(No Model.) 2 Sheets—Sheet 1.

C. R. SHEPLER.

STEAM GENERATOR.

No. 490,928. Patented Jan. 31, 1893.

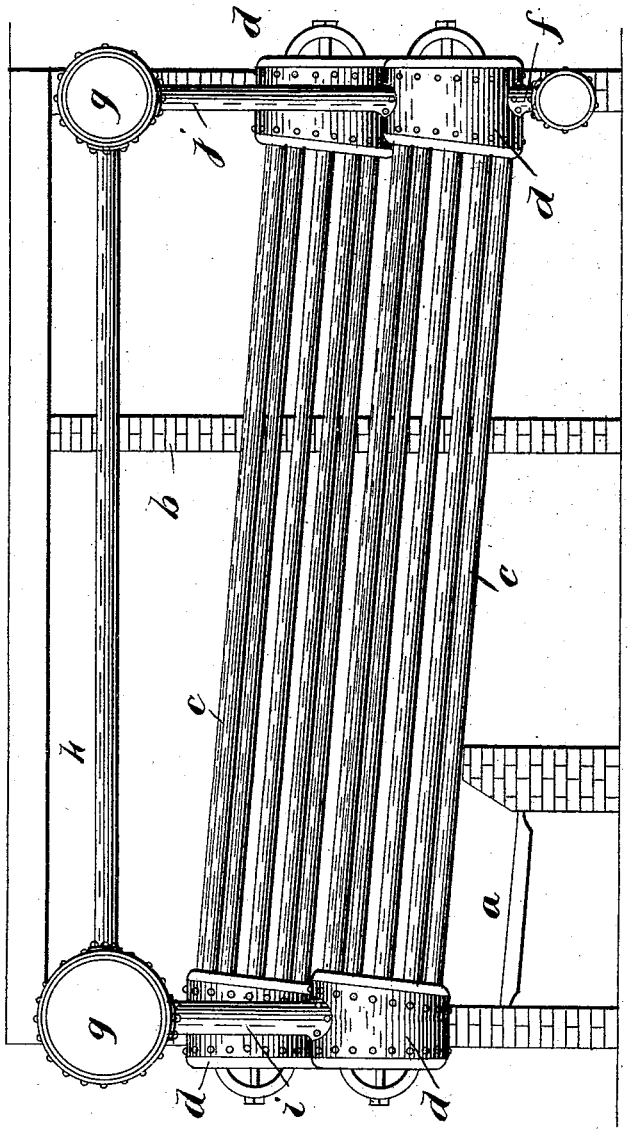


Fig. 1.

WITNESSES:

E. C. Duffy

Chas. M. Keller

INVENTOR

C. R. Shepler

BY O'Duffy

ATTORNEY.

(No Model.) 2 Sheets—Sheet 2.

C. R. SHEPLER.

STEAM GENERATOR.

No. 490,928. Patented Jan. 31, 1893.

Fig. 2.

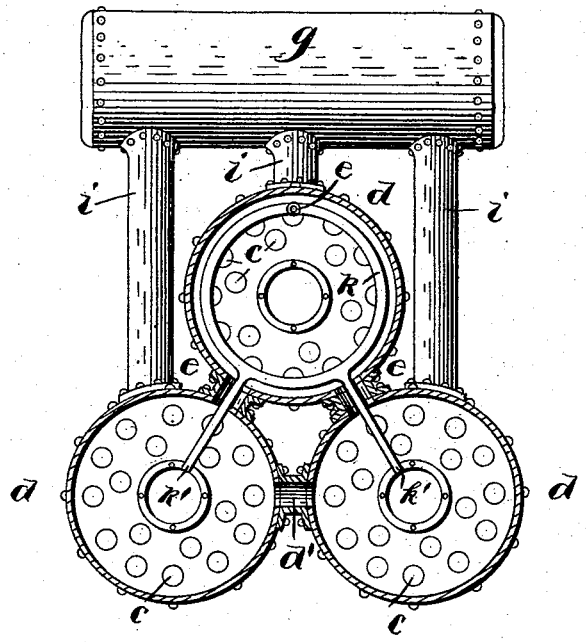
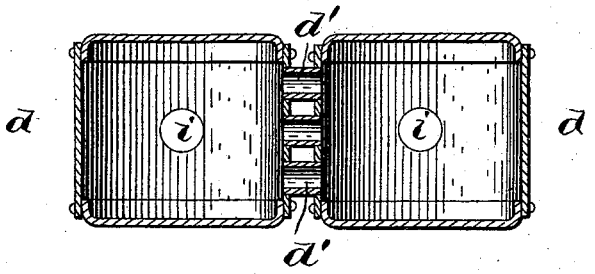


Fig. 3.



WITNESSES:

E. C. Duffy

Chas. M. Perlé

INVENTOR

C. R. Shepler

BY O. E. Duffy

ATTORNEY.

UNITED STATES PATENT OFFICE.

CASSIUS R. SHEPLER, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO W. H. LATSHAW, TRUSTEE, OF SAME PLACE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 490,928, dated January 31, 1893.

Application filed March 11, 1892. Renewed January 3, 1893. Serial No. 457,114. (No model.)

To all whom it may concern:

Be it known that I, CASSIUS R. SHEPLER, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Generators; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification.

This invention relates to steam generators, and although having independent generating cylinders connected together and arranged in sections, is not what is known or termed as a sectional boiler.

The object of the invention is to rapidly generate steam by arranging the heat transmitting plates in such manner that the circulation of the water also promotes its evaporation into steam.

It is well known that when large bodies of water are suspended over the heating surface the steam particles or globules have great difficulty in ascending to the space of the boiler through the solid bodies of water above them, and hence circulation of the water is impeded and generation proportionately retarded. It is also well known that where the steam is kept in contact with the heating plate and its release too long prevented, the transmission of heat is slow, as steam globules are a great many times lighter and less dense than water, and therefore incapable of receiving heat as water would in proportion to its density. Therefore when there is good circulation the steam is quickly released and the water takes its place which is many times more capable of heat absorption than steam, and hence it is that while thin films of water are rapidly evaporated, it is less economical in point of fuel than when a proper body of water is present, in as much as the heat of the plate transmitted to the film is not taken up and passes off, so that for economy in fuel for a rapid generation of steam and for perfect circulation of the water and for a proper release of the steam there must be proper proportion of water space, to the heating surface. Therefore to overcome the above objection and to secure the advantage just specified the nature of my invention is as follows:—

First in locating groups of tubes connected to a cylindrical header, said header being also so connected that neither the heating space nor the water circulating space will be restricted, that the water will have free circulation to the heating surface, and the steam particles free exit to the steam space, secondly, besides connecting the cylinders of the groups laterally and in an inclined position by means of necks composed of tubes expanded therein, or neck connection riveted to both headers respectively. I provide independent steam release for each group of such proportions as will readily relieve the generating group and headers of any steam as fast as it is generated, thus permitting a proportionate body of water to be constantly in contact with the heating plates thereby taking up and receiving all the heat that the said plates are capable of giving, thus quickly and surely replacing the evaporated steam particles with the refined quantity of water without obstruction of its descent, and also without obstructing the ascending steam which goes directly to the steam drum, thus oscillating the evaporation without the delay of retardation as by the old methods.

Third. The invention consists in arranging the steam space with respect to the tubular groups and headers and also in superheating the steam by means of two transverse domes connected by tubes arranged with the walls of the furnace and over the generating tubes and in contact with the products of combustion before the escape to the uptake

Fourth. The invention consists in combining with the rear cylindrical header a feed water heating coil, and pipe which is provided with branches and arranged to enter the rear connecting neck from the inside and extend down to a point below the center of the cylinder, and then deliver the feed water in divided stream and partially heated so that it will not retard the separation of the steam from the water, nor chill the water as it would were it to enter in a cool state, thus supplying the water at such point assists in the displacement of the steam globules and a re-

lease of the steam from the surface of the heating plate and their substitution by water in such condition that ready absorption is produced.

My improved boiler will now be described in detail.

The invention further consists in certain novel features of construction and in combinations of parts more fully described hereinafter and particularly pointed out in the claims.

Referring to the accompanying drawings, Figure 1, is a longitudinal vertical section. Fig. 2, is a partial cross sectional view through the rear heads. Fig. 3, is a detail elevation showing the connecting pipe between two heads in which the tubes are nested.

In the drawings reference letter *a* indicates the furnace of the generator and *b* indicates the bridge wall. The construction of furnace being any suitable or desirable construction, employed and as the construction of furnace forms no part of my invention specific description thereof will be omitted.

c, indicates the water tubes. These water tubes are nested and arranged in sections preferably, three sections, one above the other two, and the sections are inclined from their rear ends upwardly toward the front end of the furnace. The ends of the tubes are suitably secured in front and rear heads as shown located at the front and rear ends of the furnace, respectively. These heads *d* are suitably supported and each head is composed of two flanged round plates banded together by a circular plate, the round plates being riveted to the circular plates thus forming a cylindrical header which is reinforced by two more longitudinal plates of increased thickness in order to give increased stability for the series of tubes which are extended or otherwise suitably secured to the headers. The tubes are preferably secured to the headers, thus bracing the same. Where three sections or series of tubes are employed the two lower sections and their tubes are arranged side by side a suitable distance apart and the other series of tubes and their headers are arranged centrally above the lower series of tubes. Lateral tubes *d'*, connect the lower headers. These tubes are secured by riveting the peripheries of the headers as shown. Water can thus freely flow laterally between the two lower sections of tubes.

e, *e*, indicate diagonal tubes extending from the heads of the lower sections upwardly into the bottoms of the heads of the upper section. These tubes are flanged and secured by riveting as shown. Water can thus flow from either or both of the lower tube sections into the upper tube section.

f, indicates the blow offs from the bottoms of the lower headers.

g, *g*, indicate two horizontal steam drums located transversely of the series of tubes and in the top of the furnace above the same at the front and rear ends thereof. The rear steam drum is preferably somewhat smaller and in a higher plane than the front drum.

h, indicates a series of horizontal tubes extending in the top of the furnace from the rear steam drum to the front steam drum and suitably secured thereto at their ends.

Each header *d*, is connected to the steam drum above the same by means of the vertical tube *i*, extending up from the top of the heater to the under side of the steam drum. Each series of water tubes and each header thus has a direct outflow to the steam drum. A circular or coiled pipe *k*, is located on the upper rear header, and the feed water is fed into the upper portion of the same through pipe *l*. This pipe *k*, has two discharge ends or nozzles *k'* extending down through the inclined connecting tube between the lower and upper headers into the lower headers so as to discharge into the same, preferably, at the point below the centers thereof. The feed water is thus headed and discharged into the rear lower headers at such a point as not to interfere with the free upward movement of the heated water and so as to assist free circulation.

Of course I do not wish to limit myself to any particular manner of securing the various tubes, for if desirable they can be secured by expanding, yet I prefer to secure them by riveting as described, as it usually forms a stronger and better joint and assists in bracing the parts. It should be observed that an almost perfect and free circulation is attained by having the separate and capacious steam outlet for each header and a free discharge from each header to the header opposite it and to the header above it so that the water is heated on the under side of the heaters and in the tubes can freely pass off and permit the cold water to take its place. By this means a continuous and rapid circulation is attained and the steam generated passed off as soon as generated and without the least retardation from any source. By this means, as has been fully set forth, my boiler produces a maximum quantity of steam with a minimum area of heating surface and consumption of fuel. As shown in Fig. 3, a series of lateral tubes can be employed to connect the heaters if desired, although if desired only one tube may be used. The boiler furthermore, is easy to clean and keep in order and can be readily repaired. The headers and other parts are provided with man holes and are constructed in the simplest manner.

It is evident that various slight changes might be made in the form construction and arrangements of the parts described without departing from the spirit and scope of my invention, hence I do not limit myself to the exact construction herein set forth.

Having thus fully described my invention what I claim and desire to secure by Letters Patent of the United States is:—

1. The hereindescribed steam generator consisting of separate adjacent series of tubes,

separate headers for the opposite ends thereof, water tubes connecting all the headers at each end, steam drums transversely arranged above the headers, separate steam pipes from each header to the steam drum above the same, and one or more pipes connecting the steam drums, substantially as described.

2. In a furnace, the series of water tubes, separate headers for each series of water tubes, the headers at each end being connected by water tubes and arranged so that the water freely circulates between all the heads and tubes, the steam drums transversely arranged above the headers, connections from the headers to the steam drums, and series of tubes connecting the steam drums.

3. A steam generator comprising adjacent series of tubes, headers for the opposite ends of each series of tubes, water tubes connecting all the headers at corresponding ends so that the water has free outlet from each header to the other headers, a steam reservoir, and separate outlets from each header to the reservoir, substantially as described.

4. A steam generator comprising adjacent series of steam generating water sections, water pipes connecting corresponding ends of all the sections at both ends thereof so that the water can freely circulate through all of the sections, a steam reservoir or drum and separate steam pipes from the ends of each section directly to said steam reservoir, substantially as described.

5. In a steam generator, the series of nested water tubes, separate headers for each end thereof, the lower headers at each end being connected by lateral tubes, and each lower header being connected with the upper header by an inclined lateral tube, and each header having a separate steam outlet to the steam drum or reservoir, substantially as described.

6. In a steam generator, the series of nested water tubes each series having headers at their ends provided with steam outlets, the headers at corresponding ends connected by water tubes the feed water pipe in one of the upper headers provided with discharge pipes extending through said water tubes into lower headers, substantially as described

7. In a steam generator, a feed water heater in one of the headers of the nest of tubes provided with discharges through the water pipes into the lower headers, said feed water heater discharging at points approximately below the centers of said lower headers substantially as described.

8. In a steam generator, the nested tubes having headers in combination with the feed water heater in one of the headers having discharges into other headers.

9. In a steam generator, the series of nested water tubes having headers connected by lateral tubes, and coiled or circular feed water pipe in the lower header of the upper series of tubes and provided with discharge extending through said lateral pipes into the lower headers substantially as described.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

CASSIUS R. SHEPLER.

Witnesses:
W. H. LAMBERT,
R. B. PHILLIPS, Jr.