

No. 675,862.

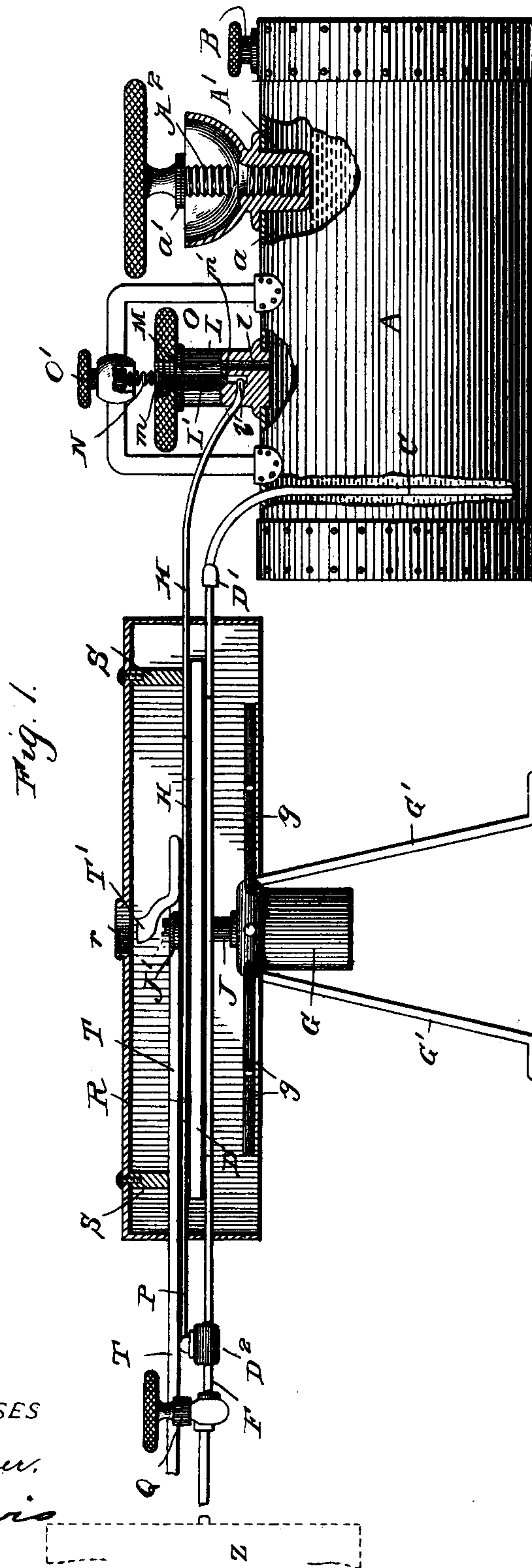
Patented June 4, 1901.

W. MITCHELL.
STEAM GENERATOR.

(Application filed Sept. 27, 1900.)

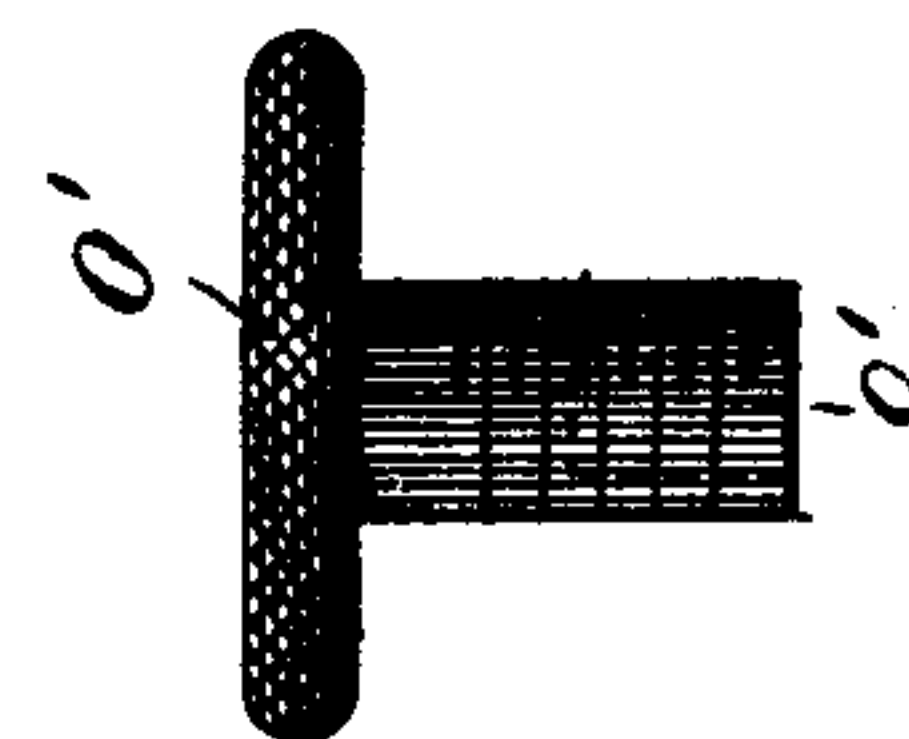
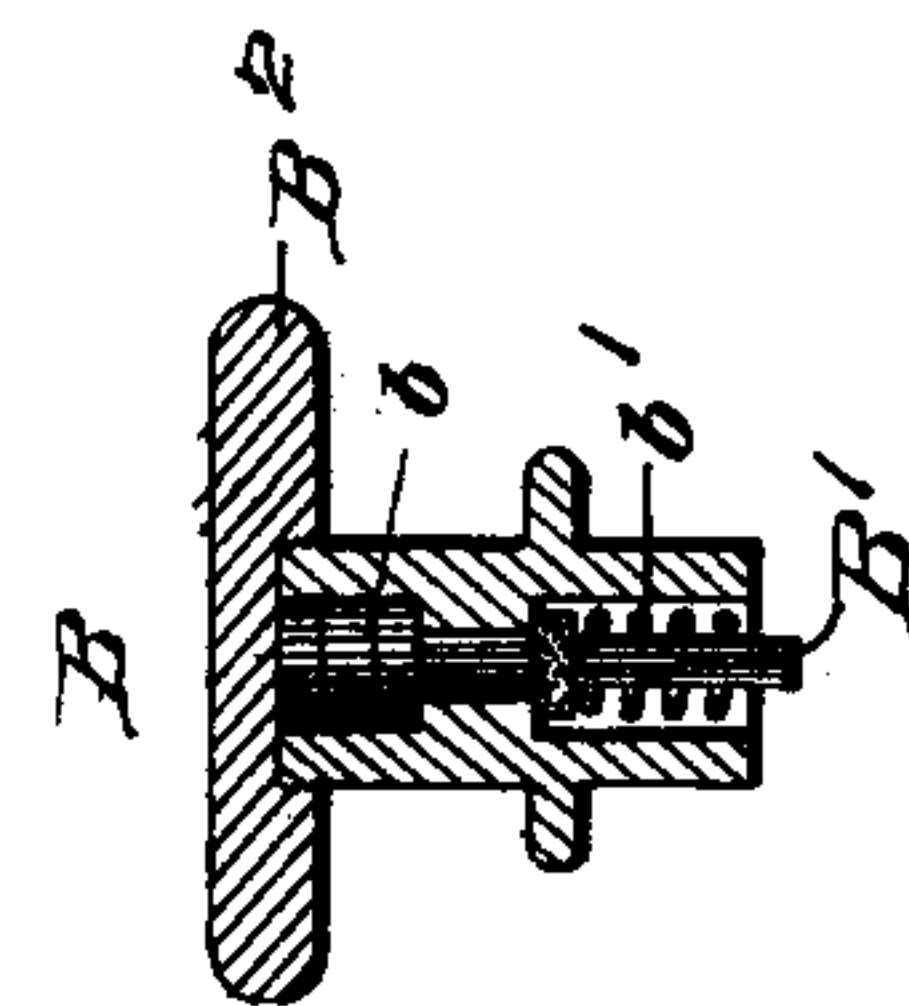
(No Model.)

2 Sheets—Sheet 1.



WITNESSES

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2 Sheets—Sheet 2.

Fig. 2.

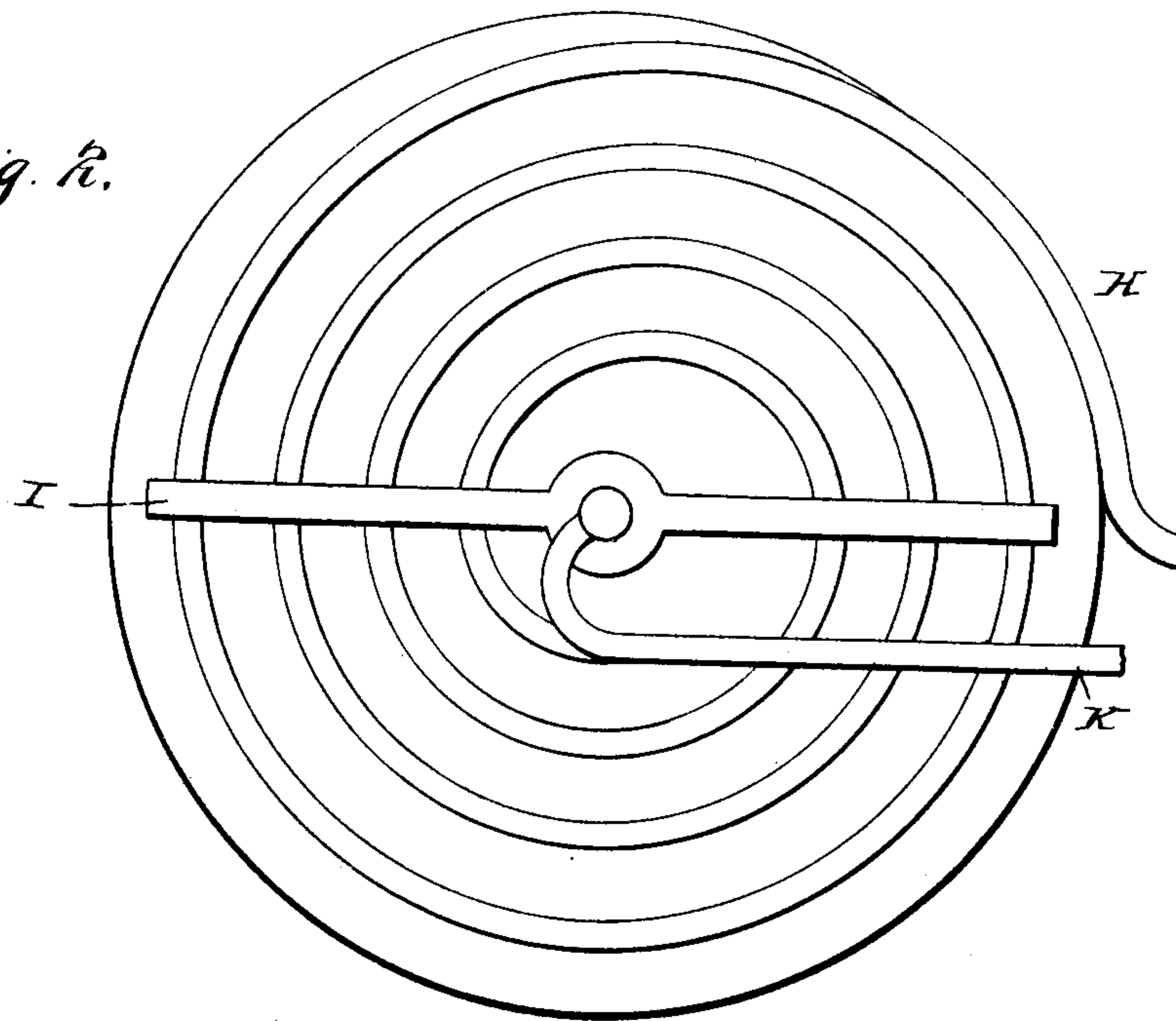
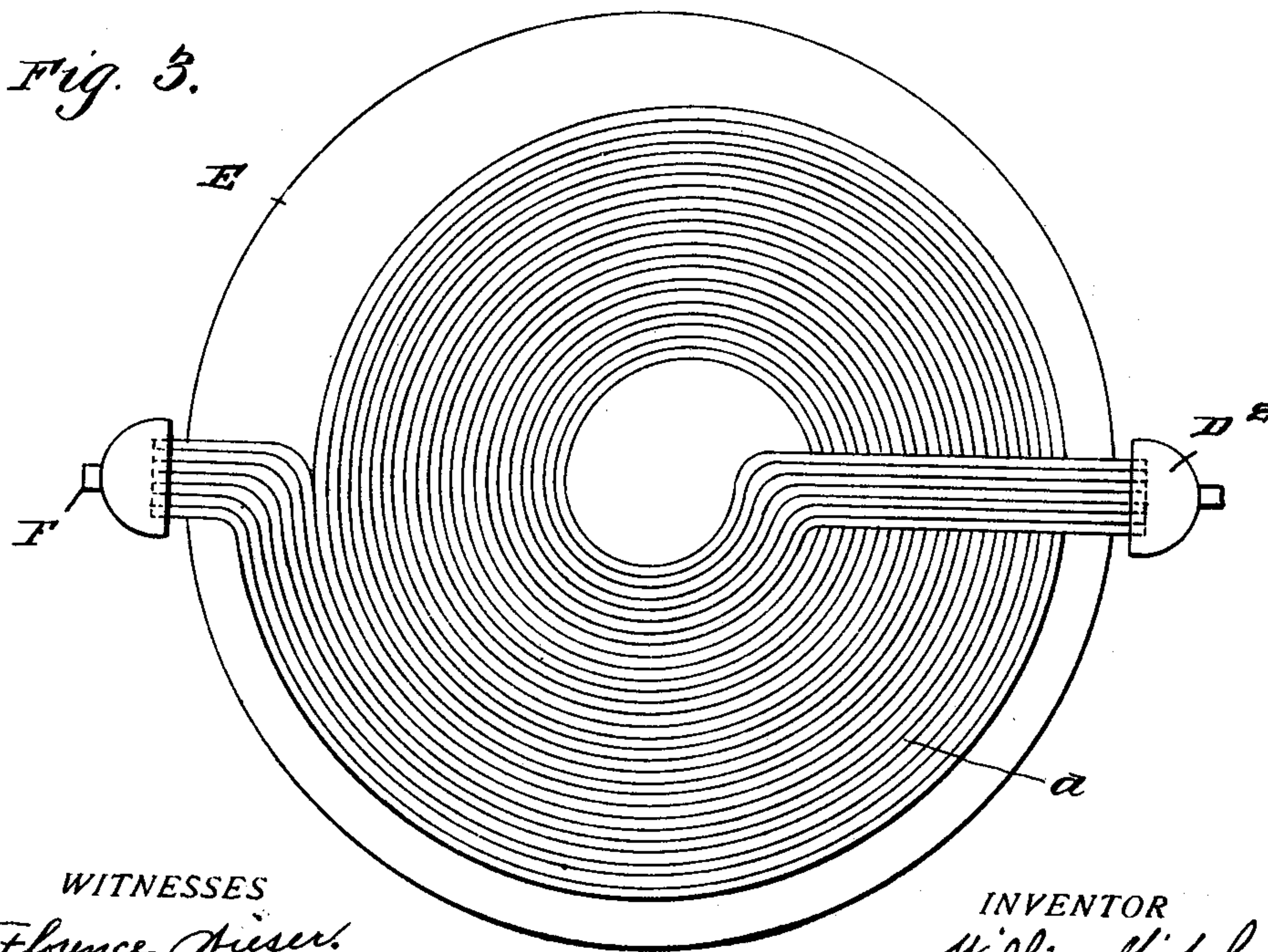


Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIS MITCHELL, OF MALDEN, MASSACHUSETTS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 675,862, dated June 4, 1901.

Application filed September 27, 1900. Serial No. 31,263. (No model.)

To all whom it may concern:

Be it known that I, WILLIS MITCHELL, a citizen of the United States, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Steam-Generators; 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.

The chief object of this invention is to provide an excess of very highly superheated steam beyond what the engine or its equivalent can consume and return the same in gaseous form to the reservoir, utilizing its expansive power therein to feed the water to the generator. The same tube serves for the outward conduction of the water and the return of the steam.

The said invention consists in the combination of the generator, reservoir, and pipe constructed and arranged to operate as above described and in certain additional combinations, features, and details, substantially as hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 represents a side elevation, partly broken away, of a reservoir, generator, and auxiliary and connecting devices embodying my invention, the water-inlet screw-cap being slightly detached and the casing or shell of the generator, as well as the posts connecting it to the disk, being shown in section. Fig. 2 represents a plan view of the upper generator and disk. Fig. 3 represents a similar view of the lower generator and the same disk from below. Fig. 4 represents an enlarged detail view in elevation of the screw-plug O'; and Fig. 5 represents a detailed view, in central vertical section, of the air-inlet and its cap.

A designates the water reservoir or boiler, which is supplied with water through a neck or inlet-tube A', extending from and through the top some distance down within the same, so as to leave an air-space *a* in the upper part of the said boiler or reservoir above the level of the lower end of the said neck or inlet. The latter is internally screw-threaded to receive a screw-plug A², provided with a gasket or packing-ring *a'*. The said reservoir or boiler is also provided with an air-inlet B,

through which air may be forced into its interior by a pump or equivalent device, a suitable tube and coupling being employed. This inlet, as shown in Fig. 5, is detachable and tubular and provided at its upper end with an internally-screw-threaded recess *b* for the coupling of the air-tube. It has also within it an inlet-valve B', automatically closed by a spring *b'*. A cap B² is screwed onto the upper end of this air-inlet after the boiler or reservoir is charged with air in the beginning of the operation of the apparatus.

C designates a water-pipe, which also serves as a return steam and air pipe, extending from the lower part of the interior of the said reservoir out through the top of the same, at one end thereof, and thence to the generator D, to which it is connected at the supply end by a tubular coupling D'. The said generator, as clearly shown in Fig. 3, consists of a series of fine parallel tubes *d*, arranged in multiple and wound in a flat coil, which is hard-soldered to the under side of a copper disk E. The discharge ends of the said coiled tubes are united by a tubular coupling D², whence a pipe F extends to the engine. The latter (marked Z) is conventionally indicated by dotted lines in Fig. 1. A gas or gasolene burner G, preferably provided with tubular radial spokes *g*, perforated on their upper sides, is arranged under the said generator for starting it. This, as shown, is mounted on supports G'; but both it and its means of support may be largely varied without affecting the invention. In order to utilize any excess of steam and air accumulating in the upper part of the reservoir to a point that would overcome the safety-valve, I provide a second generator, H, held to the top of the said disk in the form of a single flat coil by a cross-bar I, Fig. 2. A bolt J, shouldered for the support of the main generator D and disk E, passes up through central holes of said disk and cross-bar and receives at the upper end a nut J', which binds the aforesaid parts tightly together. This upper and auxiliary generator H is supplied by a pipe K, running to a switch-post L on top of the boiler. The upper part of this post is hollow, forming a chamber L', from which a bent passage *l'* extends down and laterally outward, receiving pipe K at the side surface

of the said post. A straight outlet-passage l connects the air and steam chamber a at the top of the boiler or reservoir with the said chamber. A safety-valve M of rod form, having an enlarged conoidal head m at the upper end and a conical lower point m' , closes simultaneously the passage l' and an outlet at the top of the said post, its cone-faces being received in suitable seats at these two points. This valve is held to the said seats by a spring N , set into a socket or recess n , shown in dotted lines in Fig. 4 as formed in the lower end of an adjusting-screw O' , which is turned into and through the middle of the top of a bar O , that is raised on the top of boiler A , said bar having the shape of an inverted U . The said screw, besides regulating the pressure of the said spring, allows convenient access thereto for cleaning or removing it. A pipe P extends from the discharge end of generator II to the said coupling D^2 . A shut-off cock Q is provided in pipe F' a little beyond the said coupling.

A hollow casing R of drum form, having a central top opening r , incloses the generators except at the bottom and is supported by posts S , rising from the copper disk E . It has lateral holes for the passage of the supply and discharge pipes aforesaid, as well as for an exhaust-pipe T from the engine, which latter pipe is provided with a flaring outlet or mouth T' , discharging upwardly through opening r to start or maintain a draft for the burner, besides its normal function. The casing serves as a deflecting and reflecting hood, retaining and increasing the heat about the generators. It also protects them.

The operation is as follows: Water being supplied to the reservoir, as before stated, and the cock Q closed, as well as the water-inlet, I force in air, as stated, to start the water through pipe C to the main generator D and start the burner to supply heat. The air-inlet is then closed. The arrangement of the generator-coils under the copper disk E and immediately above burner G insures prompt and intense heating, which by conduction is communicated to said disk, without unsoldering them, since a red heat is necessary for the latter purpose, and less than that suffices for all my needs, the heat being distributed evenly, or nearly so, through the mass of both generators and the intervening copper disk. I then open the cock Q , which allows the water to flow through the coils of the main generator C , being converted into steam and exceedingly superheated, as it drives the air out of the generator and passes on to supply the engine. Since the water is exposed so directly to the intense heat of the burner in a number of fine long tubes coiled into small compass and acting on each other by mutual radiation and conduction, besides the action of the disk and casing, as aforesaid, a very much greater amount of steam is produced than the engine can utilize, the excess of it

returning to the reservoir A in the form of a fixed water-gas and by its expansion forcing the water through the said pipe C to the generator D , so as to keep the apparatus self-supplying, water being poured in through the conveniently-flared mouth of the water-inlet tube A' as needed.

I do not limit either the engine or the generator D and its appurtenances to any particular size; but their relative capacity must be such that the engine will use less vapor than the generator will produce. This relation may obviously be varied at will by substituting a smaller engine or a larger generator and burner.

When the pressure within the boiler or generator A exceeds a predetermined amount, the safety-valve yields and some part of the air and steam in the upper space a of the said reservoir escapes to the outer air, while a greater volume of it passes to the upper generator II through the connections above described, where it is still further heated and joins the outflow from the main generator D to the engine. The yielding point of the safety-valve is determined by screwing in the plug O' to a greater or less extent, so as to compress the safety-valve spring N in corresponding degree. The escaping steam, conducted through exhaust-pipe T and discharged through r , is quite invisible. In the passage through casing R it is still further superheated; but even if said pipe be removed and it be allowed to escape directly from the engine it cannot be seen. This especially adapts my steam-generating apparatus to use with automobiles, as does also the combination of compactness with high heating efficiency; but of course my devices may be used with other mechanisms where needed.

By using in my generator D a number of coils all having a common supply and discharge I reduce very greatly the resistance encountered by each particle of water or steam in passing through the same as compared with sending the whole volume through a single length of pipe equal to the aggregate length of all the coils and having the same diameter. This last is preferably one-sixteenth of an inch, (internal,) the number of pipes or coils being twelve and the length of each of them seventy-two inches; but I do not confine myself precisely to these dimensions nor to the number and arrangement of pipes or coils, and there are divers other details of construction and combination hereinbefore described which may be varied without departing from my invention; but a generating apparatus constructed substantially as and in the proportions described has been found to work very satisfactorily in the manner set forth.

The superheated steam or water-gas escapes back through pipe C in bubbles and is not condensed by the water in said pipe or in

the reservoir A. These bubbles expand on reaching the surface and supply pressure to space *a* and the water below it. A certain amount of air freed from the water presumably accompanies it, contributing to the expansive action.

Apparently the flow of water and of aeriform fluid in opposite directions is strictly simultaneous and continuous through the same pipe; but there may be some rapid alternating rhythmical action within the same.

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

1. In combination with a reservoir for liquid and a vapor-generator supplied thereby for driving an engine a single tube connecting the said reservoir with the said generator and serving to conduct back through the current of liquid to the said tank the excess of said vapor produced by the said generator beyond what the engine can use, substantially as set forth.

2. In combination with a reservoir for liquid and a vapor-generator supplied thereby for driving an engine, a single tube connecting the said reservoir with the said generator, means for heating the said generator and means of communication between the said generator and the engine, the said tube serving to conduct a current of liquid from the reservoir to the generator and a returning current of vapor from the generator to the reservoir, the generating capacity of the generator being greater than the consuming power of the engine, in order that it may produce an excess of vapor beyond what the engine can consume and return this excess through the flowing liquid in the tube to the reservoir for the purpose of making the generator self-feeding substantially as set forth.

3. A flat generator consisting of fine tubes coiled concentrically and connected in multiple in combination with means for heating the same and means for supplying liquid to one end of the said tubes collectively and receiving aeriform fluid from the other end of the said parallel series of tubes substantially as set forth.

4. A generator consisting of a tubular coil practically integral with a metallic disk in combination with means for supplying liquid

to the said generator and means for heating it substantially as set forth.

5. A flat coiled generator in combination with a metallic disk to one side of which it is united, means for applying heat to said generator on the side of it which is opposite to said disk, and means for maintaining a current of fluid through the said generator substantially as set forth.

6. In combination with a burner and a disk supported thereby, a generator fixed to the under side of said disk above the said burner, and means for maintaining a current of fluid through the said generator substantially as set forth.

7. A disk and two generators arranged respectively above and below the same and held thereto, in combination with a pipe to an engine supplied with vapor or gas in common by the outlets of these generators, a liquid-reservoir, a safety-valve therefor, a pipe extending from the lower part of the said reservoir to one of the said generators and another pipe extending to the other generator from an outlet-passage controlled by the said escape-valve substantially as set forth.

8. In combination with a generator, a disk to which it is attached, and means for warming the same, a casing supported by the said disk and surrounding and covering the said generator and provided in the center of its top with an opening and an exhaust-pipe discharging upward through the said opening substantially as and for the purpose set forth.

9. In combination with a metallic disk and a generator hard-soldered to the bottom thereof, a burner arranged below them a supplemental generator arranged on top of the said disk, a supporting-bolt rising from said burner through said disk and generators, a cross-bar resting on the upper generator and perforated for the reception of the upper end of the said bolt and a nut turning home on the said end to clamp all the aforesaid parts firmly together substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIS MITCHELL.

Witnesses:

WESLEY PAUL,
DAVID J. O'CONNELL.