

No. 752,859.

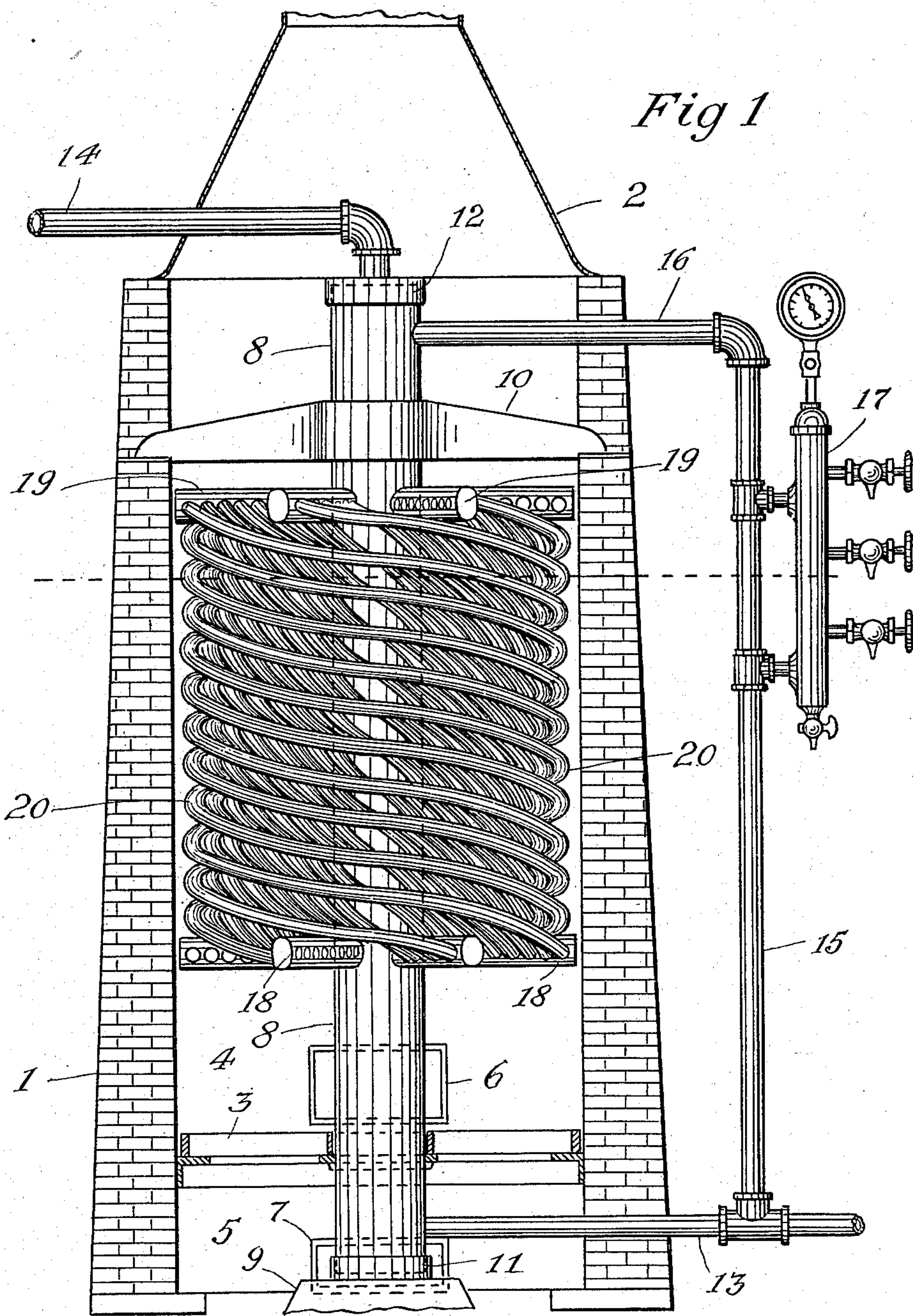
PATENTED FEB. 23, 1904.

H. E. PENNEY.  
STEAM GENERATOR.

APPLICATION FILED SEPT. 29, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses:

*Theo. Lazard.*  
*H. A. Bowman.*

Inventor:

*Herbert E. Penney*  
By *P. H. Gunkel*  
*his Attorney*

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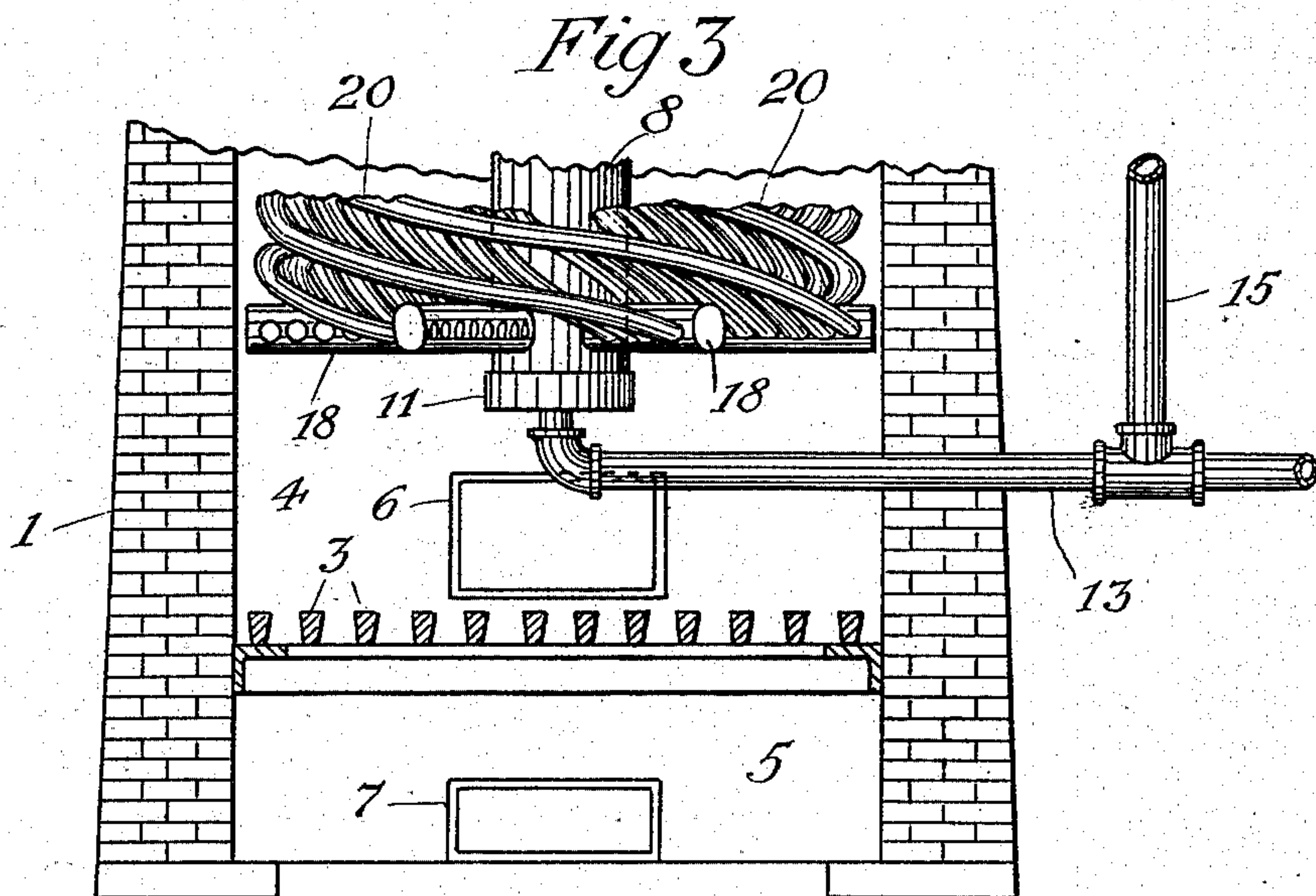
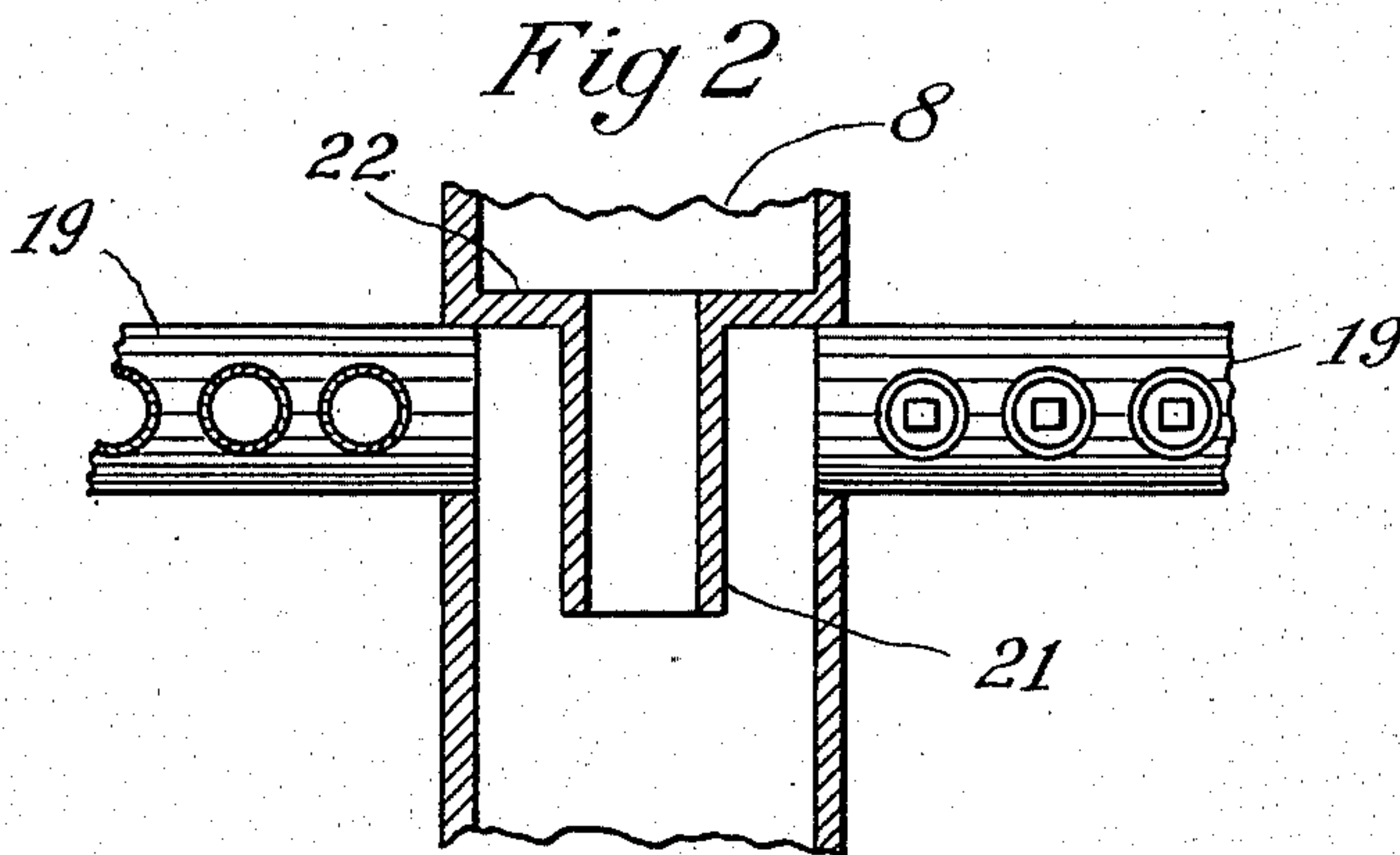
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By *O. H. Gunkel*  
*his Attorney.*



# UNITED STATES PATENT OFFICE.

HERBERT E. PENNEY, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO W. S. NOTT COMPANY, OF MINNEAPOLIS, MINNESOTA, A CORPORATION.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 752,859, dated February 23, 1904.

Application filed September 29, 1903. Serial No. 175,041. (No model.)

*To all whom it may concern:*

Be it known that I, HERBERT E. PENNEY, a citizen of the United States, residing at Minneapolis, county of Hennepin, and State of Minnesota, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to vertical boilers composed mainly of water-tubes and to the means for subjecting them to the heat of a furnace.

In an application, Serial No. 171,725, filed September 3, 1903, I have set forth a form of generator composed of concentric shells and a central column or drum in communication with the water and steam spaces between the shells and a series of tube-sections composed of upper and lower radial headers connected to the drum and water-tubes extending spirally around the drum and connecting the upper and lower headers.

It is the object of the present improvement to dispense with such annular water and steam spaces and substitute for the concentric shells masonry or a shell of any suitable material to house in the drum and tube-sections and to provide other suitable water and steam spaces, and thereby produce an efficient steam-generator that will occupy comparatively little space and economize fuel.

Patentable subject-matter disclosed herein relative to the construction of the drum and tube-sections is reserved to be claimed in the pending application above referred to.

My improvements are illustrated in the accompanying drawings, in which—

Figure 1 shows an elevation of the drum, the tube-sections, and the water and steam connections and a vertical section of the masonry inclosing the generator. Fig. 2 is a steam and water separator employed in the drum, and Fig. 3 shows a modified construction of the generator.

In the drawings, 1 designates a housing of masonry or other suitable material, preferably cylindrical in form, and 2 a smoke-stack thereon. In the lower interior space is a grate 3, above which is the combustion-chamber 4 and below which is an ash-pit 5. Doors 6 and 7 in the casing afford access to the com-

bustion-chamber and ash-pit. In the central space between the walls is a vertical drum or hollow column 8, supported on a base 9 and stayed near the top by bridge-tree 10. The ends of the drum are closed, preferably, by caps 11 and 12, which may be screwed on. Water is admitted to the lower portion of the drum through a pipe 13, and steam is discharged from the head of the drum through a pipe 14. Outside the housing is a vertical pipe 15, the lower end of which is coupled to the pipe 13 and the upper end of which is connected by a horizontal pipe 16 to the upper portion of the drum, and the pipe 15 is provided with the usual gage 17. To the drum are attached headers 18 and 19, the former being located suitably near the grate and the latter far enough below the head of the drum to provide a steam-space intermediate their points of connection and the drum-cap. As shown, six such headers are employed in each series, and the headers of the two series are preferably placed in vertical alinement, and they extend to points near the walls of the casing. Their outer ends are closed, and in cross-section the headers are preferably of oval shape for convenience in attaching the coil-tubes to them.

To each lower header 18 and to the upper header 19, that is in vertical alinement with it, is connected a series of coiled tubes 20, that are coiled two complete turns in their spiral courses between the headers, to which they are connected at corresponding distances from the header ends. It is desirable to use tubes of comparatively small diameter, placed as close together as practicable in order that a considerable number may be employed. In the construction illustrated eight tubes are shown connected to each header, making an aggregate of forty-eight coiled tubes in the boiler, and as such construction has proven satisfactory in use it is suggested as a desirable form for that purpose; but I do not wish to be limited as to the size and number of tubes employed. The tubes of a series connected to a pair of upper and lower headers are coiled concentrically and in parallel courses and are so bent that all of the coils of a se-



ries or tube-section will trend on the same inclined plane, and the tubes of the successive tube-sections are so bent adjacent to their respective headers as that the coils of the successive tube-sections will be disposed equidistantly—that is, will trend in spiral courses on substantially equidistant inclined planes—as indicated in Fig. 1. In such arrangement of the tube-sections the intervening spaces provide spiral passage-ways, through which the major portion of the hot gases take their upward course, but I do not wish to confine myself to a construction in which all of the coils of a tube-section make two turns in their course nor one in which all of the coils of a tube-section trend on a common inclined plane nor one in which the coils of the different tube-sections are arranged on equidistant planes, for in all of these respects the construction may be varied somewhat without changing the character of the generator, although such variations might tend to make a quicker or slower steam-producer by varying the passage-ways of the gases and increasing or diminishing the heating-surfaces of the coils. The coils should be detachably connected to their headers, so that a defective tube can be readily detached and removed by pulling upon it and at the same time twisting it conformably to its spiral shape and position with reference to adjacent coils. The headers should also be detachably connected to the drum 8, so that when freed from the coil-tubes both the coils and headers of a tube-section can be readily removed.

In the upper portion of the drum 8 is provided a separator 21 for the steam and water flowing from the upper headers into the drum. This separator consists of a centrally-disposed short tube having a circular flange 22 at its top, which closes the space between the tube and drum and by which the separator is secured to the inner walls of the drum. This tube being placed opposite the outlets of the headers deflects their discharge downward, causing the water to fall to the water-level below and permitting the steam to rise through the separator to the steam-space in the upper portion of the drum and to discharge through the pipe 14.

In the modified construction shown in Fig. 3 the column terminates a short distance above the grate and immediately below the lower headers and the water-pipe 13 is connected with the column through the base of the cap 11. In this instance the column and tube-sections are supported wholly from the bridge-tree 10. The water-leg is shortened by this arrangement; but the operation of the

generator is the same as in the arrangement first described.

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

1. In a steam-generator, the combination with a suitable housing, of a central vertical drum providing a water-space in its lower portion and a steam-space in its upper portion, suitable water and steam connections, and tube-sections comprising series of upper and lower radially-arranged headers in communication with the drum and series of coils extending spirally around the drum and connecting the upper and lower headers, substantially as set forth.

2. In a steam-generator, the combination with a suitable housing, of a central vertical drum providing a water-space in its lower portion and a steam-space in its upper portion, suitable water and steam connections, and tube-sections comprising series of upper and lower radially-arranged headers in communication with the drum and connected in radial order to the upper and lower headers, substantially as set forth.

3. In a steam-generator, the combination with a suitable housing, of a central vertical drum providing a water-space in its lower portion and a steam-space in its upper portion, suitable water and steam connections, tube-sections comprising series of upper and lower radially-arranged headers in communication with the drum and series of coils extending spirally around the drum and connecting the upper with the lower headers and trending in substantially equidistant spiral courses around the drum, substantially as set forth.

4. In a steam-generator, in combination, a suitable housing, a central vertical drum providing a water-space in its lower portion and a steam-space in its upper portion, a water-pipe and a steam-pipe extending from the drum to the outside of the housing, and tube-sections comprising series of upper and lower radially-arranged headers in communication with the drum and series of coils extending spirally around the drum and connecting the upper and lower headers, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 11th day of September, 1903.

HERBERT E. PENNEY.

Witnesses:

P. H. GUNCKEL,

H. A. BOWMAN.