

No. 746,593.

PATENTED DEC. 8, 1903.

F. S. SMITH.  
STEAM GENERATOR.

APPLICATION FILED JULY 25, 1903.

NO MODEL.

2 SHEETS—SHEET 1.

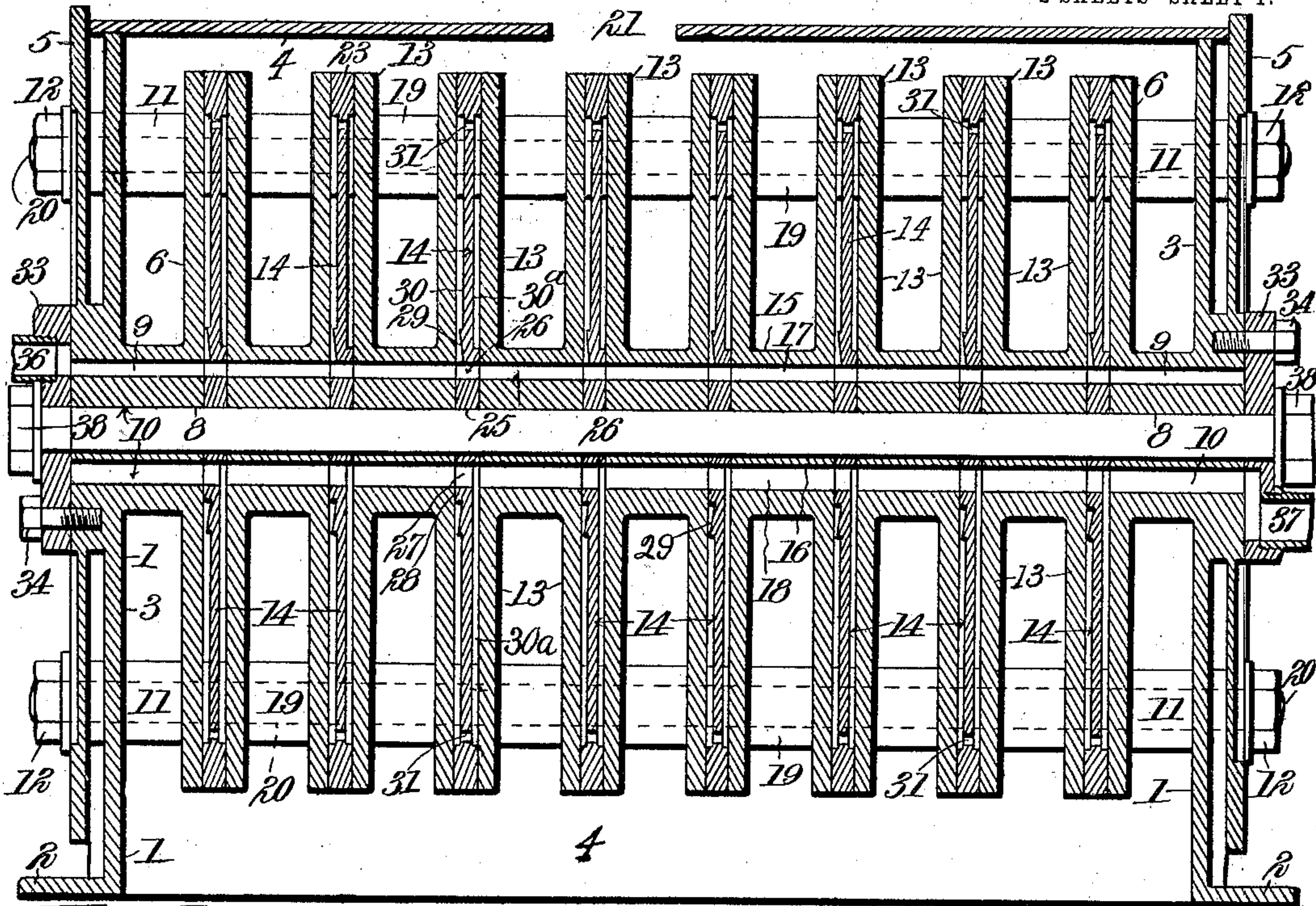


Fig. 1.

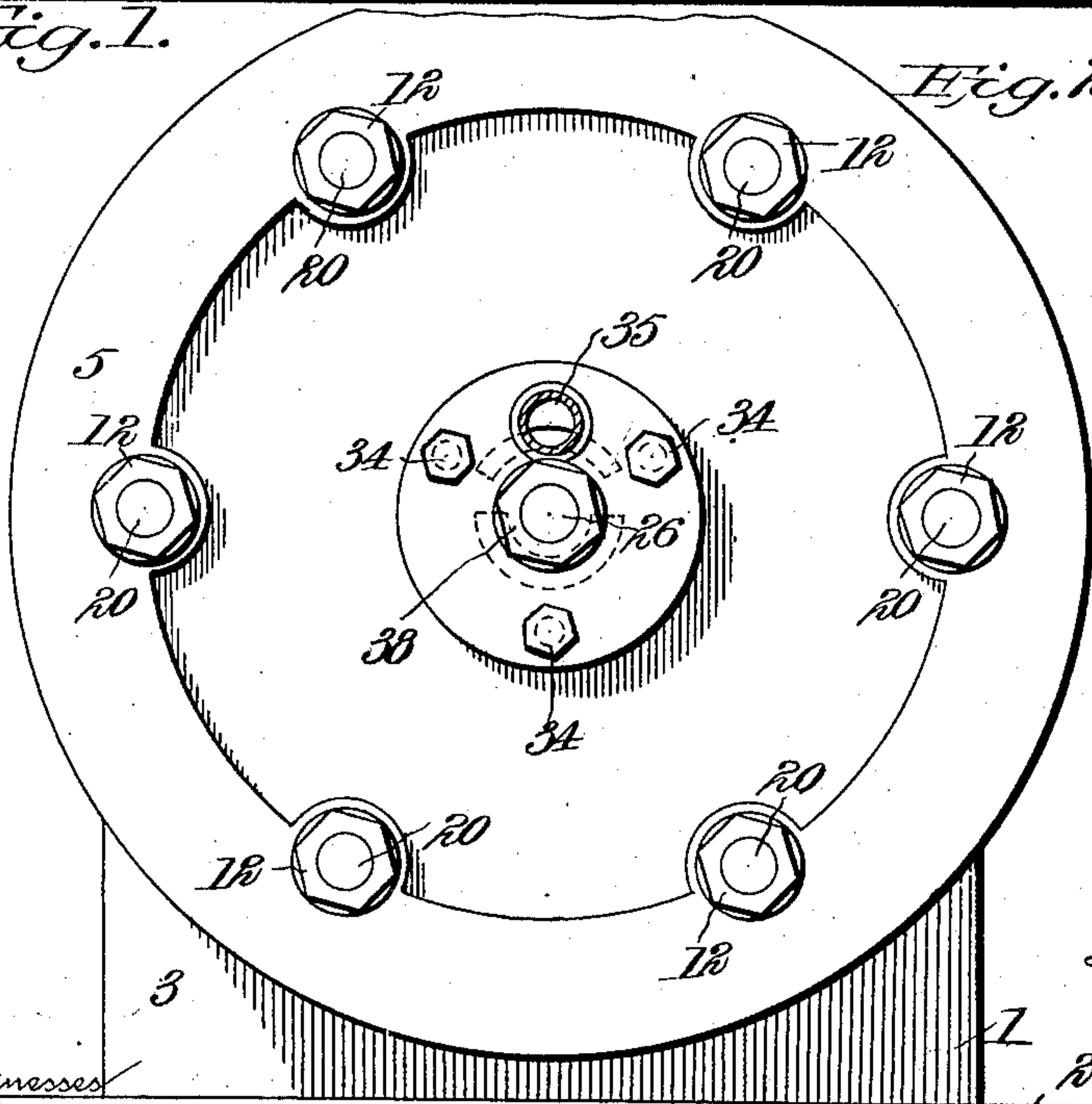


Fig. 2.

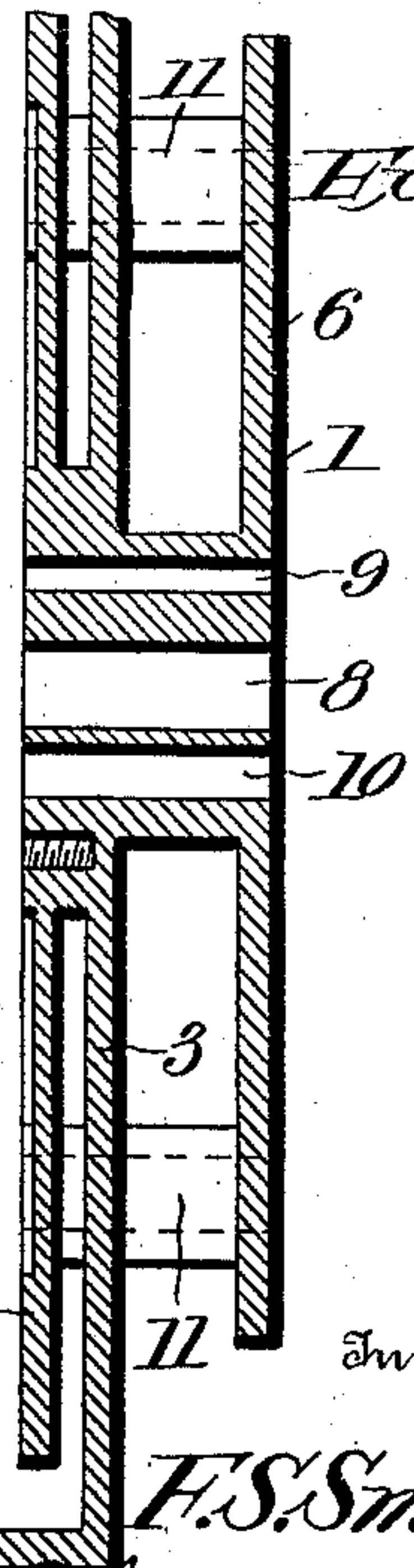


Fig. 3.

Witnesses

C. N. Walker  
Theodore Dalton

By M. A. Gibbons  
Attorney

Inventor  
F. S. Smith,



No. 746,593.

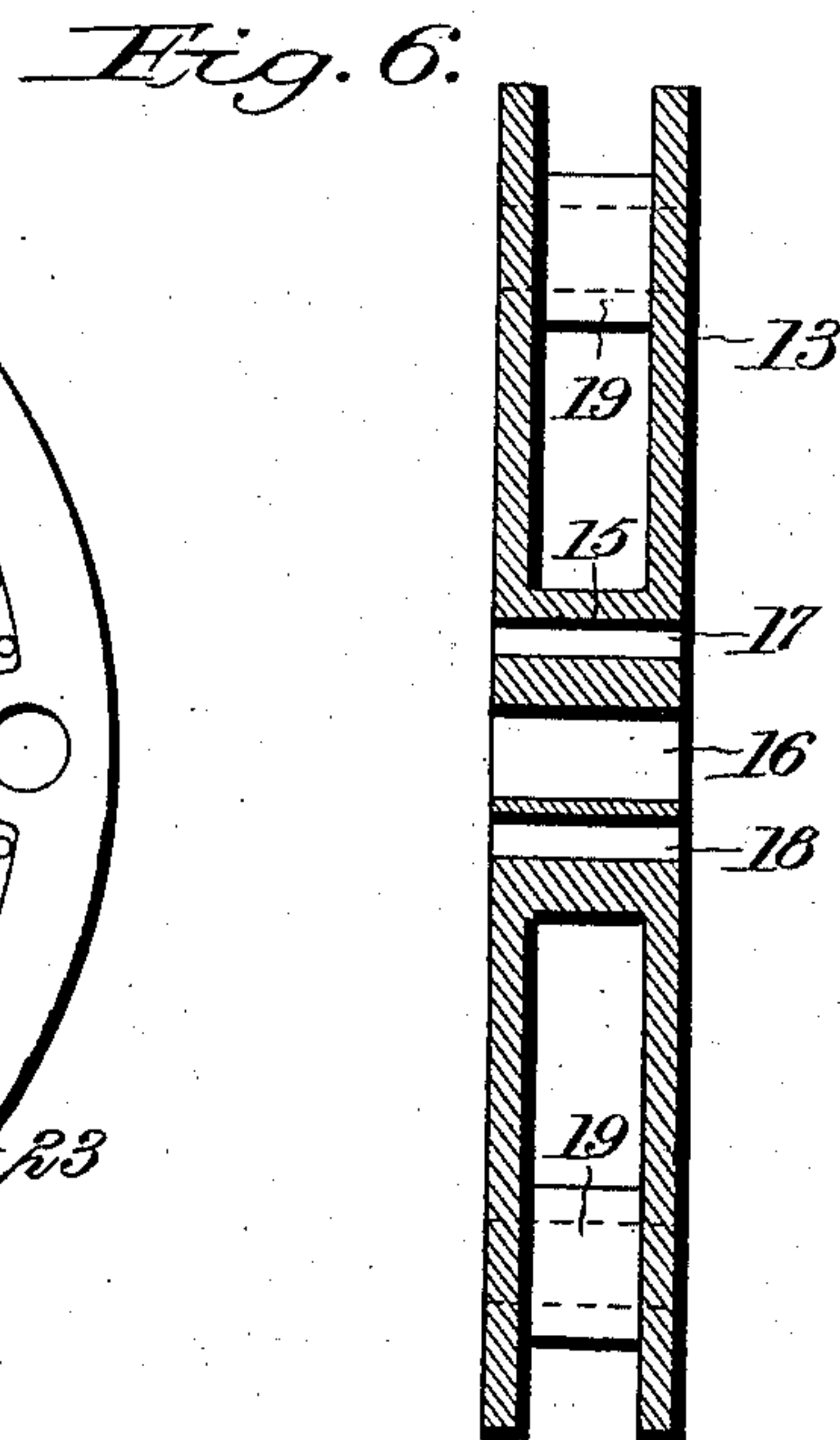
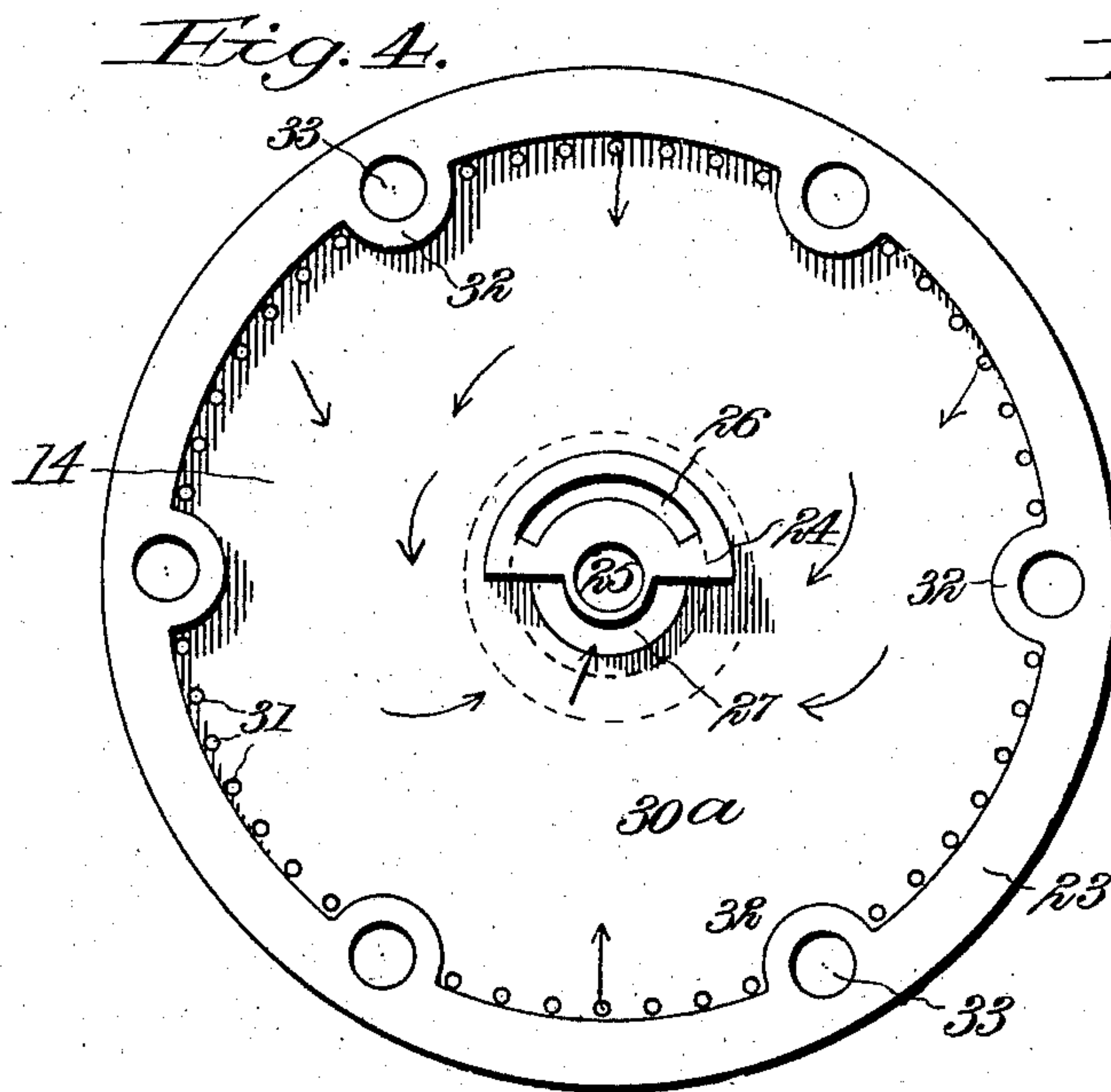
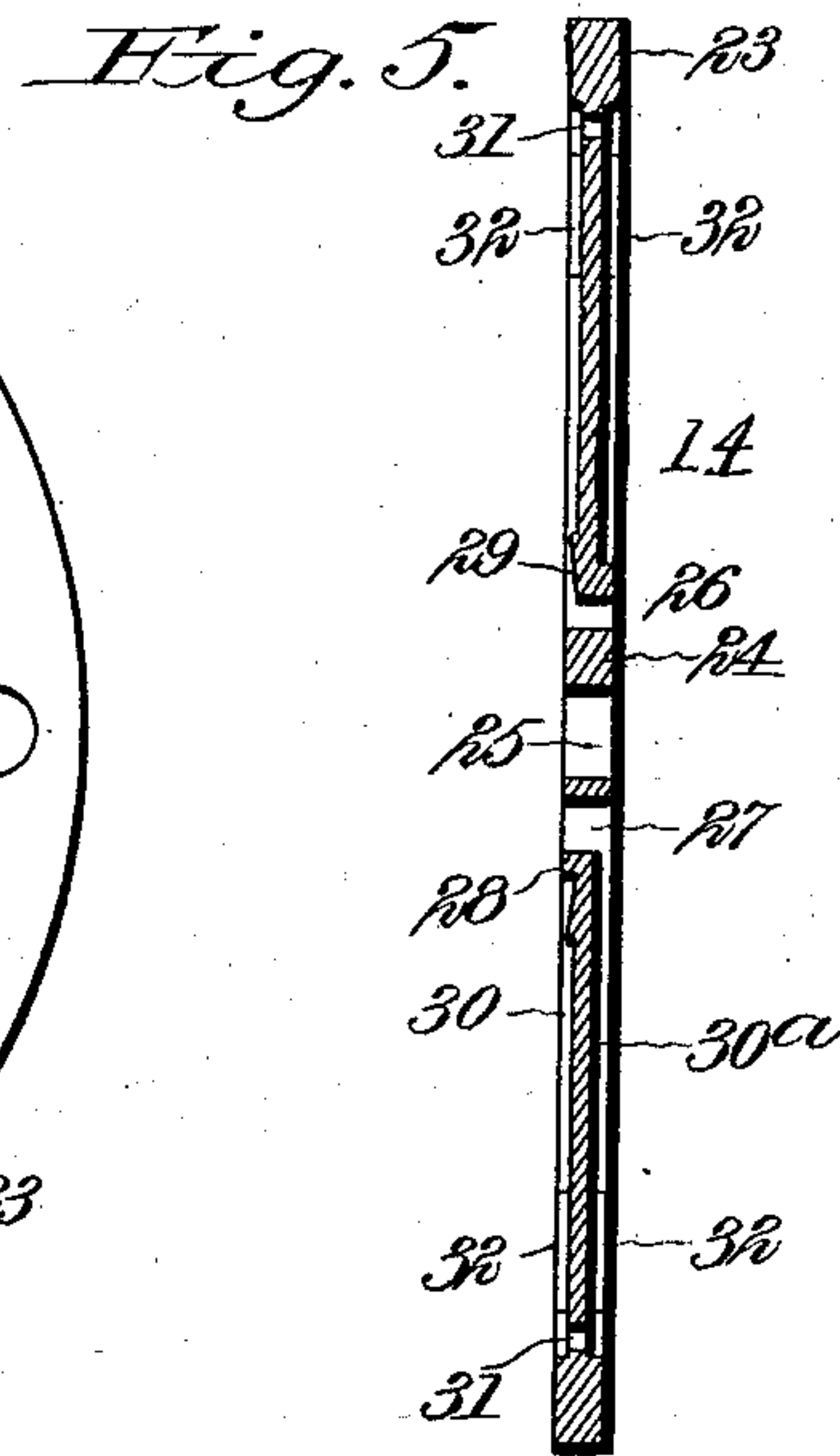
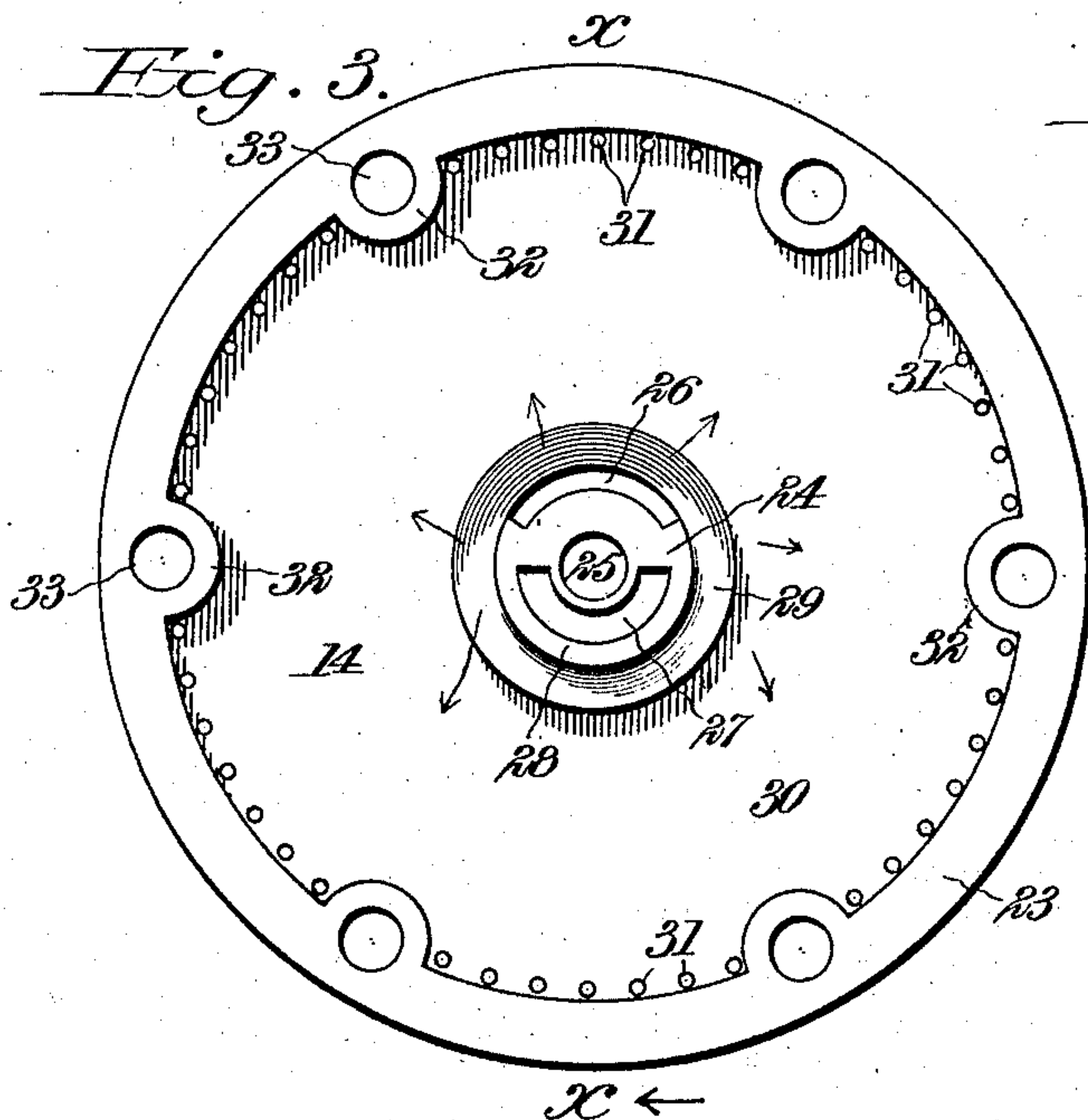
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*C. H. Walker*  
*Theodore Dalton*

Inventor  
*F. S. Smith*  
By *M. A. Hibbons*  
Attorney



# UNITED STATES PATENT OFFICE.

FREDERICK SMALLWOOD SMITH, OF SOUTH BEND, INDIANA.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 746,593, dated December 8, 1903.

Application filed July 25, 1903. Serial No. 166,989. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK SMALLWOOD SMITH, a citizen of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to improvements in steam-generators, and more particularly to that type wherein is involved the instantaneous vaporization of the water, whereby the latter is immediately flashed into steam; and the object is to improve and simplify the construction and to render the generator more certain and efficient in operation than existing or prior steam-boilers and more durable in use.

Another purpose is to provide a generator the parts of which may be readily dismembered to clean or repair the same and which economizes in space and fuel with an increased heating area and rapid generation, whereby the generating capacity of the generator generally is enhanced and wherein the use of safety-valves, governors, water-gages, and the like is obviated.

The invention embodies a plurality of disk members interposed between a plurality of spacer members and provided with chambers between each disk and the contiguous faces of the spacer members and each disk having means formed thereon for admitting the water into one of said chambers in the form of jets or fine sprays, whereby the volume of water introduced is such as to be readily and instantaneously converted into steam, which is caused to take a circuitous passage before escaping from the generator, and thereby becomes thoroughly heated. A distinguishing and improved feature of the invention is to associate with these chambers formed by the disks and spacer members continuous channels, which extend the entire length of the generator and are in communication with each chamber, and, finally, the object of the invention is to construct, combine, and aggroup the parts in a novel manner, whereby the above objects are carried out.

For a full understanding of the merits and advantages of my invention reference is to

be had to the following description and the accompanying drawings, wherein—

Figure 1 is a longitudinal vertical section of the generator embodying all the features of my invention. Fig. 2 is an end elevation of the same. Fig. 3 is a plan view of one side of one of the disks of which the generator is constructed. Fig. 4 is a plan of the other side of the disk shown in Fig. 3. Fig. 5 is a vertical section on the line *xx* of Fig. 3 looking to the left, as indicated by the arrow. Fig. 6 is a vertical section of one of the spacing members or plates, and Fig. 7 is a vertical section of one of the end plates and its standard.

Referring to the drawings, wherein similar reference notations indicate corresponding parts appearing in the several illustrations and reference being made thereto, 1 designates one of the end plates and its standard, the standard having a base 3, which rests upon the floor or other suitable support and from which rises the upright 3, the upper edge of which is semicircular to provide a seat for a casing 4, which extends from end to end of the generator and envelops the same with its ends in engagement with the inner faces of the end plates 5, each of which is separated from the upright portion 3 of the standard to reduce the degree of radiation to a minimum. Formed integral with the standard and end plate is a spacer-disk 6, and through the hub or center of these three integral members is formed a bore 8 and segmental ports 9 and 10, which are arranged concentric to the bore 8 and the purpose of which will be described hereinafter. Hollow bosses 11 are spaced apart at uniform distances around the periphery of the spacer-disk, standard, and end plate and connect the three elements, so that a substantial connection is provided, and when rods or bolts are passed through the bosses and secured at their ends by nuts 12 the casing 4 is securely held between the end plates and the members constituting the generating-surfaces are held in intimate contact, as will be more fully described hereinafter. The burners or other source of heat-supplying means may be arranged in the bottom of the casing between the uprights of the standards,



but as they form no part of the present invention they are not shown in the drawings.

The generator-surfaces consist of a plurality of spacer rings or members 13 and a plurality of disk members 14, the latter being interposed between the spacer members, as shown in Fig. 1 of the drawings.

Each of the spacing-rings consists of two disks arranged parallel to each other and having a central boss or hub 15, provided with a central bore 16 and segmental concentrically-arranged water-inlets 17 and segmental concentrically-arranged steam-outlets 18, each of which aligns with the bore 8 and segmental ports 9 and 10 of the end plates when the parts are assembled, as shown in Fig. 1. The space between the disks of the spacer members provides a plurality of flues for the products of combustion and the peripheral hollow bosses 19 serve the dual function of a connection and bearing for the connecting-rods 20 and obstructions for the products of combustion, whereby the latter are caused to take a circuitous passage around the spacer members and insure an increased heating-surface for the generator. The products of combustion, after circulating around and through the spacers between the parallel disks, escape to a flue through the opening 21 in the top of the casing 4.

Interposed between the outer faces of each disk of the spacing members is a disk 14. (Better shown in Figs. 3, 4, and 5.) Each disk has a peripheral ring 23 with flat faces and a hub or central boss 24, the opposite faces of which are likewise flat and in the same vertical plane with the faces of the peripheral rim, whereby a close fit is effected between the outer faces of the spacer members when the parts are assembled. The central boss 24 is provided with a central bore 25, which is in alinement with the bores 8 and 16 of the spacer members and end plates and through which bores the central tie-rod 26 passes to secure the parts together. In the boss 24 are concentrically-arranged ports 26 and 27, the former serving as a water-inlet and arranged on a different radius with relation to the bore 25 than the port 27, which serves as a steam-outlet port, and is for this purpose preferably made wider than the water-inlet, and when the disks are assembled between the spacer members and the tie-rods 26 and 20 secured in place the ports 26 and 27 are in alinement with the ports 9 and 10 and 17 and 18 of the end plates and spacer member, respectively, whereby continuous segmental passages are formed throughout the length of the generator, as is clearly shown in Fig. 1. Referring to Fig. 3 of the drawings, it will be noted that the central boss 24 on one side of the disk is substantially circular in shape, except that its periphery near the upper edge is broken by the port 26, while the lower portion or annular rib 28 below the port 27 lies flush with the outer surface of the spacer

member and prevents the steam escaping from that side of the disk below the steam-outlet. This side of the disk around the boss is formed with a spreader 29, the inclination of which tends to spread the water outwardly away from the disk and against the contiguous face of one of the disks of the spacer member. The space between the outer periphery of the spreader and the face of the spacer-disk being so narrow as to cause the water to spray in a fine jet or stream against the heated contiguous surface of the disk, the water is thereby immediately vaporized, and this instantaneous vaporization greatly increases the generating capacity of the generator. The water in passing from the spreader after being converted into steam is confined within the annular channel portion 30 of the disk, such channel portion being on opposite faces of the disks and providing chambers for the steam. At the margin of the channel portions 30 there is formed a plurality of apertures 31, through which the steam escapes to the opposite side of the disk and into the chamber 30<sup>a</sup> on the other side and circulates therearound and into contact with the heated surface of the spacer-disk on the opposite side, so that the steam is thoroughly heated before escaping from the ports 27 and 18. From the peripheral rim on each side of the disk are inwardly-extended semicircular portions 32, having openings 33, through which the tie-rods 20 pass. Referring to Fig. 4, wherein is shown the opposite side of the disk member, it will be noted that the central boss 24 surrounds the borders of the water-inlet 26, while the lower edge of the steam-port 27 is flush with the channel portion forming the chamber 30<sup>a</sup>, and its upper edge is flush with the boss, whereby the steam after passing through the apertures 31 onto this side of the disk is caused to circulate around the boss 24 to escape through the steam-outlet 27, as is indicated by the arrows. The outer circle of dotted lines in Fig. 4 represents the shoulder formed by the outer periphery of the spreader, and the inner circle (shown in dotted lines) indicates the boss 24 on the opposite side of the disk.

At one end of the generator is a plate 33, which is secured to the end plate 5 by bolts or screws 34 and has a hole 35 tapped therein to receive the end of a water-supply pipe 36, the hole being arranged to communicate with the port 9 in the end plate. A similar plate is secured to the other end of the generator and has a similar hole tapped therein to receive the end of a steam-pipe 37, the hole being in communication with the steam-port 10 of the end plate, as shown in Fig. 1, and when the central tie-bolt 26 is passing through the spacer members and disks and nuts 38, secured on its ends, the parts are held in intimate contact with the several ports in alinement.

It being premised that water is being intro-



duced through the pipe 36 and that the exterior surfaces of the spacer-disks are heated, the water will pass through the continuous channel formed by the ports 9, 17, and 26, and some of the water will pass through the space between the inner face of one of the disks of the spacer members and the spreader and be sprayed in fine jets against the heated surface of the spacer-disks. The steam will pass through the apertures 31 into the chamber 30<sup>a</sup> on the opposite side of the disk and circulate therein, becoming highly heated and finally escape into the port 18 of the adjacent spacer member and will then pass through the continuous channel formed by the ports 18 and 27 and will finally enter the pipe 37, where it may be conveyed either to a superheater or to an engine-cylinder direct or may be utilized for any purpose.

By this construction and arrangement of parts I provide an instantaneous steam-generator with an increased heating-surface and one capable of generating a great amount of steam with the least possible amount of fuel, and I also obviate the use of safety-valves, governors, and other expensive parts, the liability of explosion being reduced to a minimum, since the steam is not confined within any single casing, and the parts may be readily dismembered, so that the expense and trouble of cleaning are greatly reduced.

The best possible results are accomplished by successively or intermittently admitting the water into the generator, so that the successive jets or sprays injected by the spreaders 29 are permitted to expand or explode directly and instantaneously in the generating-chambers before the injection of the next jet or spray. It will be noted that the spreader being annular and extending entirely around the hub of each disk member causes the water to be equally distributed throughout the chamber in the disk, the jets being directed radially and outwardly against the contiguous disk portion of the adjacent spacer member, and thus the entire heating-surface is utilized and instantaneous vaporization insured.

While I have shown and described a construction by which the water is admitted at one end of the generator, it is obvious that the water may be more evenly distributed throughout the generator by having it enter at both ends into the water-channel, or it may enter through the hub of any or all of the spacer members and each entrance communicate with the port 17. It may also be found advisable to provide the outer walls in the space between the disk portions of the spacer members with corrugations or protuberances to increase the heating area. These, with many other changes in the form, proportions, and minor details of construction, may be resorted to without departing from the principle of my invention or sacrificing any of the advantages thereof.

Having thus described my invention, what

I claim, and desire to secure by Letters Patent, is—

1. A steam-generator comprising a plurality of disk members arranged in alinement, separated from each other and having chambers separated from but in communication with each other.

2. A steam-generator comprising a plurality of disk members separated from each other and having chambers separated from but in communication with each other.

3. A steam-generator comprising a plurality of spacer members between which the products of combustion circulate, and a plurality of chambered disks interposed between said spacer members and in communication with each other.

4. A steam-generator comprising a plurality of spacer members having parallel disk portions spaced apart, and chambered disks interposed between the contiguous faces of the disk portions of the spacer members.

5. A steam-generator comprising a plurality of spacer members having parallel disk portions spaced apart, the disk members being connected at their central portion, and a plurality of disks interposed between the contiguous faces of the disk portions of the spacer members and having chambers formed in opposite sides thereof, and means to hold the spacer members and disks in intimate contact.

6. A steam-generator comprising a plurality of spacer members having parallel disk portions and a central integral hub, a plurality of disks interposed between the contiguous faces of the disk portions of the spacer members and having chambers formed in opposite sides thereof, continuous channels for the water and steam extending through the hubs of the spacer members and communicating with the chambers in the disks.

7. A steam-generator comprising a plurality of spacer members, each having disk portions spaced apart and a central hub connecting the disk portions, water and steam ports formed in the hub of each spacer member, disks interposed between the contiguous faces of the disk portions of the spacer members and having chambers formed in opposite sides thereof in communication with the water and steam ports of the spacer members respectively, and means piercing the hub of each spacer-bar and the center of the disks for holding the parts in intimate contact.

8. A steam-generator comprising a plurality of spacer members, each having parallel disk portions and a channeled hub, integral bosses spaced apart and connecting the disk members near their peripheries, a plurality of disks interposed between the disks of the spacer members and having chambers formed in opposite sides thereof, ports in the disks in alinement with the channels of the spacer members, whereby continuous channels are formed in the generator, said channels being



in communication with the chambers in the disks, tie-bolts passing through the bosses of the spacer members and through the disks, and a central tie-bolt piercing the hubs of the spacer members and centers of the disks, substantially as specified.

9. In a steam-generator, the combination with a plurality of spacer members, of a plurality of disks interposed between the contiguous faces of the spacer members, each disk having chambered portions on opposite sides thereof, and water and steam ports extending through the disks.

10. In a steam-generator, the combination with a plurality of spacer members having water and steam ports extending therethrough, of a plurality of disks interposed between the contiguous faces of the spacer members and having chambers formed in opposite sides thereof, and water and steam ports in the disks and arranged in alinement with the ports in the spacer members, whereby continuous channels extend throughout the generator.

11. In a steam-generator, the combination with a plurality of spacer members having water and steam ports extending therethrough, of disks interposed between the contiguous faces of the spacer members and having chambers formed in opposite sides thereof, and water and steam ports extending through the disks and arranged in alinement with the ports in the spacer members, and an inclined spraying-surface formed on one side of the disk around the ports, whereby the water is admitted to the chamber in fine sprays or jets.

12. In a steam-generator, the combination with a plurality of spacer members having water and steam ports extending therethrough, of disks interposed between the contiguous faces of the spacer members and having chambers formed in opposite sides thereof, a central boss on each side of the disk, a water-inlet extending through both bosses, a steam-port extending through the boss on one side of the disk only and having its lower edge in communication with the chamber on the other side of the disk, and a spraying-surface merging from the boss on one side of the disk to admit the water to the chamber in small jets or sprays, and means to hold the spacer members and disks in intimate contact with their respective ports in alinement.

13. A steam-generator comprising standards having uprights and end plates integral therewith but spaced therefrom, a casing seated upon the uprights and in engagement with the end plates and surrounding the generator, and steam-generating means supported by and confined between the standards.

14. In a steam-generator, the combination of standards having end plates and spacer-disks integral therewith, a plurality of spacer members, each composed of parallel disk portions and a central hub, integral bosses con-

necting the disk portions near the peripheries thereof, water and steam ports extending through the hub, a plurality of disks interposed between the disk portions of the spacer members and having chambers formed in opposite sides thereof in communication with the water and steam ports of the spacer members, tie-rods extending through the bosses of the spacer members, the disks and the end plates, a central tie-rod extending through the hubs of the spacer members and the centers of the disks, and plates secured to the end plates and having water-inlet and steam-outlet connections, substantially as specified.

15. In a steam-generator, the combination with a plurality of spacer members having segmental water and steam ports extending therethrough, of disks interposed between the contiguous faces of the spacer members and having chambers formed in opposite sides thereof, said chambers being closed by the contiguous faces of the spacer members, bosses extending from the center on each side of the disk and having segmental water and steam ports extending therethrough and arranged in alinement with the ports of the spacer members, and an inclined gradually-decreasing steam-spraying surface arranged concentric to the ports on one side of the disk, apertures formed in the disk at the margin of the chambers, whereby the chambers are in communication with each other, and means for holding the parts in intimate contact.

16. A steam-generator comprising a plurality of chambered disks spaced apart, and means for admitting the water into the chambers of said disks in successive jets or sprays.

17. A steam-generator comprising a plurality of chambered disks separated from each other, and means formed in said disks for spraying the water radially into the chambers thereof.

18. In a steam-generator, a plurality of generating chambered disks spaced apart and each provided with an annular spreader adapted to spray the water radially in fine jets throughout the chamber.

19. A steam-generator comprising a plurality of spacer members, a plurality of chambered disks interposed between the said spacer members, ports in the spacer members, ports in the disks in alinement with the ports of the spacer members, a spreader formed on each disk to inject the water radially into the chambers of the disks in intermittent jets or sprays, whereby the successive jets or sprays are instantaneously expanded or flashed into steam.

20. A steam-generator composed of a plurality of disk members, each of which is formed with a channeled portion to provide a steam-generating chamber, and a spreader formed on the disk for injecting the water into said chamber.

21. A steam-generator composed of a plu-

5 reality of disk members, each disk having channeled portions on opposite sides thereof to provide steam-generating chambers, and means formed on the disk for injecting water into one of said chambers in fine jets or sprays.

In testimony whereof I have signed my

name to this specification in the presence of two subscribing witnesses.

FREDERICK SMALLWOOD SMITH.

Witnesses:

EDWIN PERCY MOORE,  
J. D. CASEY.