No. 737,727. PATENTED SEPT. 1, 1903.

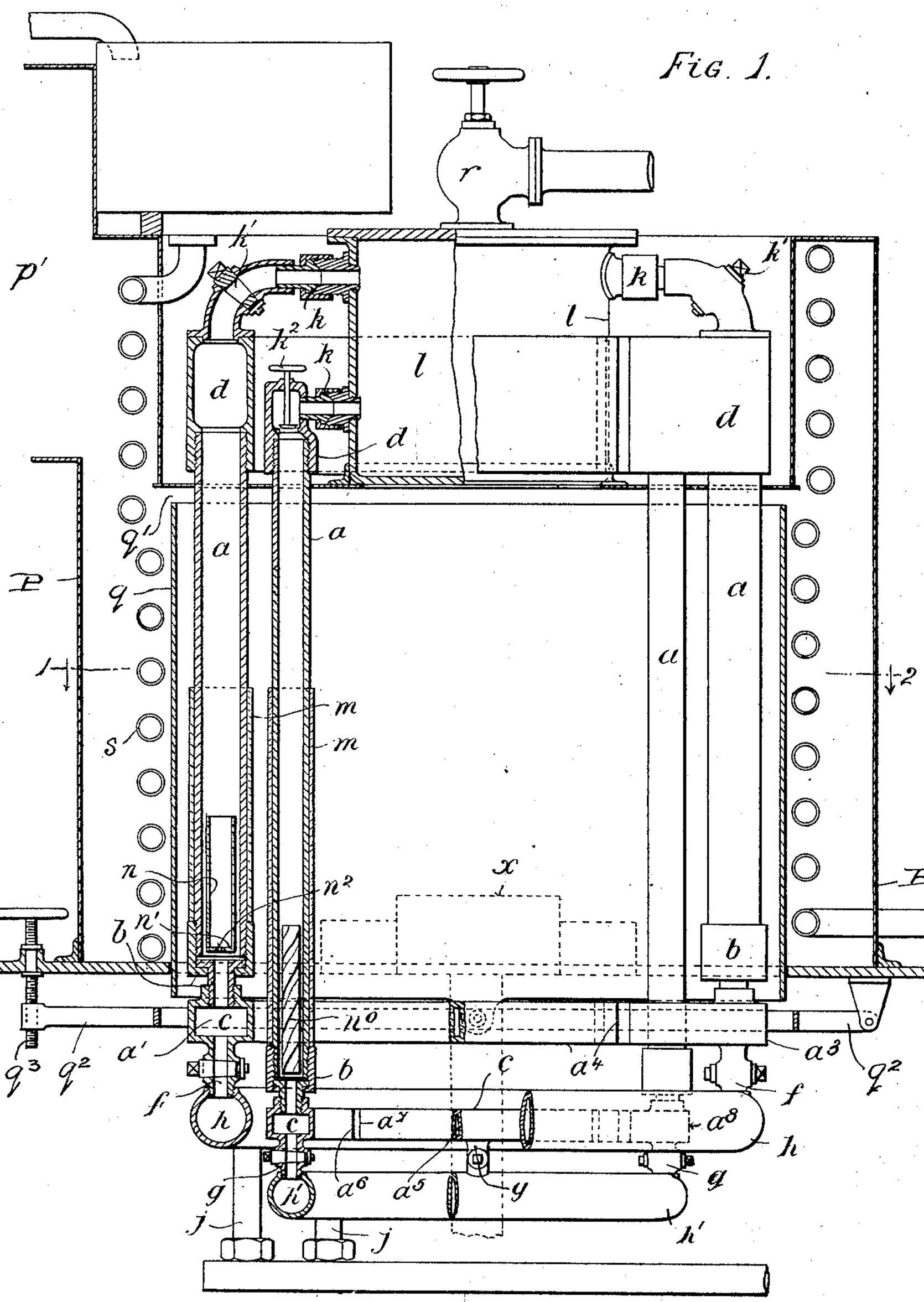
H. J. FISHER.

STEAM GENERATOR.

APPLICATION FILED JULY 5, 1902

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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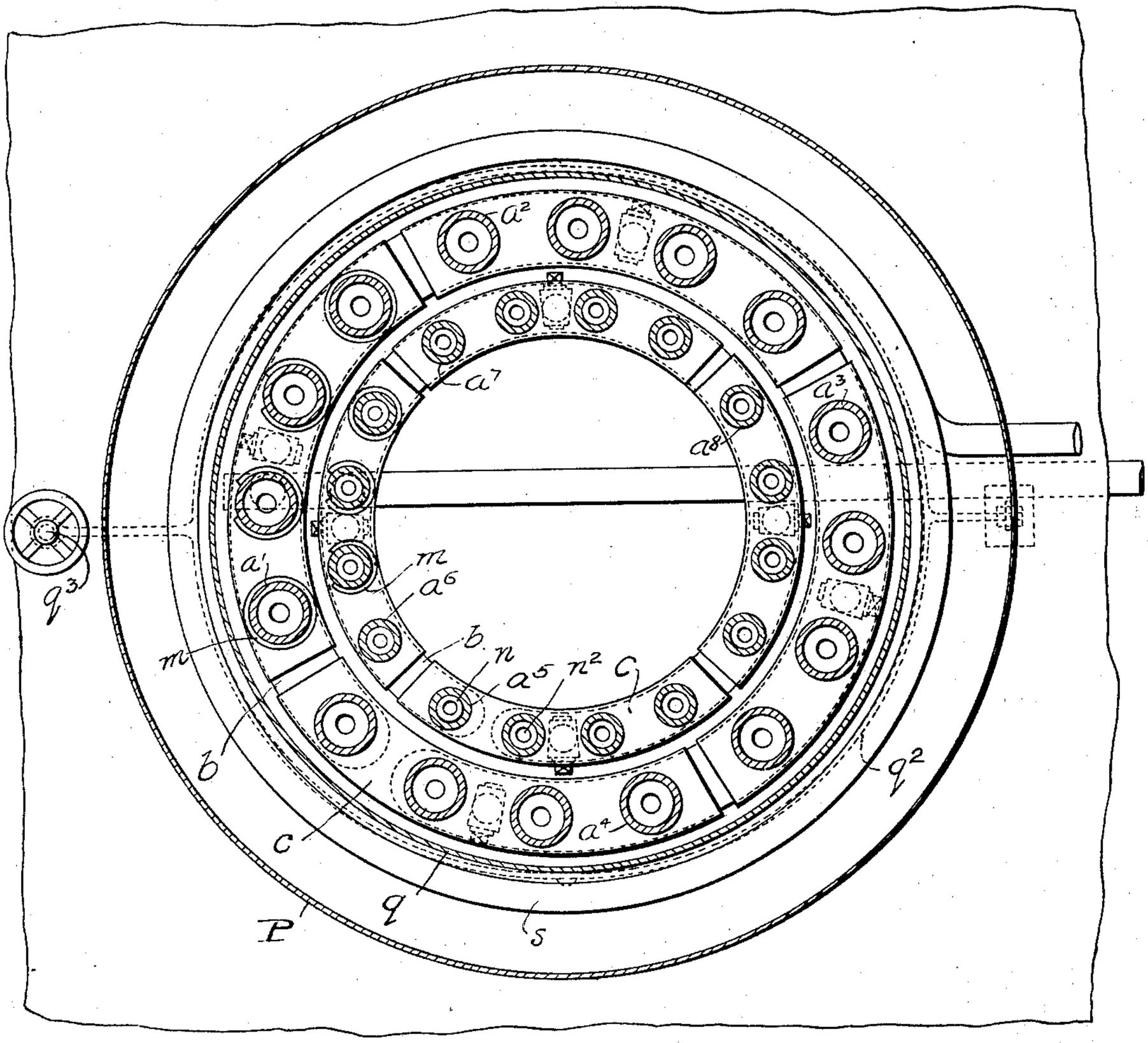
NO MODEL. 3 SHEETS—SHEET 2.

FIG. 2.



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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

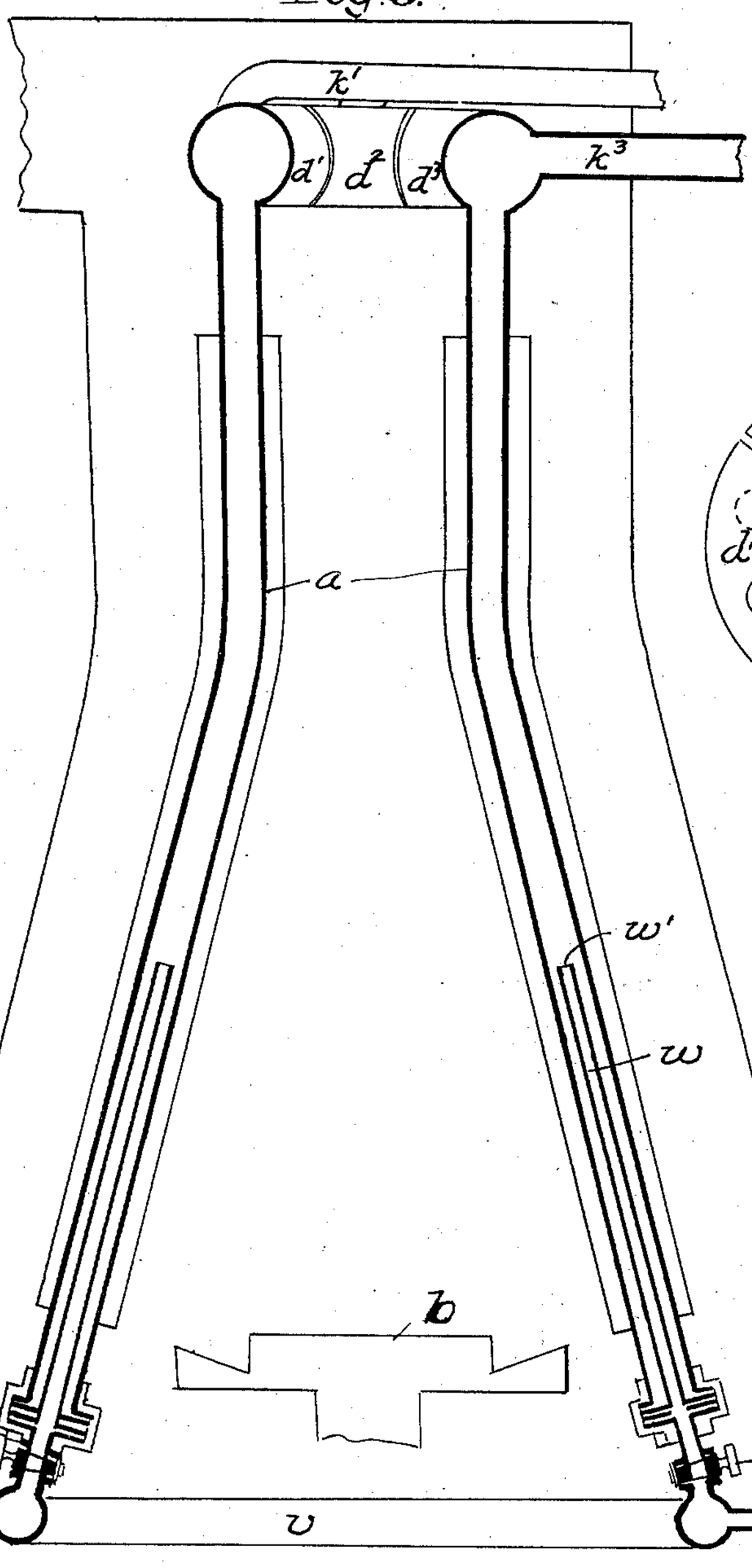
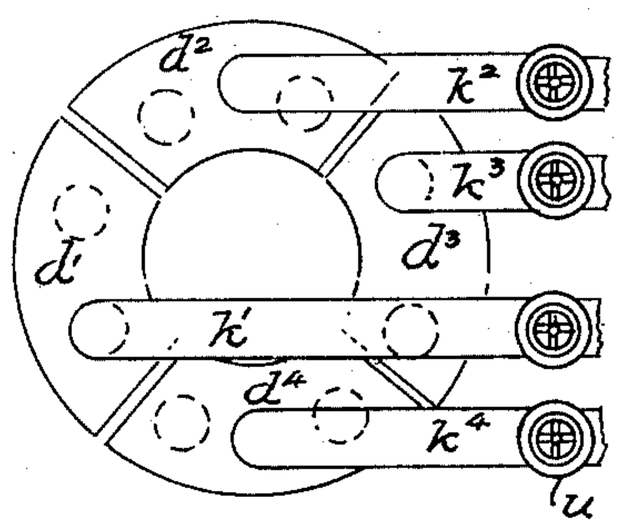


Fig. 4.



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No. 737,727. Patented September 1, 1903.

UNITED STATES PATENT OFFICE.

HENRY JAMES FISHER, OF LONDON, ENGLAND.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 737,727, dated September 1, 1903.

Application filed July 5, 1902. Serial No. 114,494. (No model.)

To all whom it may concern:

Be it known that I, HENRY JAMES FISHER, engineer, of 102 Shooter's Hill road, Blackheath, London, England, am in possession of an invention for Improvements in Steam-Generators, of which the following is a specification.

This invention relates to steam-generators of that type known as "instantaneous" steam-generators and used for motor-vehicles. The difficulty hitherto experienced with steam-generators of this type is that the steam is not produced in sufficient volume, although produced rapidly, but in a comparatively small volume, this difficulty being further increased by the necessarily small dimensions of the generator used for motor-vehicles.

The object of this invention is to provide a generator of small dimensions adapted to generate a comparatively larger quantity of steam in a given time than such generators as hitherto constructed. To this end I divide up the tubes into groups, sections, or single tubes with a water-jet to each tube, group, or set of tubes. A suitable stop cock or valve is or may be provided on the steam connection between each tube or set of tubes, and a suitable stop cock or valve is also provided on the water connection on both sides of any tube or set or group of tubes, so that such tube or set can be quickly and completely cut off—say for cleaning or repairs—from the remaining set, which can continue to be worked efficiently for steam-generating purposes. Further, the said steam-generating tubes are inclosed individually or in sets or groups or as a whole by a protecting casing or casings or tubes, the space between the said inclosing tubes or casings and the tubes being filled with a refractory material, if required. I also provide in connection with the tubes of said steam-generator an inner tube fitted loosely or otherwise at or about the inlet and serving to distribute the inflowing water, for which purpose the outer or outer and inner surfaces of said tube may be grooved spirally or be provided with spiral projections.

The accompanying drawings illustrate one form of steam-generator made in accordance with my invention.

Figure 1 is a vertical section. Fig. 2 is a plan in section on line 1 2 of Fig. 1. Fig. 3 is a sectional elevation of a modified construction, and Fig. 4 is a plan of Fig. 3.

The steam-generator shown in Figs. 1 and 2 has eight sets of tubes a' to a^8, disposed in two concentric rings, four sets of four tubes on the outside and four sets of four tubes on the inside, each of the inside tubes being of slightly smaller diameter than that of the outside tubes. The said tubes surround a central burner x, which is usually an oil-burner, such as shown. a a are the tubes, each set of four being connected separately by union-joints b (see Fig. 2) to a box or chamber c at their lower end, and said set are screwed direct into a similar box or chamber d at their upper end. Both the inner and outer sets of tubes are provided with similar connecting or grouping boxes or chambers c, and these boxes at the lower end are each connected at suitable points, as at f on the outer ring and g on the inner ring, to tubular rings or water-feeding pipes h h'. These pipes are in their turn connected by pipes j j to any usual or suitable feed-pump. The chambers d at the upper ends of the tubes are connected by suitable union joints and pipes, such as k k, to a steam-chest l, disposed centrally over the generator, although it may project down thereinto between the tubes, if desired. Shut-off cocks k' k^2 are provided in the connections k k or in the steam-boxes d. In order to protect the tubes from the great heat of the burner at certain points, they may be provided with protecting-tubes m m, which tubes m may be conveniently formed as split tubes pressed over or around the generator-tubes a, as shown in Fig. 2, or they may inclose the tube entirely, as shown generally in that figure. The space between the tubes a and the protecting-tubes m may be filled with a refractory material, although in most cases this will not be necessary. n is a small tube of suitable length adapted to fit loosely within the steam-generator tubes a. The base n' of this tube n is closed except for a small central aperture n^2 and rests directly over the inlet or nozzle o, where the water passes into the tube, so that the said inner tube acts as a means for spreading or dividing up the water as it enters the tube a, and to further facilitate this operation the outer faces of the tube n may, as shown at

n^0, Fig. 1, where a tube is shown in elevation, be grooved spirally or otherwise. The whole of the generator is inclosed in a suitable casing P, in the upper part of which is located a flue p'. Just outside the outer ring of tubes is disposed a damper q in the form of a cylindrical casing inclosing the tubes and mounted so as to slide up and down and open and close the exit q' between its stop and the casing, thereby regulating and adjusting the draft. This damper may be conveniently operated by a lever, such as q^2, pivoted to the casing P, adapted to be locked in the position to which it is moved, for which purpose it may be operated by a screw, as at q^3. r is the valve through which the steam is drawn from the generator to the engine. In order that the feed-water may be efficiently heated, the tank from which the supply is drawn is connected to the feed-pump through a coil of heating-tubes s, which can be conveniently placed inside the generator-casing, as shown. In operation the tubes of generator are heated by the means provided and may even be heated up to a dull-red heat. Then by means of a hand-pump a small quantity of water is forced into the tubular rings h h', from whence the water passes by the connections f and g into the grouping-boxes c and thence through the connections into the bottom of each steam-generating tube a. On entering the same the water encounters the base of the inner tube n and is spread out, thereby passing up between same and the inner walls of the steam-generating tubes until it passes the end of the inner tube, where, if not previously, it is at once converted into steam by the heat of the tubes and is conducted away through the boxes or collecting-chambers d and connections k to the steam-chest l, from whence it is drawn off by the stop-cock r to the engine, as required, in the usual manner. The hand-pumping is continued until the required pressure in the steam-chest is reached. The steam-pressure in the generator is afterward maintained by the engine driving a small pump, as usual, and continuously pumping water into the generator. A diaphragm-regulator may be use to release the check-valve of the pump when the required pressure is reached, so that when the required pressure is reached the pump drives water back into the feed-tank. When the pressure in the generator falls, the diaphragm-regulator allows the check-valve of the pump to close, and the pump drives water into generator. The small hole n' in the base of the inner tube n allows a certain amount of water to pass to the inside of the tube n and displace any air that may be contained therein. The damper q is regulated as required by the lever q^2 in the manner described. Should any of the tubes give out from any cause, such as burning or otherwise, they can be readily replaced by others by disconnecting the union-joint at their lower ends and putting a new tube in its place, or, if required, in order to enable the boiler to go on working a set or sets of tubes may be cut off from the water-supply and rendered inoperative by closing the water-cocks in the connections f or those in the connections g and steam-cocks k' or k^2, as the case may be, thus completely isolating the damaged group of tubes.

Referring now to Fig. 3, which shows a modified construction, a a are the steam-generating tubes arranged in four sets of two tubes each. These tubes are connected at their upper ends to chambers d in a similar manner to the construction shown in Fig. 1, and each chamber d is connected by separate pipes k' k^2 k^3 k^4 to a common discharge-pipe. (Not shown.) Each of the branch pipes k' k^2 k^3 k^4 is provided with a separate stop-cock u, so that each set may be disconnected as required. In this construction the generating-tubes a are arranged somewhat in the form of a truncated vertical cone or pyramid around a central burner or furnace b, and the tubes are connected together at their lower ends by means of a circular pipe or hollow ring v, into which feed-water is admitted at one or more points v'. A stop-cock v^2 is provided for each tube, or, if required, for each pair of tubes, and corresponding to the grouping at their upper end. Each steam-generating tube a of a set may be constructed as a single or a compound tube, but is preferably constructed with an inner feed-tube w, surrounded by and delivering into an outer steam-generating tube a. The feed-water passes first into the inner tube and out thereof at its open end w' into the outer tube, where the steam generated therefrom passes off to the main steam-pipe. The steam-generating tubes a may be surrounded or inclosed by other tubes, such as m, with or without the intervening spaces being filled with refractory material or metal filings, &c., said inclosing tubes preventing overheating of the steam-tubes. Generally the nature of the material of the tubes which surround the steam-tube and the material used in the intervening space will depend on the kind of fuel employed in the furnace. In some cases instead of each tube being inclosed in a separate protecting-tube, as described, they may be inclosed in a common outer casing and suitably packed with refractory material.

The operation of the construction shown in Figs. 3 and 4 is similar to that described with reference to Figs. 1 and 2, with the exception that in this case no damper is shown and a stop-cock is provided between the water-supply and each separate tube. It also differs in that the water-supply passes up within the inner tube instead of outside same.

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

1. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper ends of said tubes and connecting the same in groups, a

steam-chest, connections between said boxes and said steam-chest, water-boxes at lower ends of said tubes connecting the same in groups corresponding to the upper boxes, water-injecting nozzles on said water-boxes, one nozzle to each tube, a tube within the steam-generating tube and resting over the nozzle, a closed end to said inner tube with a central perforation over said nozzle, a burner for heating said steam-generating tube, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated all substantially as and for the purpose set forth.

2. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper end of said tubes and connecting the same in groups, a steam-chest, connections between said boxes and said steam-chest, water-boxes at the lower ends of said tubes connecting the same in groups corresponding to the upper boxes, water-injecting nozzles on said water-boxes one nozzle to each tube, a detachable union-joint between the nozzle and tube, a tube within the generating-tubes and resting over the nozzle, a closed end to said inner tube with a central perforation over the nozzle, grooves on the external surface of said inner tube, a burner for heating said steam-generating tubes, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated substantially as and for the purpose set forth.

3. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper ends of said tubes, and connecting the same in groups, a steam-chest, connections between said boxes and steam-chest, water-boxes at lower ends of said tubes connecting the same in groups corresponding to the upper boxes, water-injecting nozzles on said boxes, one nozzle to each tube, a cylindrical damper around said tubes, means for opening and closing the damper, a burner for heating said steam-generating tubes, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated all substantially as and for the purpose set forth.

4. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper ends of said tubes and connecting the same in groups, water-boxes at lower ends of said tubes connecting the same in groups corresponding to the upper steam-boxes, water-injecting nozzles on said water-boxes, one nozzle to each tube, a tube within the steam-generating tube and resting over the nozzle, a closed end to said inner tube with a central perforation over said nozzle, grooves on the external surface of said inner tube, casings inclosing said steam-generating tubes, a burner for heating said steam-generating tubes, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated, all substantially as and for the purpose set forth.

5. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper ends of said tubes and connecting the same in groups, a steam-chest, connections between said boxes and said steam-chest, water-boxes at lower ends of said tubes connecting the same in groups corresponding to the upper steam-boxes, water-injecting nozzles on said water-boxes, one nozzle to each tube, a detachable union-joint between the nozzle and tube, a tube within the steam-generating tube and resting over the nozzle, a closed end to said inner tube with a central perforation over said nozzle, grooves on the external surface of said inner tube, protecting-tubes inclosing said steam-generating tubes, a burner for heating said steam-generating tubes, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated, all substantially as and for the purpose set forth.

6. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper ends of said tubes and connecting the same in groups, water-boxes at lower ends of said tubes connecting the same in groups corresponding to the upper boxes, water-injecting nozzles on said water-boxes, one nozzle to each tube, a tube within the steam-generating tube and resting over the nozzle, a closed end to said inner tube with a central perforation over said nozzle, grooves on the external surface of said inner tube, casings inclosing said steam-generating tubes, refractory material between said casings and the tubes, a burner for heating said steam-generating tubes, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated, all substantially as and for the purpose set forth.

7. The improvements in instantaneous steam-generators comprising the combination of a number of steam-generating tubes, steam-receiving boxes at the upper ends of said tubes and connecting the same in groups, a steam-chest, connections between said boxes and said steam-chest, water-boxes at lower ends of said tubes connecting the same in groups corresponding to the upper boxes, water-injecting nozzles on said water-boxes, one nozzle to each tube, a detachable union joint between the nozzle and tube, a tube within the steam-generating tube and resting over the nozzle, a closed end to said inner tube with a central perforation over said nozzle, grooves on the external surface of said inner tube, casings inclosing said steam-generating tubes, refractory material between

said casings and the tubes, a burner for heating said steam-generating tubes, a feed-water pipe for connecting the water-boxes to a pump, means for conveying away the steam generated, all substantially as and for the purpose set forth.

8. The improvements in instantaneous steam-generators comprising the combination of a furnace, groups of tubes inclosing said furnace, a steam-receiving box for each group of tubes, a steam-receiver, a separate connecting-pipe between said steam-receiver and each steam-receiving box, a stop-cock on each separate connection, a water-feeding box for each group of tubes at the lower ends thereof, a separate water-injecting nozzle between said water-box and each tube, a detachable union-joint between each nozzle and its tube, a water-feeding ring for a number of water-boxes, a pipe connection between said water-feeding ring and the water-boxes, a stop-cock in each such connection, a distributing-tube of suitable length within the steam-generating tube over the injecting-nozzle, a feed-water pipe for connecting the water-boxes to a pump, all substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY JAMES FISHER.

Witnesses:

HENRY ALLEN PRYOR,

ALFRED B. CAMPBELL.