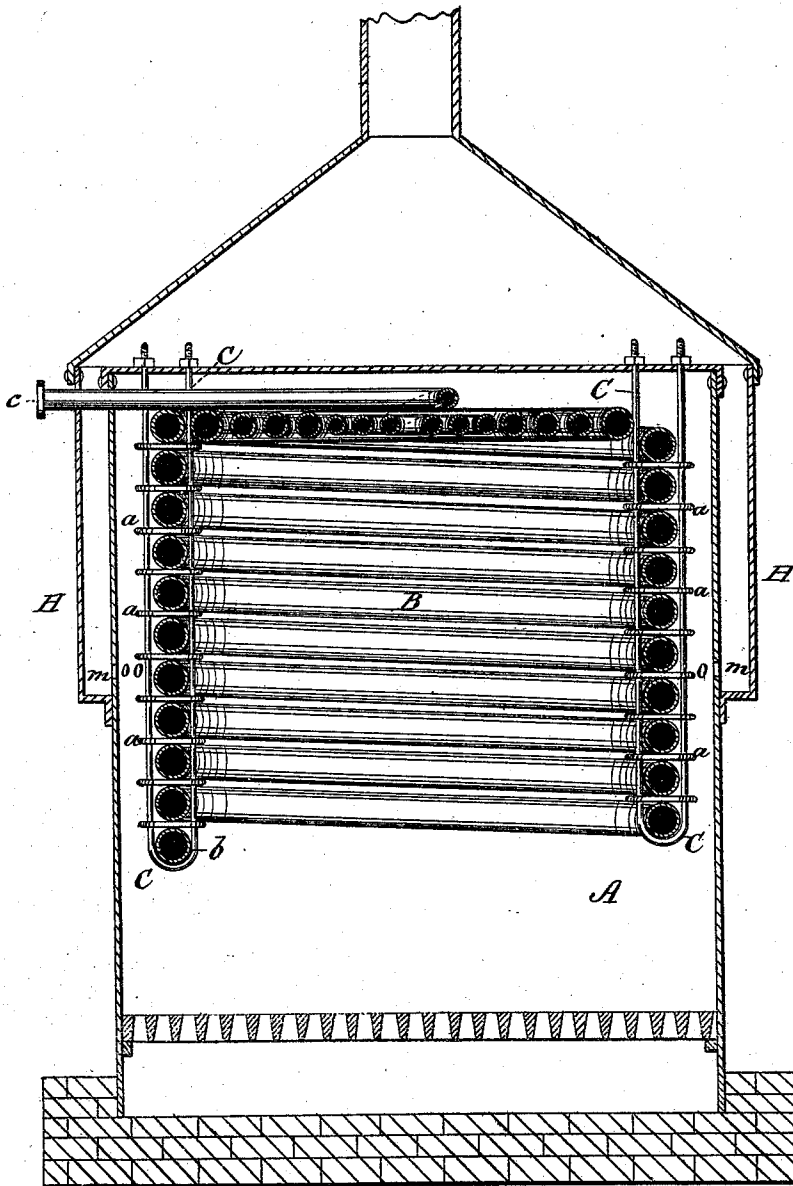


B. S. BENSON.
WATER-COIL STEAM GENERATOR.
No. 177,791. Patented May 23, 1876.

Fig. 2.



WITNESSES:

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BENJAMIN S. BENSON, OF BALTIMORE, MARYLAND.

IMPROVEMENT IN WATER-COIL STEAM-GENERATORS.

Specification forming part of Letters Patent No. **177,791**, dated May 23, 1876; application filed February 16, 1876.

To all whom it may concern:

Be it known that I, BENJAMIN S. BENSON, of Baltimore city, State of Maryland, have invented a new and Improved Steam-Generator; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a vertical front elevation, with a portion of the thermostat in section; Fig. 2, a vertical section.

My invention relates to a novel construction of steam-generator adapted to be also used as a boiler. It belongs to that class of generators in which a cylindrical coil of pipes are employed above a furnace or heating-chamber to generate the steam; and it consists in the construction and arrangement of the coils, which are made to project at one point beyond the containing-shell, and are provided upon the outside of the shell with peculiarly-constructed elbow-joints, which permit the ready removal of defective or worn-out sections of the coil, and also give easy access to the pipes for cleaning out the same.

The invention also consists in the peculiar construction and arrangement, with the coils, of a thermostat or automatic relief-chamber, for the surplus water not evaporated by the generator.

In the drawing, A represents the outer cylindrical shell of the generator, the lower part of which is fitted up for a furnace, with grate-bars and doors, and the upper part of which contains the cylindrical set of coil-pipes B. This coil is supported in pendent loop-rods C, which are attached to the top of the shell by means of nuts, each fold of the coil being supported upon a separating bar or link, *a*, which keeps them all the same distance apart. This coil terminates below in a connection, *b*, and above in a connection, *c*, both of them projecting outside the shell. The connection *c* communicates with the middle of the coil, which, at the top, is drawn inwardly into a series of parallel volute spiral folds of constantly-diminishing diameter, the pipes being made of smaller transverse dimensions to accommodate themselves to being bent into smaller circles. Every other one (or every one, if desired) of

the folds of the coil B is made to project eccentrically through the side of the shell, and are provided with elbow-couplings D, which have flanges at each end, which are bolted to the flanged ends of the coil-pipes. This series of couplings is provided with steam-pipes E and water-pipes F, which are provided with stop-cocks, and are connected, the steam-pipes to the upper portion of the couplings, and the water-pipes to the lower portion of the couplings. The steam-pipes are designed to communicate with a steam-dome above, provided with a supply-pipe for the engine and a return-pipe for the water, which devices are not shown. The water-pipes F connect the lower bellied portion of the couplings with a thermostat. This consists of a cylindrical receptacle, G, having an outlet-pipe, *d*, at the bottom, terminating inside in a valve-seat, *e*, and a valve, *f*, formed upon a rod, *g*, which passes through a packing in the upper end of the cylinder, and is adjusted by means of the frame *h* and nuts *i* upon its screw-threaded end. This rod *g* is made of any metal capable of rapid expansion and contraction from variations in temperature, and operates, by means of this principle, to open or close the outlet.

When the device is to be used as a generator, the water is introduced through the upper connection *c*. The water then, in passing down in the heated coils, flashes immediately into steam, and, for the most part, is dissipated in the form of the aqueous gas, and passes off below through the connection *b* in the bottom of the coil to the steam-dome. In passing down through the lower and hotter part of the coil the steam, by this means, becomes superheated. When it is not desired to superheat it, it can be passed off through pipes E to the steam-dome. A portion of the water, however, will not be evaporated, and will pass down the coil. To carry off this water before it reaches the bottom of the coil, the bottom parts of a portion or all of the couplings are bellied at *k*, and a thimble, *l*, placed between the bellied end and the end of the coil-pipe. This forms a trap which catches the water and carries it away through pipes F, which are connected with the lower bellied portion of the couplings. The water, which

thus passes through the coils without being evaporated is conducted to the thermostat, which operates as an automatic relief-chamber for the water without the escape of the steam.

The valve-rod in the thermostat is first adjusted to its proper position. Then, when the water which accumulates in the chamber rises upon the valve-rod, it, being colder than the steam, causes the latter to contract, and, becoming shorter, it raises the valve, so as to let the water escape through the outlet. Then, as the chamber becomes filled with steam, the higher temperature of the latter causes the valve-rod to expand, and, being made longer, brings the valve upon its seat, thus closing the outlet. As the water again accumulates in the chamber the same operation is repeated, and the device is thus rendered automatic in its operation.

When the generator is used as a boiler the water is pumped in at the lower coil-connection *b*, the thermostat is disconnected, and the couplings *D*, having bellied portion *k*, are reversed, and their pipes *F* turned upward. These pipes, in this position, become steam-pipes, and are connected with the steam-drum, as are also the pipes *E* and *c*. By means of this arrangement steam can escape from any portion of the coil as fast as it is generated.

To carry off the smoke and gases from the furnace, the upper portion of the shell is perforated at *m*, and a metal jacket, *H*, is made to encompass the shell, so as to leave an annular flue around the top of the shell, which converges above the same into a smoke-stack.

I am aware of the fact that steam-generators have been constructed heretofore with a coil contained within an outer shell, and I therefore do not claim such broadly.

My arrangement of the coil and the attachments to the same, it will be seen, secure very great advantages, for the reason that any section of the coil may be readily repaired with-

out troubling the others, and the couplings outside the shell permit the ready introduction of the scraper for cleaning out the pipes, which could not be accomplished with the old forms of coils except with great trouble and inconvenience.

Having thus described my invention, what I claim as new is—

1. In a steam-generator, the combination, with a cylindrical containing-shell, of a spiral coil of pipes projecting eccentrically upon one side through the containing-shell, and provided at such points with detachable couplings, substantially as and for the purpose described.

2. In a steam-generator, the combination, with the spiral coil of pipes projecting eccentrically through the containing-case, of pipes *E* and reversible couplings *D*, provided with pipes *F*, as and for the purpose described.

3. The combination of the couplings *D*, bellied at *k*, with the water-pipes *F*, as and for the purpose described.

4. The combination of the couplings *D*, bellied at *k*, and the coil-pipes *B* of the interposed thimble *l*, as and for the purpose described.

5. The combination, with the coil *B*, bellied couplings *D* and water-pipes *F*, connected with the coil, of the thermostat, consisting of the receptacle *G*, having outlet *d* and valve-seat *e*, the rod *g*, made of readily-expandible metal, and carrying-valve *f*, the frame *h*, and adjusting-nuts *i*, as and for the purpose described.

6. The combination, with the coil *B* and the upper part of the shell, of the pendent loop-rods *C*, provided with alternating links *a*, as and for the purpose described.

BENJAMIN S. BENSON.

Witnesses:

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