C. W. DAKE.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAR. 22, 1906.

911,576. Patented Feb. 9, 1909.

2 SHEETS—SHEET 1.

Fig. 1.

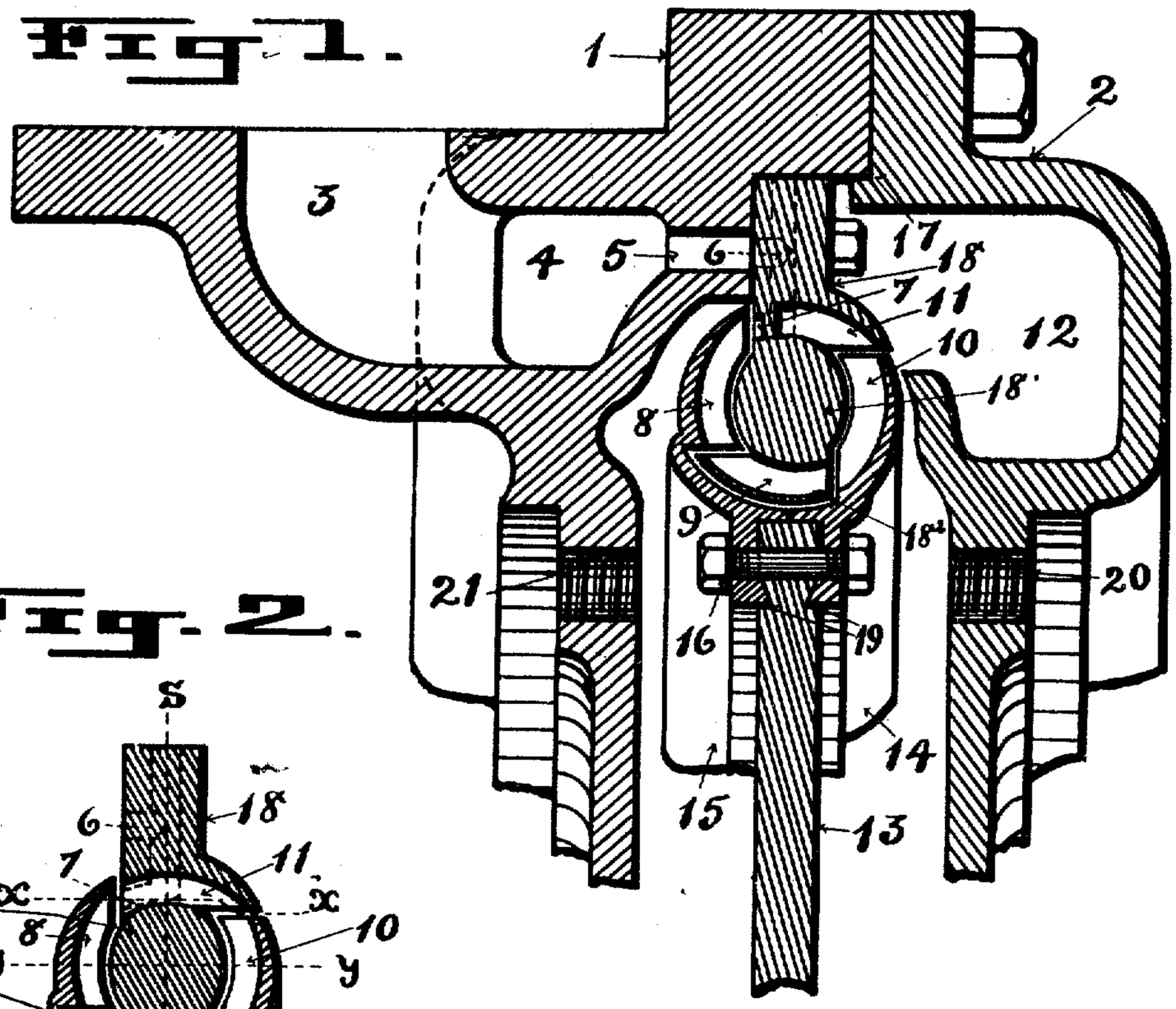


Fig. 2.

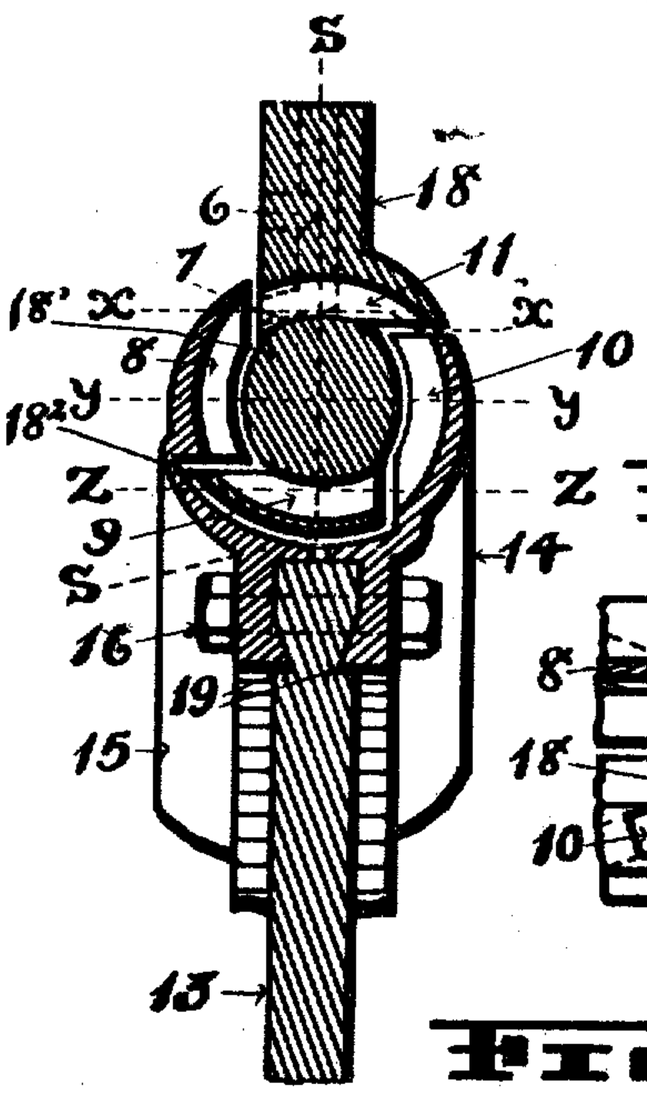


Fig. 3.

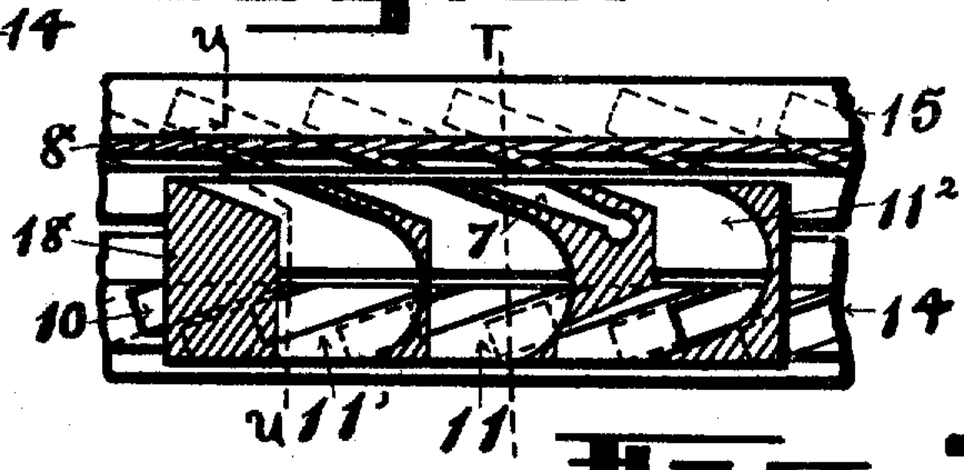
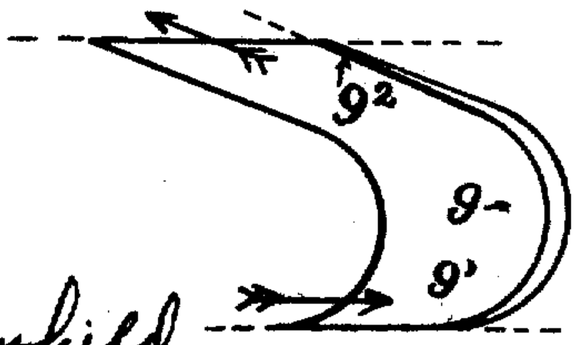


Fig. 7.

Fig. 8.



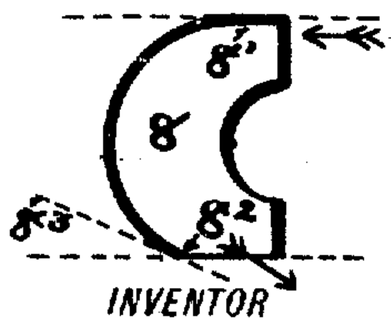


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Fig. 4.

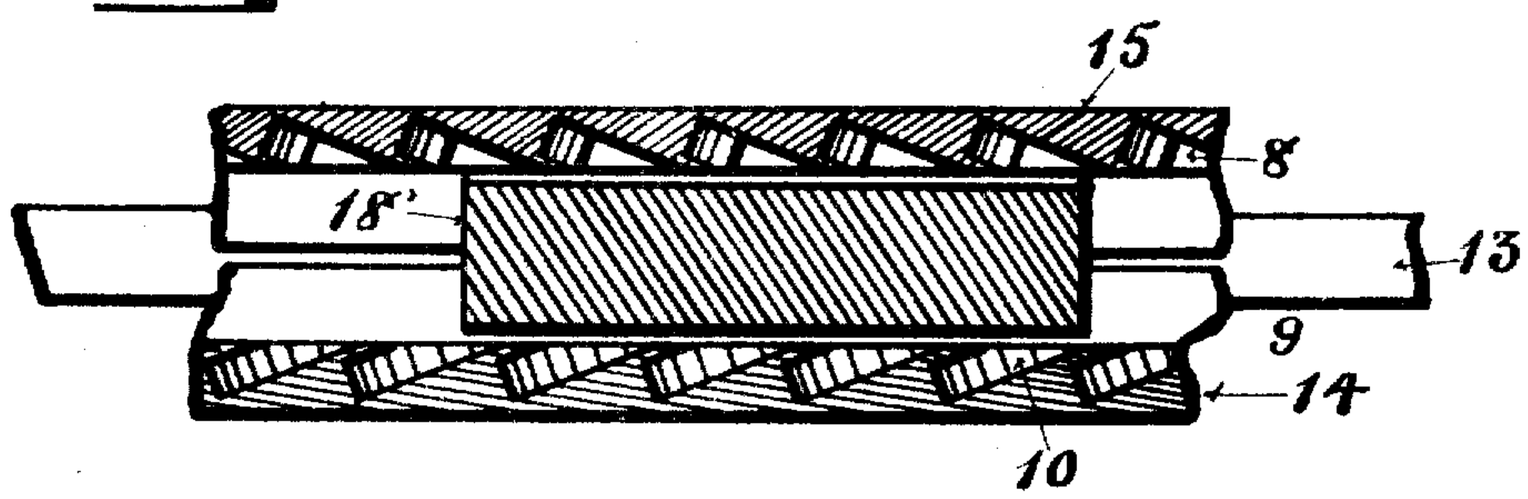


Fig. 5.

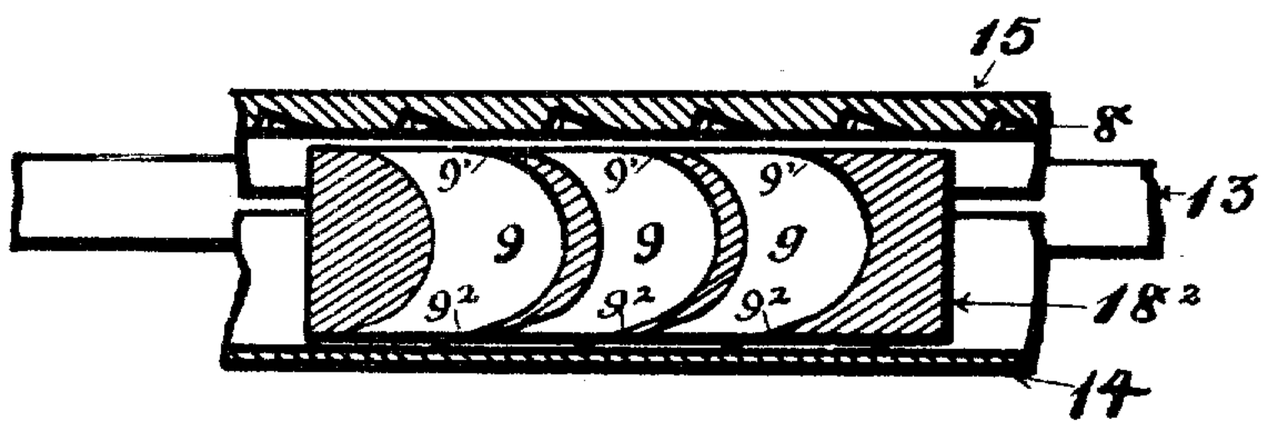


Fig. 6.

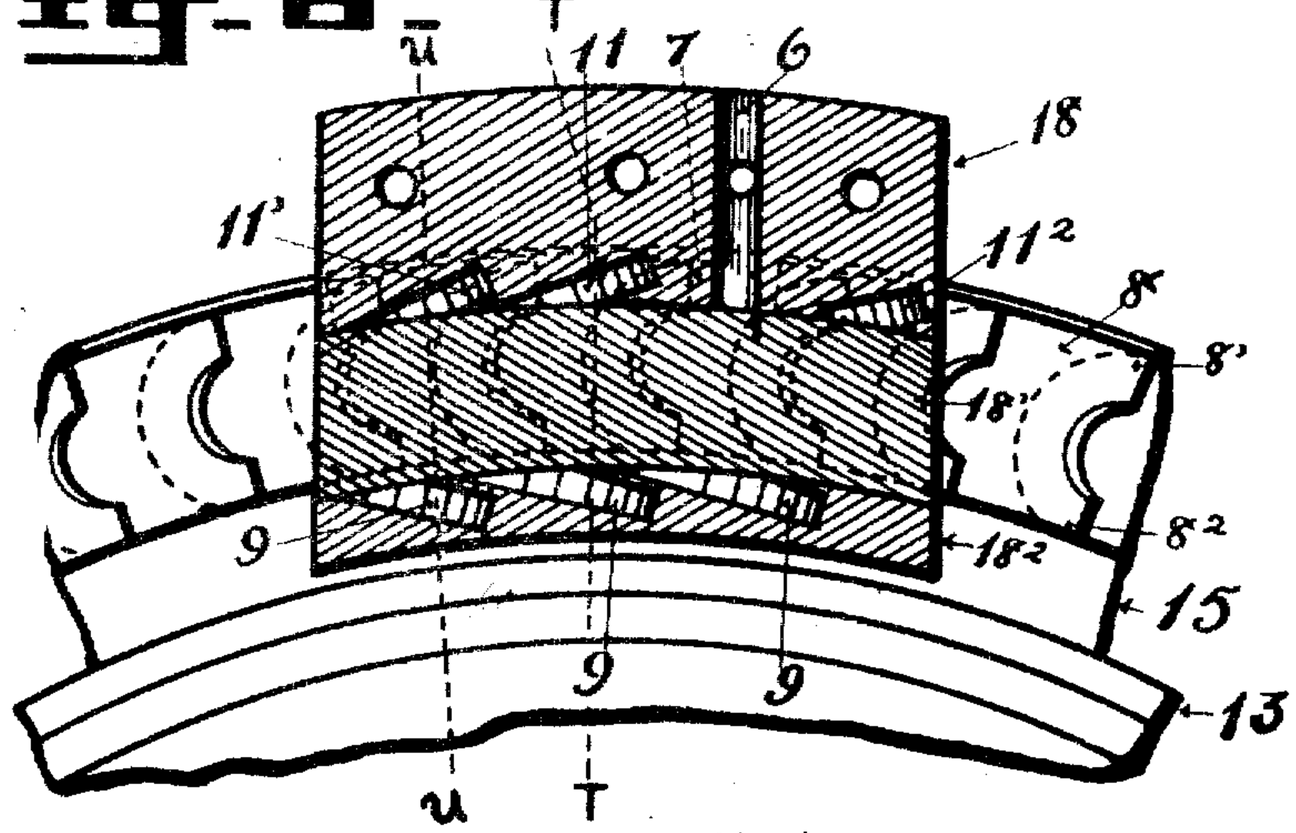
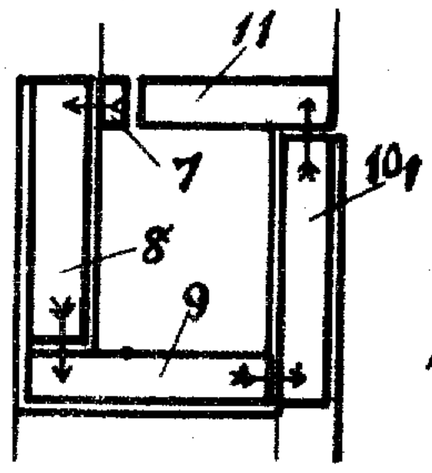


Fig. 9.



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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

No. 911,576. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed March 22, 1906. Serial No. 307,459.

To all whom it may concern:

Be it known that I, CHARLES W. DAKE, a citizen of the United States, residing at Grand Rapids, State of Michigan, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to improvements in elastic fluid turbines.

The object of this invention is to improve more particularly the formation and the arrangement of buckets and nozzles and guide passage blocks of such turbines.

Objects pertaining to details of construction will appear in the detailed description to follow.

I accomplish the object of my invention by the devices and means described in the following specification.

The invention is clearly defined and pointed out in the claims.

Portions of an elastic fluid turbine embodying the features of my invention are clearly illustrated in the accompanying drawing, forming a part of this specification, in which—

Figure 1 is a transverse detail section through the casings, guide passage blocks, and buckets of my improved turbine. The section through the guide blocks and bucket being taken on a line corresponding to the irregular line T T of Figs. 3 and 6; Fig. 2 is a detail sectional view through the guide blocks and buckets, taken on a line corresponding to the lines U U of Figs. 3 and 6; Fig. 3 is a detail sectional view lengthwise of the guide blocks and buckets, taken on a curved plane corresponding to the line X X of Fig. 2; Fig. 4 is a similar longitudinal sectional view and curved plane taken on a line Y Y of Fig. 2; Fig. 5 is a similar longitudinal sectional view taken on a line Z Z of Fig. 2; Fig. 6 is a detail sectional view longitudinally through the guide block and buckets, the guide blocks only being shown in section, taken on the irregular line S S of Fig. 2; Fig. 7 is a detail view of the outline form of the bucket looking at right angles to the face of the same; Fig. 8 is a detail view of the form of the fluid reverse passage in the guide block, the wall at one side of the pocket being indicated by the double lines. Fig. 9 is a diagrammatic view showing the buckets and guide passages receiving at their sides and discharging at their ends, arranged in substantially square cross-section.

In the drawings similar reference numerals refer to similar parts throughout the several views.

Referring to the numbered parts of the drawing, to the main casing 1 which contains the supply chamber 4 with the passage 3 leading thereto, and passages 5 leading from the chamber to the passage 6 in the guide block which delivers nozzle 7, is secured the cover or head 2. This head 2 is provided with an annular chamber 12 into which the exits from the turbine deliver freely, and is connected to chambers surrounding the turbine, so that the same shall be evenly heated and suitable exhaust passages lead therefrom to the outside.

In casing 1 and cover 2 are screw holes 20 and 21, to which the support for the bearings of the disk or wheel is connected, the same not being illustrated here, as not pertaining to this invention.

The guide block 18 is secured to the main casing A and contains at one side the nozzle passage 7 which connects to the passage 6 and delivers obliquely therefrom, this block also containing the recurved guide passage 11, the same extending outwardly into a projection at one side, the under side of which is a chord to the circle which embraces the buckets and steam passages. To the under side of this block 18 is secured the block 18^1 which forms the central core about which the elastic fluid circulates, and to the under side of this core portion 18^1 is secured a section 18^2 having a projection similar to the projecting portion of block 18 and symmetrical thereto. The upper left hand projecting portion is in the line of a chord of the circle embracing the course of the main passage through the guide block and buckets.

The turbine disk or wheel 13 is provided with bucket segments 14 and 15 on the opposite sides thereof, the outer walls of which are in the line of a continuation of the outer walls of the casing of the guide passage, and they are of such form as to complete the circle around the central core portion 18^1; that is, the outer bucket segment 14 fits within the chord-like projecting surface of guide block 18, and the inner portion of bucket segment 15 is conformed to fit into and embrace the outer surface of the guide block 18^2, to properly embrace the reverse passages

9 thereof. There is a slight clearance between these various parts.

The bucket segments are formed to embrace a dove-tailed periphery of the disk 13, having shoulders at 19—19, which contact with the shoulders thus formed near the periphery of the disk, the same being bolted together by the bolts 16.

The form of the buckets and guide passages is substantially the U-shape recurved type, though they do not completely reverse the direction of the flow of the fluid therethrough, but owing to the peculiar formation deflect the same practically to the minimum amount to secure the maximum effect of steam, without retarding action at their discharge ends.

The elastic fluid enters through the passage 6 in the guide block, passes down into the nozzle 7, thence it delivers into the bucket 8 substantially in the direction indicated by the arrow in Fig. 7; passes substantially in the direct line of the rotation of the wheel into the bucket, delivers at 8′, exerts the full force of its impact in the direction to secure the maximum result, is recurved by the wall of the bucket and discharged outwardly at 8^2, in substantially the direction of the dotted line 8^3, (see Fig. 7) much less recurved than 180°; and from there passes immediately into the reverse guide passage 9, at 9′, and is then deflected by the wall thereof and delivered from thence out in the direction of the dotted line at 9^2 (see Fig. 8) into the bucket 10, substantially the same as it was delivered into the nozzle in the bucket 8, the bucket 10 being in substantially the same form as the bucket 8. From the bucket 10 the same is delivered into the recurved guide passage 11, which is substantially the same form as the recurved guide passage 9; from thence into the bucket 8, thence into the reverse passage 9, thence to the bucket 10, thence out at the exit. It is obvious that this circuit of elastic fluid could be repeated indefinitely, but two circuits through the passages and buckets are sufficient to utilize a great percentage of the energy.

In Fig. 9 I have illustrated in diagram the buckets and guide passages and nozzles, showing their arrangement in square cross section, so that it will be readily understood what I mean when I state that said guide passages and buckets receive at their sides and discharge from their ends. This has the effect of conveniently changing the direction of the steam or other elastic fluid from the guide passages to the buckets through an angle of 90°, so that by the use of two rows of buckets and two rows of guide passages the steam or other elastic fluid is returned to the first row of buckets with a minimum retardation due to the change of direction of the current. By this method the passages are not necessarily made completely recurved, but as the steam or other elastic fluid delivers from the end of one passage or bucket into the side of the next succeeding bucket or passage it is not necessary completely to recurve the buckets, and the discharge side can consequently be made shorter than the receiving side, and in this way the retardation of the turbine is substantially avoided.

I desire to remark that the details of this structure can be considerably varied without departing from my invention, though I desire to claim the specific details as well as the invention broadly.

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

1. In an elastic fluid turbine, the combination of a casing 1, having the supply chambers and passages leading therefrom, a guide block 18 secured thereto, said guide block containing nozzle passages 7 and recurved passages 11, and being formed with a projection to one side, the inner side of which is substantially in the chord of the circle of the circuit of the fluid; a core portion 18^1 secured to said block 18, and a block 18^2 secured to the inner portion of the core block 18^1, containing the recurved passages 9, a portion of the same projecting and its outer surface conforming to the chord of the circle of the circuit of the fluid; and a turbine wheel 13 with bucket segments 14 and 15, secured thereto, containing the recurved buckets 8 and 10, respectively, the said segments being conformed to fill in the space between the recurved passages of the guide blocks to complete the circuit for the fluid, co-acting substantiafly as described for the purpose specified.

2. In an elastic fluid turbine, the combination of a suitable casing; a guide block secured to the casing, having nozzle passages formed therein, and recurved guide passages therein; a core block secured to the said nozzle and guide passage block, and a recurved guide passage block secured to the opposite side of the said core block, the said guide passage blocks having projections substantially conforming to the chord of a circle on their recurving sides to receive the elastic fluid from the buckets; a turbine wheel with recurved buckets of the U-shaped type on its periphery, conformed to fill the vacant space between the said guide passages and embracing the core block, the same having their receiving ends substantially on the chord of the circle of the circuit of the fluid, to receive the direct action of steam from the nozzles and passages, and delivering into the said recurved passages of the guide blocks, on their projecting sides, co-acting substantially as described and for the purpose specified.

3. In an elastic fluid turbine, the combination of a suitable casing; a guide block secured to the casing, having nozzle passages formed therein and recurved guide passages therein; a core block secured to said nozzle and guide passage block; a recurved guide passage block secured to the opposite side of said core block; a turbine wheel with buckets on its periphery conformed to project into the vacant space between the said recurved guide passage and forming substantially a continuous passage for the fluid around the central core, co-acting for the purpose specified.

4. In an elastic fluid turbine, the combination of a guide block with recurved passages and nozzles therein, the said passages and nozzles at their delivery end delivering substantially in the direction of the rotation of the wheel and in a plane parallel therewith; recurved buckets corresponding to said buckets, discharging in a plane at substantially right angles to the plane of the wheel, into the succeeding series of recurved guide passages, to secure the maximum effect in delivering the energy to the buckets of the wheel, as specified.

5. In an elastic fluid turbine, the combination of a turbine wheel with opposite-arranged and oppositely-faced bucket segments, containing buckets of the U-shaped, recurved type, the receiving sides of which buckets and bucket segments are in planes parallel with the plane of the disk, and the exit openings in planes at right angles to the plane of the disk, the direction of the inlets being substantially at an angle of 20° to the face of the disk, and the exits being substantially at an angle of 20° to the direction of the rotation; and intervening recurved guide passages arranged between the said bucket segments and corresponding thereto, as specified.

6. In an elastic fluid turbine, the combination of a turbine wheel with oppositely-arranged and oppositely-faced bucket segments, containing buckets of the U-shaped, re-curved type, the receiving sides of which buckets and bucket segments are in planes at right angles to the plane of the exit passages, the direction of the inlet and outlet passages being substantially at an angle of 20° to the direction of the rotation; and intervening recurved guide passages arranged between the said bucket segments and corresponding thereto.

7. In an elastic fluid turbine, a turbine wheel provided with buckets of the re-curved U-shape type, the receiving ends of which are substantially in the plane of the rotation, varying therefrom at an acute angle, and the discharge end opening in a plane at an acute angle to the general direction of the receiving end, and substantially parallel to the direction of the plane of the wheel.

8. In an elastic fluid turbine, the combination of a turbine wheel with oppositely-arranged bucket segments thereon containing buckets of the U-shaped recurved type; a guide passage and nozzle structure between the said buckets, consisting of an outer portion 18, a core portion 18^1, and an inner portion 18^2, detachably secured together, the recurved reversing passages being formed on the arc of a circle in the contiguous surfaces of the said portions, for the purpose specified.

9. In an elastic fluid turbine, buckets of U-shape recurved type and fluid reverse guide passages of similar form, receiving the fluid at their sides and discharging it from their ends.

10. In an elastic fluid turbine, buckets of U-shape recurved type receiving fluid at their sides and discharging from their ends, passages that receive fluid at their sides and discharge at their ends to convey the fluid from one row of buckets to another row of buckets.

11. In an elastic fluid turbine, the combination of buckets of U-shaped recurved type and fluid reversing guide passages of similar form arranged to deliver an elastic fluid at their ends and receive the same at their sides, whereby the fluid enters the row of buckets at its side and discharges at its end into the side of the reversing passage, thence from the end of the reversing passage into the side of the opposite row of buckets, thence from the end of the opposite row of buckets into the sides of the reversing passages, thence from the ends of said reversing passages into the sides of the first named row of buckets, through the circuit a predetermined number of times, discharging from the said buckets at any predetermined point as specified.

In witness whereof, I have hereunto set my hand and seal in the presence of two witnesses.

CHARLES W. DAKE. [L. S.]

Witnesses:
FRED L. CHAPPELL,
CLARA A. SABIN.