G. WESTINGHOUSE.

REËNTRANT TURBINE.

APPLICATION FILED FEB. 26, 1909.

969,821.

Patented Sept. 13, 1910.

3 SHEETS—SHEET 1.

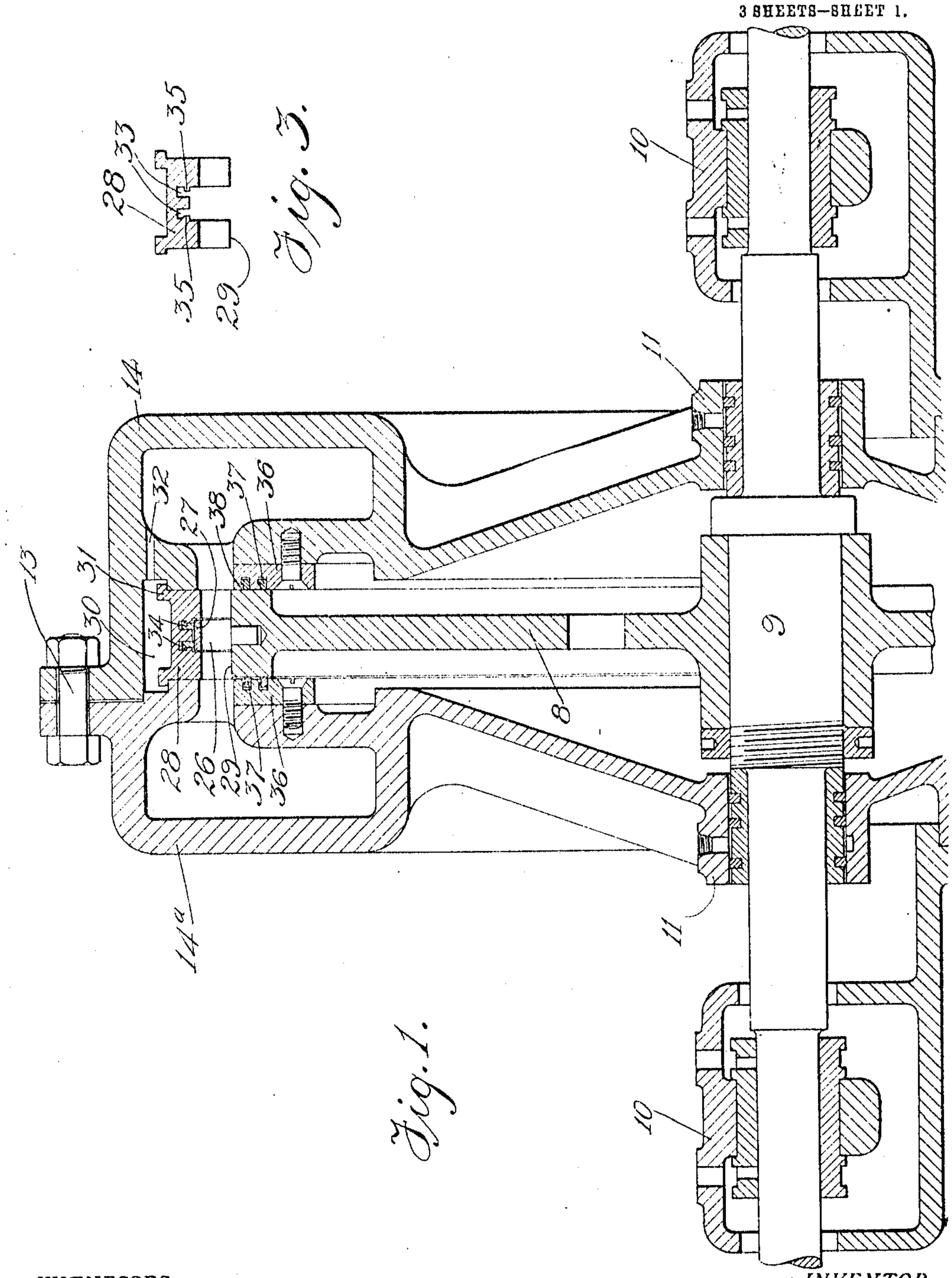


Fig. 1.

Fig. 3.

WITNESSES:

D. C. Fiero.

Geo. Arnold

INVENTOR.

BY George Westinghouse

Jno. S. Green

his ATTORNEY IN FACT.

G. WESTINGHOUSE.

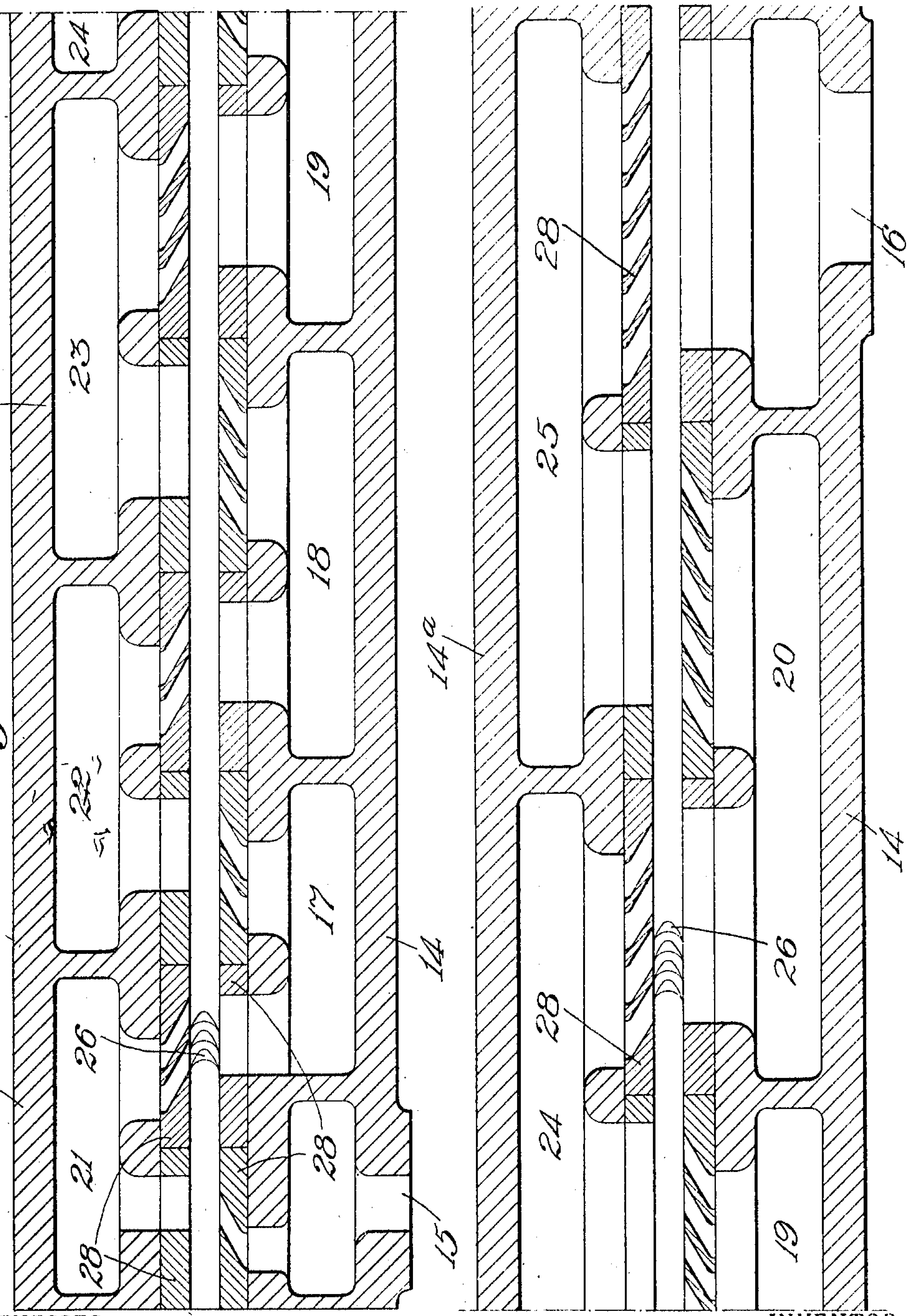
REËNTRANT TURBINE.

APPLICATION FILED FEB. 26, 1909.

969,821. Patented Sept. 13, 1910.

3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

W. M. Fero.

Geo. A. Walker.

INVENTOR.

George Westinghouse

BY Jno. S. Green

his ATTORNEY IN FACT.

G. WESTINGHOUSE.

REËNTRANT TURBINE.

APPLICATION FILED FEB. 26, 1909.

969,821. Patented Sept. 13, 1910.

3 SHEETS—SHEET 3.

Fig. 5.

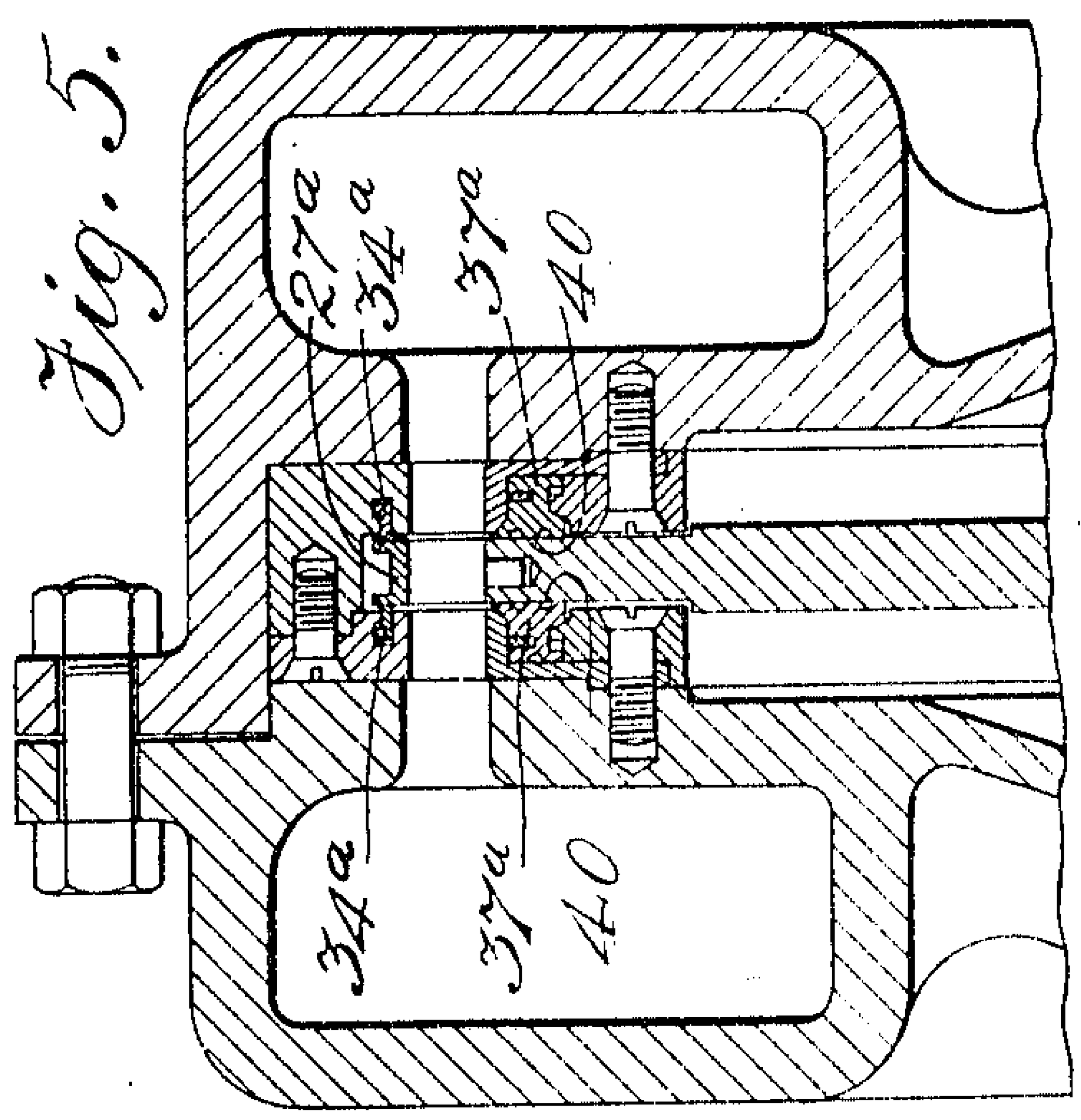
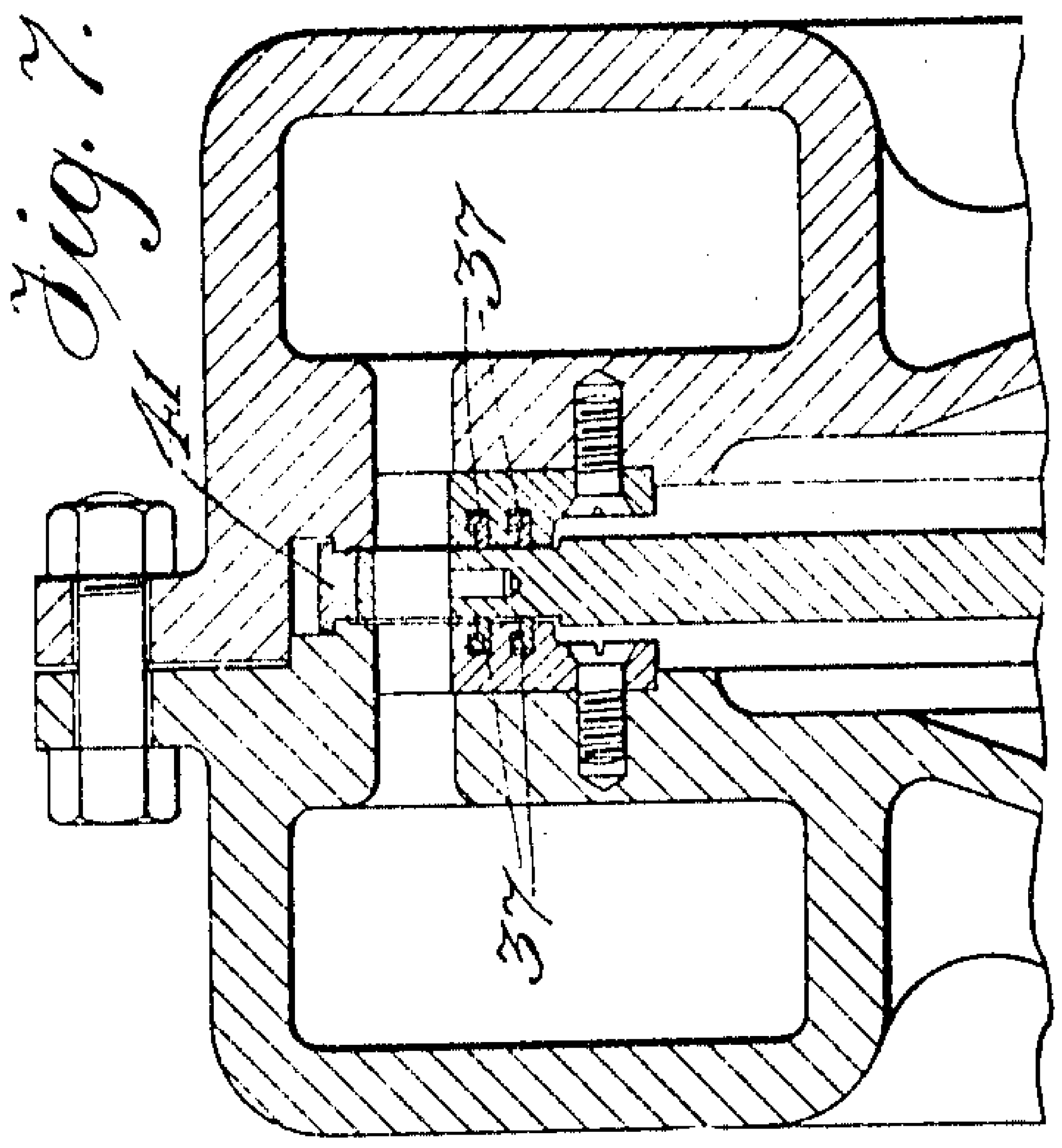


Fig. 7.



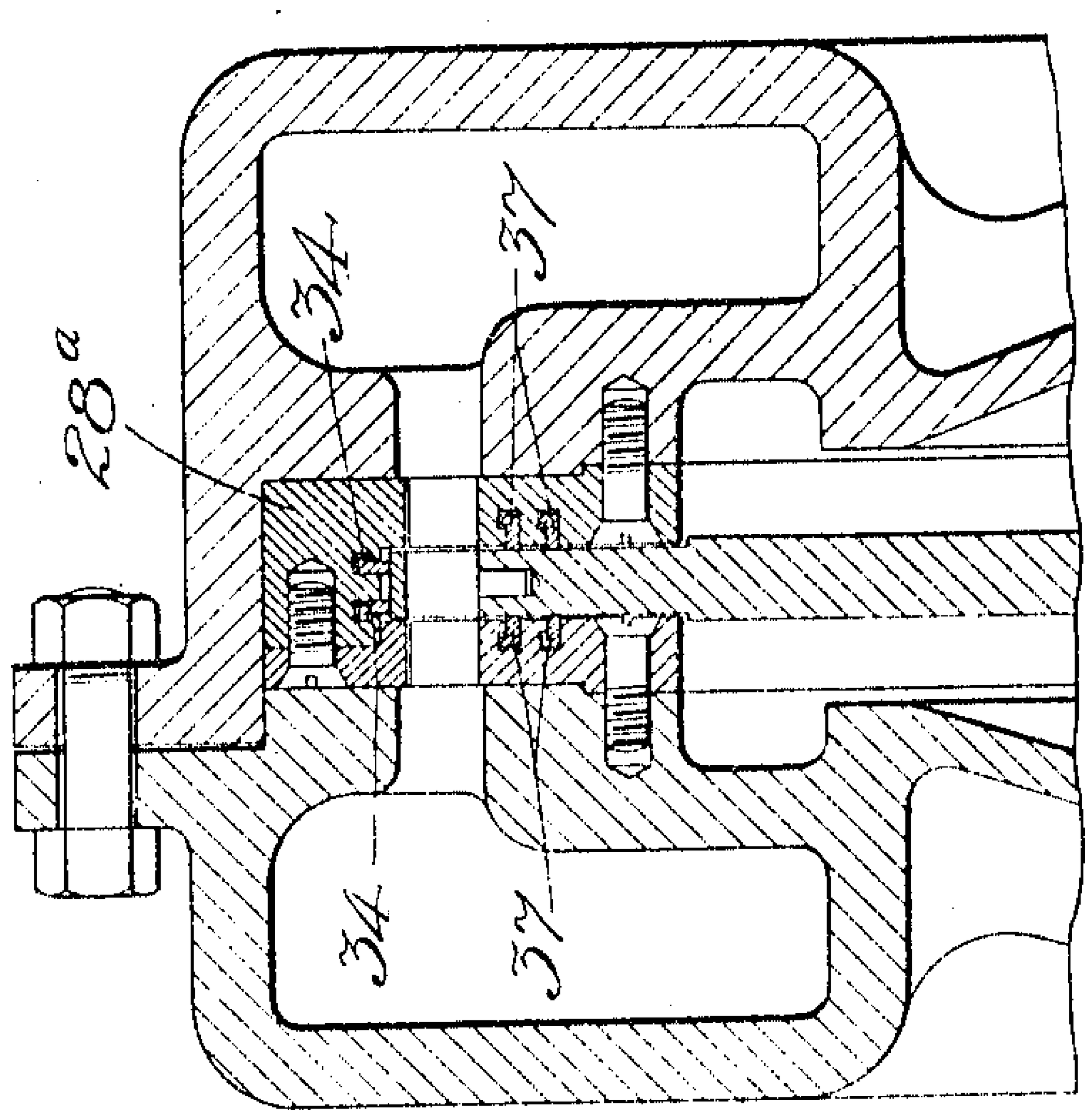


Fig. 6.

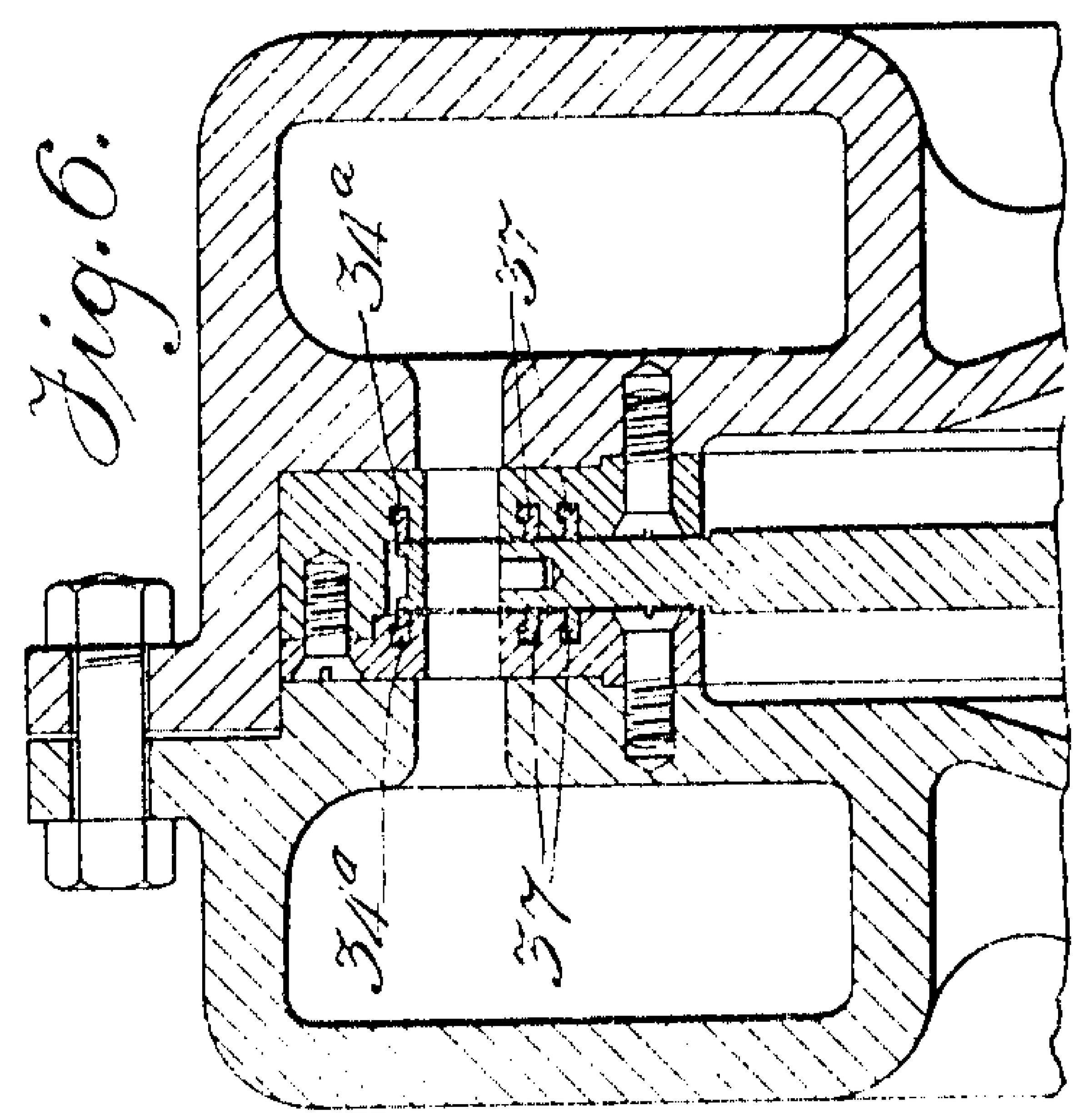


Fig. 4.

WITNESSES:

W. M. Ferg

Geo. W. Walker

INVENTOR.

George Westinghouse

BY Jno. S. Green

his ATTORNEY IN FACT.

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

REËNTRANT TURBINE.

969,821. Specification of Letters Patent. Patented Sept. 13, 1910.

Application filed February 26, 1909. Serial No. 480,225.

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, a citizen of the United States, and a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Reëntrant Turbines, of which the following is a specification.

This invention relates to elastic fluid turbines and more particularly to turbines of the reëntrant type.

In the drawings, Figure 1 is a view in sectional elevation of the upper half of a turbine embodying this invention; Fig. 2 is a developed section showing the lay-out for the several expansion stages; Fig. 3 is a detail view of a portion of the turbine illustrated in Fig. 1; and, Figs. 4, 5, 6 and 7 are views of modified forms of the turbine illustrated in Fig. 1.

The turbine consists of a rotor or wheel 8 mounted upon a shaft 9 which is journaled within suitable bearings 10. The shaft passes through suitable stuffing boxes or glands 11 carried by the casing 12 which is circumferentially split into two portions and bolted together at 13. The portion 14 of the casing contains the initial inlet 15 of the turbine and the exhaust 16. This portion also carries the collecting chambers 17, 18, 19 and 20 for the third, fifth, seventh and ninth expansion stages, while the portion 14ª of the casing contains the collecting chambers 21, 22, 23, 24 and 25 for the second, fourth, sixth, eighth and tenth expansion stages.

The rotor element carries a single row of impulse blades 26 which are preferably drop-forged and provided with shroud portions 27, which when machined, form a practically continuous smooth shroud. The outer periphery of the rotor on each side of the row of blades is machined and segmental nozzle members 28, which together form a ring, have their inner peripheral surfaces 29 machined so as to lie in close proximity with the outer periphery of the rotor.

The two sections of the casing are machined so as to provide a shouldered recess 30 and each of the sections 28 forming the nozzle ring is provided with flanges 31 which are held against the shoulders of the recess 30 by means of steam pressure bled into the recess 30 through a restricted port 32 from one of the lower stages of expansion.

The nozzle sections 28 are grooved at 33 to receive sectional packing strips 34 which lie within the groove and are fluid pressure pressed toward the shroud of the blades. The grooves 33 are provided with offset shoulders 35 which limit the movement of the packing pieces toward the shroud. Blocks 36 screwed or otherwise secured to the casing are provided with fluid pressure pressed packing strips 37 corresponding to strips 34 which yieldingly bear against the side faces of the rotor element and prevent leakage of steam to the interior of the casing. These packing strips are limited in their movement toward the wheel by means of shoulders 38 formed for that purpose in the blocks 36.

The interior of the casing or that part lying within the inner packing ring 37 may be connected to the condenser or to atmosphere, or if desired, to one of the stages of expansion, in order to maintain a predetermined pressure within the casing to minimize leakage from stage to stage.

In Fig. 4 the packing rings 34 are carried in a two-part stationary member 28ª which is rigidly secured within the casing. In this modification the sides of the wheel or rotor are reduced and the packing strips 37 bear against the reduced portion of the wheel. In the modification shown in Fig. 5 the blade shrouds are preferably machined into the channel section as shown at 27ª and yielding packing strips 34ª bear against the sides of the shroud. In this modification also the packing strips 37 are supplanted by a single packing strip 37ª provided with a broad grooved face 40 which lies in close proximity to the reduced portion of the rotor.

In the modification shown in Fig. 6, packing rings 37 are used in combination with the packings 34ª bearing against the sides of the shroud.

In the modification shown in Fig. 7, packings 37 are used in combination with a single yielding packing strip 41 which is preferably of the same width as the shroud.

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 is:

1. In an elastic fluid turbine, a rotor element provided with shrouded blades, a casing, fluid discharge devices carried by said casing and forming with said rotor element, reëntrant stages and yielding fluid pressed packing means for minimizing the escape of working fluid radially outward and inward from said blades.

2. In an elastic fluid turbine, a rotor element provided with a row of shrouded blades, a casing surrounding said element, fluid discharge devices forming with said element, reëntrant stages extending circumferentially of said turbine, yieldingly mounted packing strips located above and below the working faces of said blades for minimizing the escape of working fluid from stage to stage, and means for limiting the movement of said strips toward said element.

In testimony whereof, I have hereunto subscribed my name this 16th day of February, 1909.

GEO. WESTINGHOUSE.

Witnesses:
CHARLES W. MCGHEE,
JNO. S. GREEN.