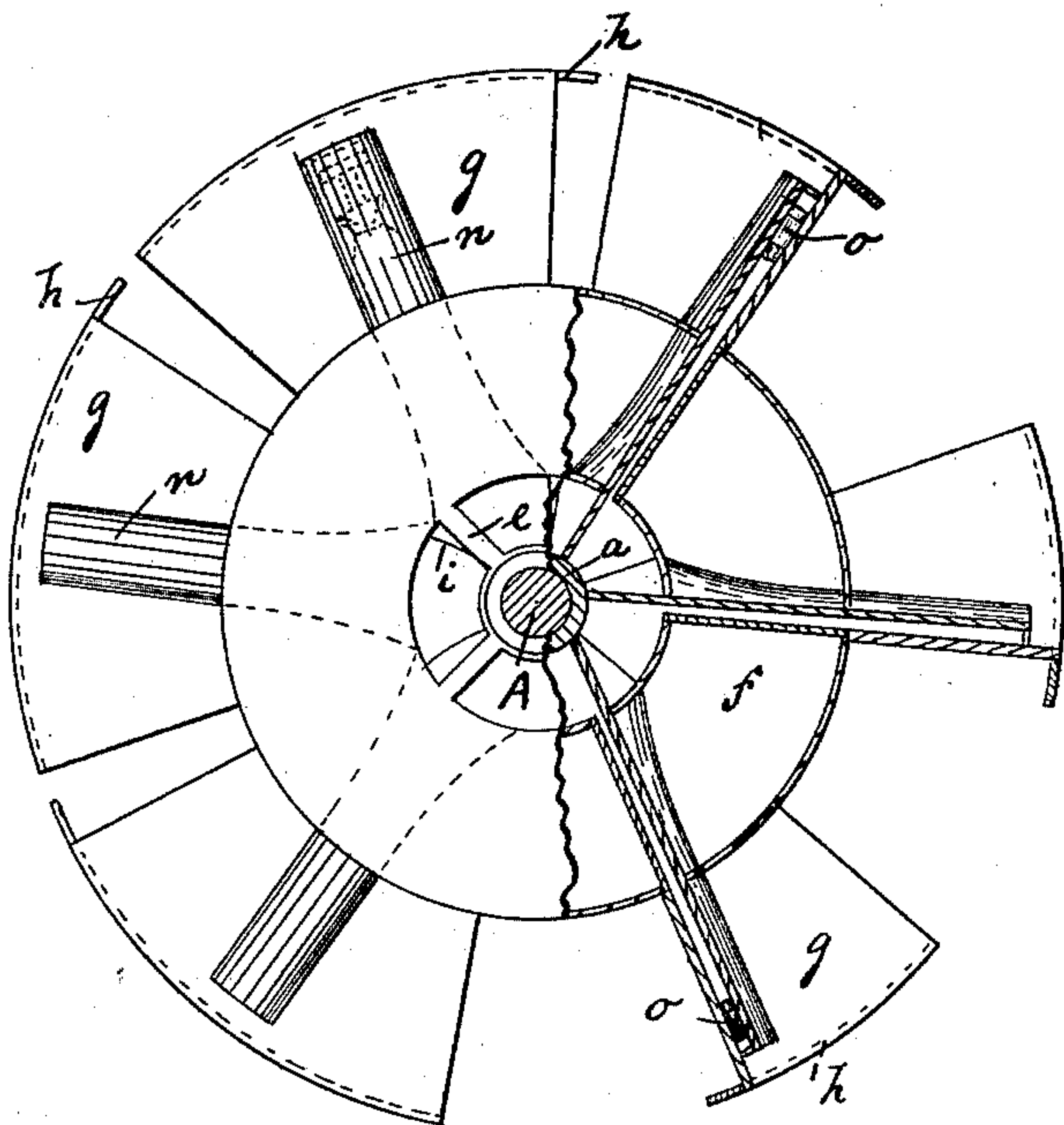


Fig. 7.

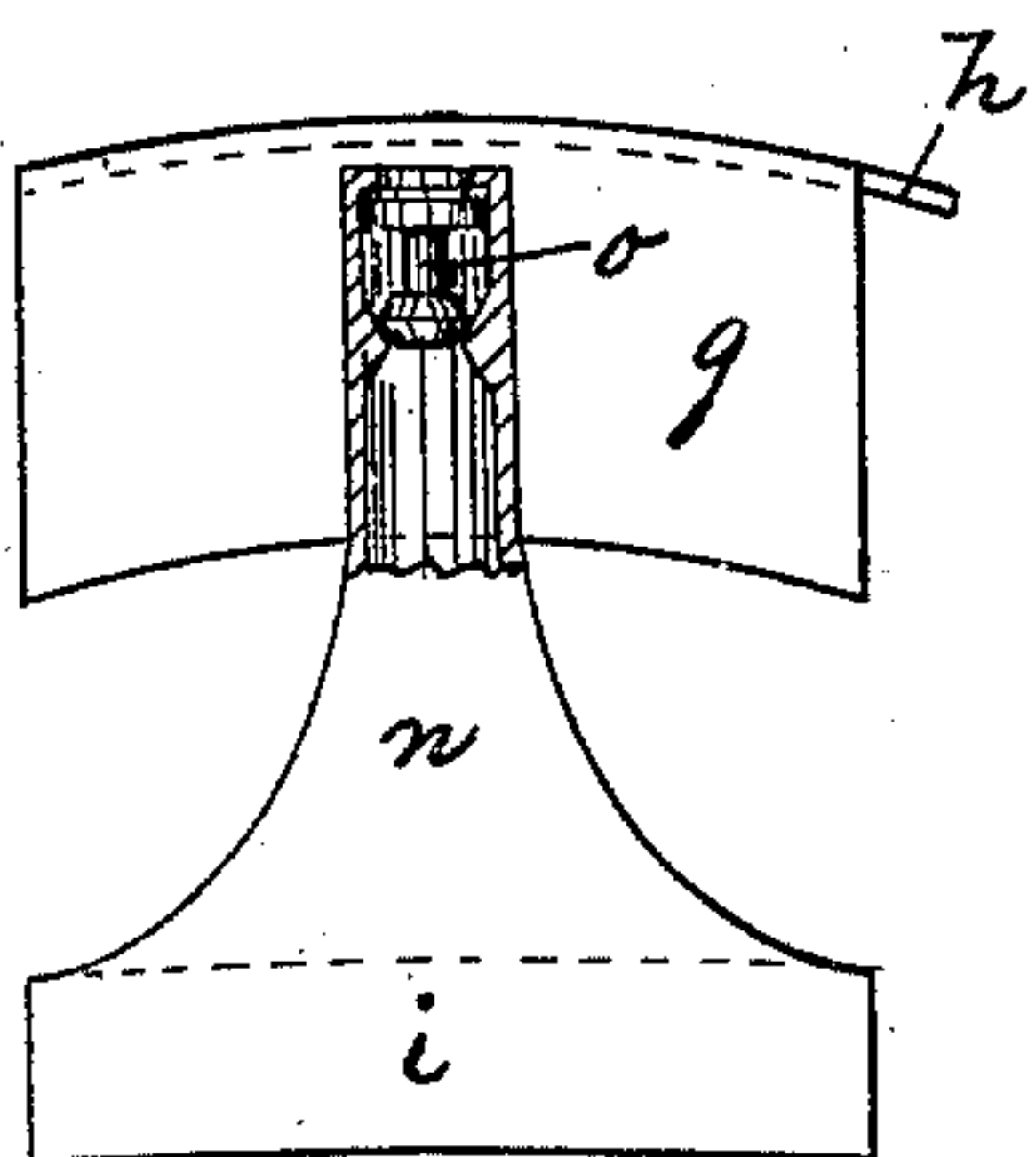


Fig. 8.

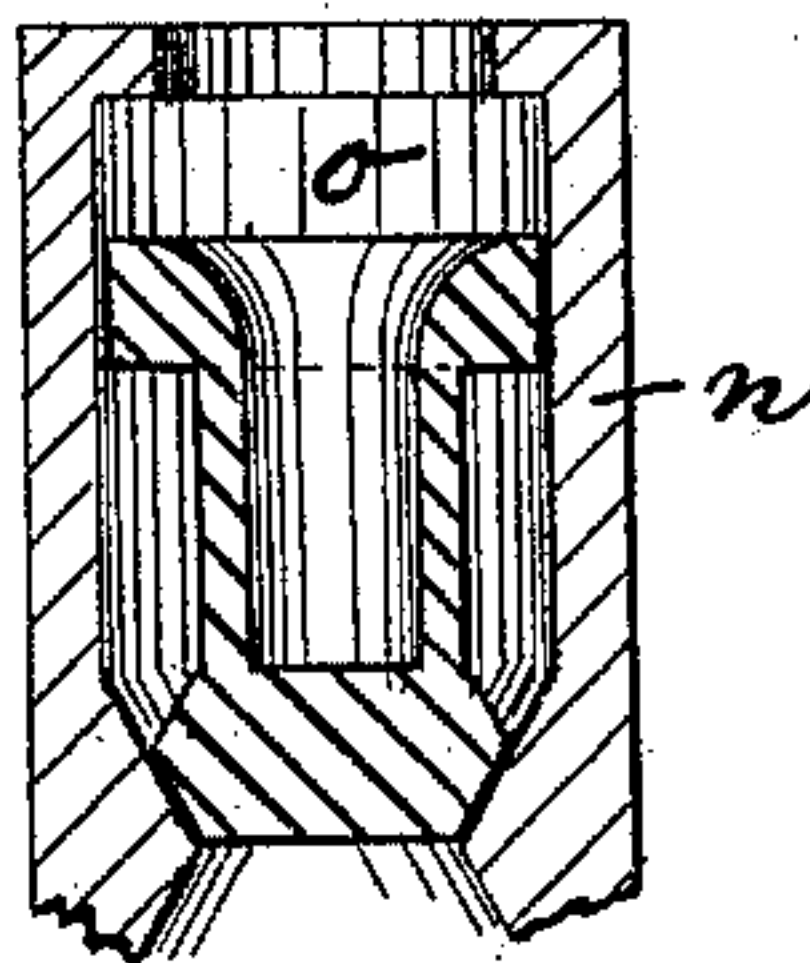


Fig. 9.

WITNESSES:
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INVENTOR:
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UNITED STATES PATENT OFFICE.

MARTIN R. RUBLE, OF NEWARK, NEW JERSEY.

CENTRIFUGAL STEAM-INJECTOR.

SPECIFICATION forming part of Letters Patent No. 467,655, dated January 26, 1892.

Application filed June 16, 1891. Serial No. 396,444. (No model.)

To all whom it may concern:

Be it known that I, MARTIN R. RUBLE, a citizen of the United States, residing at Newark, Essex county, and State of New Jersey, have invented certain new and useful Improvements in Centrifugal Steam-Injectors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The object of this invention is to produce a centrifugal steam-injector, whereby the direct exhaust-steam from the cylinder can be driven back into the boiler without first condensing it, as in the ordinary manner.

The invention consists in the improved method or process of injecting exhaust-steam into a boiler by means of centrifugal force, and in the improved centrifugal steam-injector and the arrangement and combination of the various parts thereof, substantially as will be hereinafter more fully described, and finally embodied in the clauses of the claim.

Referring to the accompanying drawings, in which like letters of reference indicate corresponding parts in each of the several figures, Figure 1 is a side view of a centrifugal steam-injector embodying my improvement. Fig. 2 is a front view with the front plate and small steam-drum removed, showing the arrangement of the parts. Fig. 3 is a full cross-section taken on line *y*, Fig. 2. Fig. 4 is a sectional view of the wheel on line *x*, Fig. 1. Fig. 5 is an enlarged plan view of one of the combined fans and steam-passages. Fig. 6 is a cross-section on line *x'*, Fig. 1. Fig. 7 is a view similar to Fig. 4, but showing rounded steam-passages instead of flat ones, a portion of the steam-drum being shown in full. Fig. 8 is a plan view of one of the fans and rounded steam-passage with its valve, and Fig. 9 is an enlarged central vertical section of the valve.

In said drawings, A indicates a driving-shaft revolving in bearings C on standards D and provided with loose and fixed driving-

pulleys E. Upon said shaft, but not revolving with it, is arranged a steam-receiving drum F, with another large steam-drum G, secured thereto by bolts, as shown in Fig. 1, and resting in frame H, Figs. 1 and 2. The back plate of the drum F, to which the drum G is secured, is made of one piece with the shell of the drum, the shell portion being so constructed as to form a bearing *a*, on which the shaft revolves, an air-chamber *b*, and steam-chamber *c*, as clearly shown in Fig. 3.

Within the drum G and secured to the shaft by a key or in any desired manner is a collar *d*, from which extend radial arms *e*, supporting and revolving with them a hollow drum *f*, thus forming a chamber for receiving the exhaust-steam from the drum F, as shown in Figs. 2, 4, and 7.

Upon the outer periphery of the drum *f* are firmly secured in any desired manner a series of curved angular blades *g*, and are so arranged on the drum that the series shall form a true continuous screw, as shown in dotted lines in Fig. 1. These blades extend outward far enough to snugly fit within the inner periphery of the drum G and are provided with forward-extended flanges *h*. Upon the rear of the blades *g* are firmly secured thereto steam-passages *n*. These passages can be made flat, as shown in Figs. 2, 4, and 5, or round, as shown in Figs. 7 and 8, and extend from near the outer edge of the blades *g* down to and through the drum *f* and opening into the exhaust-steam chamber formed between the drum *f* and the collar *d*, as shown in Figs. 2, 3, 4, and 7, the rear of said steam-passages being extended down and secured to the collar *d*, forming curved fan-blades *i*, as shown in said figures. Connected with the steam-chamber *c* in drum F and opening into it is a steam-pipe *m*, connected at the other end with the exhaust pipe or chamber of a steam-engine. When a flat steam-passage is used, the outer opening can be curved, if desired, as shown at *n'*, Fig. 2. When a rounded steam-passage is used, it is secured to the blade in the same manner as the flat passage, and is provided at its outer end with a valve, preferably a check-valve *o*, as shown in Figs. 7, 8, and 9, the inner end of said rounded

passage terminating in a similar flat fan-blade *i*. The outer end of the rounded steam-passage can be bent backward, if desired, and aid the centrifugal force by acting as a siphon.

In the rear plate of the steam-drum *G* are openings *p*, (shown in dotted lines in Fig. 2,) in which are secured one end of a series of inwardly converging and extending pipes *r*, the other ends of said pipes being secured in the large end of a cone-chamber *s*, the small end of said cone-chamber being connected with a pipe *t* leading directly into the boiler. The pipe *t* and covers *s* are supported and held firmly in position by a standard or post *u* in which they rest.

The driving-shaft at the outside of the drums *F* and *G* should be provided with a bushing or any steam-tight packing to prevent the escape of steam from the drums around the shaft.

In the pipe *t*, and between the cone-chamber *s* and the boiler, a stop-cock or check-valve should be inserted to prevent the return of steam from the boiler when the injector is not in operation.

By surrounding the shaft-bearing in the drum *F* with an air-chamber, as shown in Fig. 3, the shaft is prevented from being unduly heated by the steam in the drum.

My improved injector can be used in connection with steam, water, air, or other fluids under pressure.

In operating my device the pipe *m* is first connected with the exhaust-steam passage of the cylinder, and the pipe *t* with the pipe connected with the boiler. The valve in the pipe being then opened the drum *f* is set in motion in the direction shown by the arrow in Fig. 2, and the blades and fans revolve with it. The exhaust-steam passes through pipe *m* into the steam-chamber *c* in drum *F*, and thence into the exhaust-steam chamber surrounding the collar *d* in drum *G*, and impinges upon the revolving fans *i*, by which it is forced by centrifugal action into and through the steam-passages, and is compressed into the spaces between the plates *g* in the drum *G*, and again by the centrifugal action of the plates *g* is forced through the openings *p* and pipes *r* into the pipe *t* and thence into the boiler.

The speed of the mechanism of the device should be such that the centrifugal force exerted upon the steam as it passes through the injector should exceed the steam-pressure in the boiler. The series of blades *g* being so placed on the drum *f* as to form a continuous perfect screw, there can be no back action of the steam retarding the motion of the blades, and the extending flanges *h* aid in guiding the steam into the pipes connecting with the boiler, and also serve to prevent any escape of steam over the outer edge of the blade into the rear space.

The object and purpose of the inner drum

f is to partially fill up the central space in the steam-drum *G*, and by placing the blades *g* on the outside of this inner drum, instead of having them extend down to the shaft, all counteracting currents that might be engendered are entirely avoided.

When it is desired to exhaust into the open air or any place where there is no back-pressure to be overcome, the centrifugal action of the injector will create a vacuum in the cylinder, removing the back-pressure of the steam therein, and thus facilitating the motion of the piston.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The improved centrifugal steam-injector herein described, consisting of a steam-drum connected with the exhaust of a steam-cylinder, a drum within said steam-drum secured to a revolving shaft, a series of blades arranged on the outer periphery of said inner drum in the form of continuous perfect screw steam-passages secured to the rear of said blades and extending down and through said inner drum, fans secured to the base of said steam-passages and within the exhaust-steam-receiving chamber, and converging pipes connecting said steam-drum through openings in its rear plate directly with the boiler, all said parts being arranged and adapted to operate substantially as described, and for the purposes set forth.

2. In a steam-injector or centrifugal injecting mechanism consisting of a stationary steam-drum connected with the boiler and with the exhaust-chamber of a steam-cylinder, a hollow drum adapted to revolve within said steam-drum, a series of blades secured to the outer periphery of said inner drum in the form of continuous perfect screw steam-passages secured to said blades and extending through said inner drum, and fans connected to said steam-passages, all said parts being arranged and adapted to centrifugally force the exhaust-steam through said steam-drum into the boiler, substantially as described and set forth.

3. In a centrifugal steam-injector, the combination, with a steam-drum centrifugal mechanism within said drum and a driving-shaft, of an auxiliary steam-drum connected to said first-mentioned drum and provided with a bearing for said shaft, and an air-chamber between said bearing and the steam-chamber, substantially as described, and for the purposes set forth.

4. In a centrifugal steam-injector, an inner drum *f*, secured to the driving-shaft and arranged between the inner periphery of an outer steam-drum and the outer periphery of the exhaust-steam chamber, substantially as described, and for the purposes set forth.

5. The method or process, substantially as herein described, of injecting exhaust-steam into a boiler, consisting in conducting the

exhaust-steam into a steam-drum, forcing the
steam by revolving fans into steam-passages,
then driving the steam by centrifugal force
through said passages into the outer portion
5 of said drum under great pressure, and then
by the action of revolving blades forcing it
through the pipes into the boiler.

In testimony that I claim the foregoing I
have hereunto set my hand this 3d day of
June, 1891.

MARTIN R. RUBLE.

Witnesses:

WALTER THOMPSON,
E. L. SHERMAN.