2. Sheets, Sheet 1.

S. L. Wiegand,

Sectional Boiler.

No. 104,522. Patented June 21, 1870.

fig. 2.

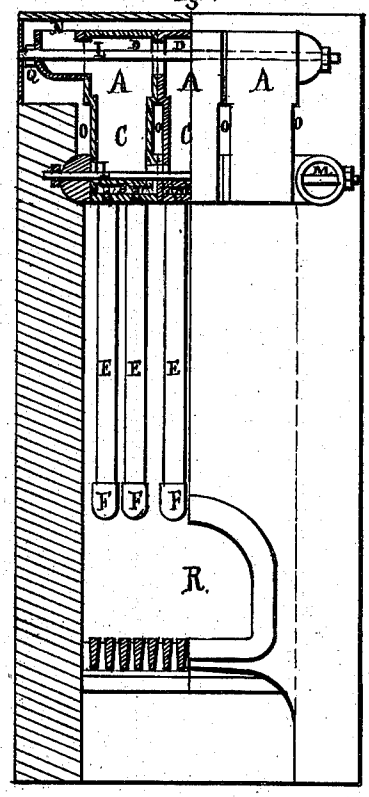


fig. 3.

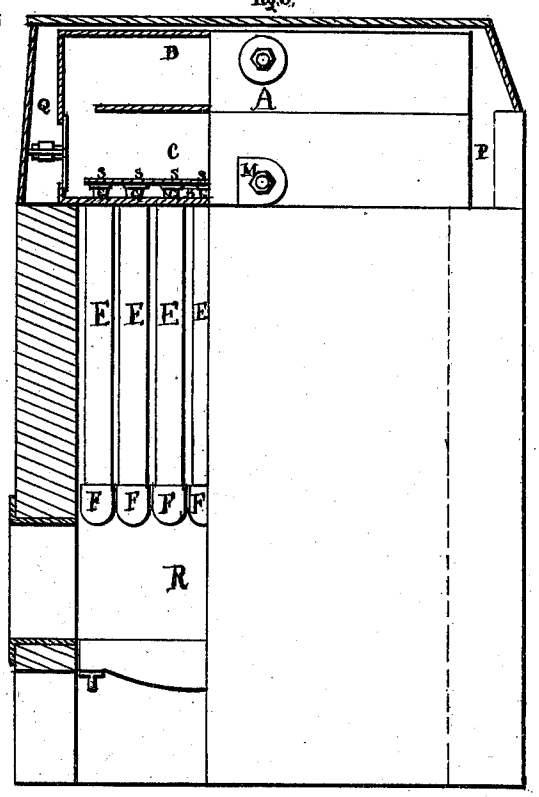


fig. 1

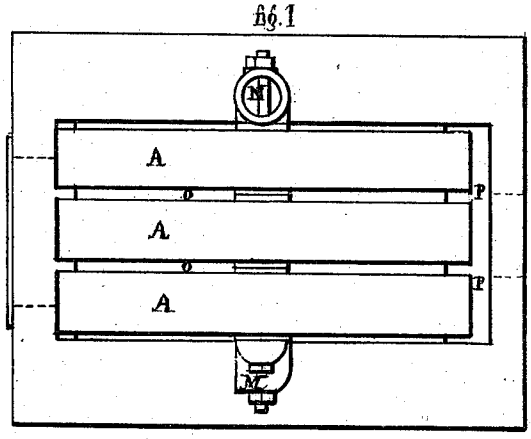
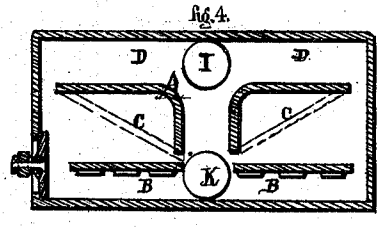


fig. 4.



Witness.

John B. Devine

Wm. F. Johnson

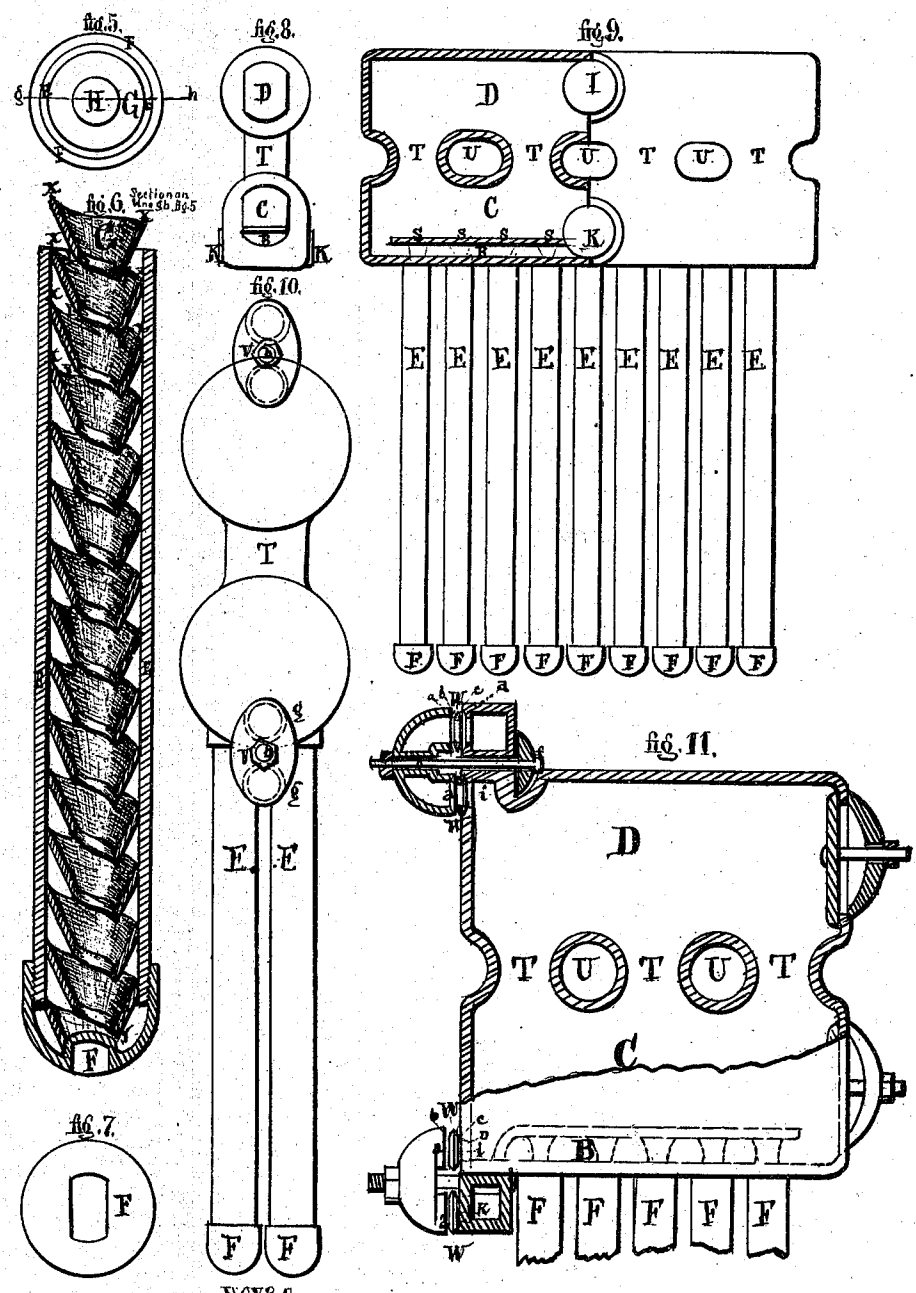
S. Lloyd Wiegand

S. L. Niegand,

2. Sheets, Sheet 2.

Sectional Boiler.

No. 104,522. Patented June 21, 1870.



Witness,

John B. Devine

Wm. A. Johnson

S. Lloyd Niegand

UNITED STATES PATENT OFFICE.

S. LLOYD WIEGAND, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-GENERATOR.

Specification forming part of Letters Patent No. **104,522**, dated June 21, 1870.

To all whom it may concern:

Be it known that I, S. LLOYD WIEGAND, of the city of Philadelphia and State of Pennsylvania, mechanical engineer, have invented a certain new and useful Steam-Generator; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing and letters of reference marked thereon.

The nature of my invention consists in providing, in that class of steam-generators which are composed either in part or chiefly of tubes containing water and exposed in vertical or inclined position to the action of heat, an apparatus which maintains the circulation of water in the tubes after the level of water has fallen below its normal position, and increasing the steam and water capacity of such steam-generators without occupying more space or impairing the safety thereof; also, forming the tanks of such boilers in compartments, so that a circulation is maintained in them and cleanliness of tank thus maintained, and a better supply of water to the descending currents in the tubes insured.

I will now proceed to particularly describe the construction of this invention, referring to the drawing annexed, forming part of this specification.

The same letters of reference apply to the same parts in the several figures.

Figure 1 shows a plan. Fig. 2 shows a front elevation, partly in section, on the line *a b c*, Fig. 1. Fig. 3 shows a side elevation, partly in section, on the line *a d e*, Fig. 1. Fig. 4 shows one of the tanks in longitudinal section. Figs. 5, 6, and 7, respectively, show a top, vertical section, and bottom view of one of the tubes. Figs. 8 and 9, respectively, show an end view and partially sectional side elevation of one of the tanks of a modified form, with the tubes attached.

A A A represent steam and water tight tanks, formed in three compartments, B C D, which compartments are in free communication with each other at the ends, and also at the center, although they may intercommunicate at intermediate points, as is shown in Figs. 8 and 9. Into the bottoms of the tanks, securely inserted by screwing or otherwise, are tubes E E E E E E, which tubes E are closed at the lower ends by means of caps F, or by welding them up. Inside of each of the tubes E, and extending up from the bottom of the cap nearly or quite up to the top of the lower compartment, B, of the tanks A, are flexible helical guides G, (best seen in the section, Fig. 6,) in the center of which helical guides G there are clear channels H, leading from top to bottom, within the coils of the helices G. These helical guides G are so formed that the outer portion or periphery, X, is higher than the inner portion, Y, which bounds the channels H, when measured on the same radial line, being inclined in a curved line obliquely upward from their axes. This will appear most clearly upon inspection of Fig. 6. The several coils of the helices do not touch each other, but have a helical space between them.

Directly over each of the tubes E, and leading downward to the central channels, H, in the helical guides, are funnel-shaped apertures S in the partition between the compartments B and C.

The several tanks A A A are connected together by necks I and K, which are faced off so as to fit accurately to each other, and are held together by rods L, with nuts screwed upon the ends. Upon the same rods L the water-inlet and steam-outlets are secured, although steam may advantageously be taken, when the number of tanks is large in any one bed, by attaching pipes near the center to the upper portion of each tank.

The lower necks, K, through which water is introduced in the lower part of the tanks, are in such position relatively to the two lower chambers that feed-water introduced passes directly to the central chamber, C, and there mingles with the water that passes down the funnels S to supply the tubes E through the channels H, and when the tanks are being emptied the water from the chamber B passes out readily.

The upper neck is placed relatively to the lower neck, so near that the expansion of the intervening metal does not cause any difficulty in preserving tight joints between the tanks, but is as remote from the point of the introduction of the feed-water K as it can be when measured in the direction of the current flowing from the feed-inlet K to the steam-outlet I.

The connections between the several tanks need not be made centrally to fulfill the requirements of this invention, it being only

necessary that the steam-connection and water-connection should be near enough to each other not to make any appreciable difference in the fitting of the joints from the expansion and contraction of the intervening metal, and the point from which the steam is drawn made remote from point of introduction of the feed-water, when measured in the direction of the flow of currents produced by the application of heat.

In Figs. 10 and 11 a tank is shown in which the steam and water connections are at the end instead of upon the sides.

The ends of the return-bend V are made with spherical or spheroidal concave bearing-faces, (marked *a a*,) and fit upon corresponding-shaped convex bearing-faces *b b* on the thimbles or short tubes W, the other ends, *c c*, of which thimbles W are shaped the same as *b b*, and fit upon bearings *a a*, formed in the openings I and K in the tank.

The return-bends V are held in position by means of bolts *e e*, passing through the tubular aperture *h*, which divides the channel of the bend V, as shown in the dotted lines below and in section above in Fig. 11. The bolts *e e* are fastened to the tanks by means of lugs *g g* cast upon them, as shown in the lower part, or by means of a clamp, *f*, inserted into a pocket or recess formed in the tank, as shown in the upper part.

Gaskets or packings are placed between the bearings *a* and *b* and *c* and *d*, and secure and tight connections of great flexibility are thus made, which may be rendered even more flexible by using spring-washers between the nuts of the bolts *e* and the return-bends V. This is, however, only necessary where the joints are liable to great strains and concussions, as is the case with locomotives and marine boilers.

The dotted lines in Fig. 4 show a modification of the form of the chambers C and D, made by inclining the bottom of D and top of C toward the water-inlet.

The tank shown in Figs. 8 and 9 is made cylindric in most of its parts, and is of greater strength than the square tank of the same weight and capacity, besides offering a larger surface for superheating, and offers an advantage of easier connection to the chimney-flue through the spaces U between the upright connections or necks T.

The tanks A are made narrower at the bottom than they are at the top, leaving spaces O O between the lower portions of them, through which the products of combustion pass to the flue P, leading to the chimney.

The upper portion of the tanks A is covered by the plates Q Q, which protect them from loss of heat by radiation, and form a chamber around them, which is kept supplied with the heated products of combustion from the fuel in the furnace R, which pass through the narrow interstices between the tanks A, and thus heat the tanks.

The water in this generator is supplied when in use until it reaches nearly or quite to the center of the upper compartment, D, and may be evaporated, without detriment, to the bottom of the compartment C.

When heat is applied to the generator by fire being made in the furnace, the water contained in the tubes E in the helical space or channel between the coils of the guides G becomes lighter by being heated, and rises and is replaced by a current descending in the channel H, through the funnel-shaped apertures S, from the chamber C, and the supply to the chamber C is maintained by the rising current from the tubes passing in the direction of the arrows in Fig. 4 from the chamber B, through the chamber D, and down to the chamber C. This circulating action accelerates until steam is formed, when it becomes quite violent, the steam being liberated from the water in the chamber D.

If the water-supply is neglected when the water has been evaporated so far that it does not reach the tank A, a circulation of water takes place from the helical spaces between the coils of the guide and the vertical channel H. This action continues until the water is entirely evaporated from the tubes.

In boilers composed of double tubes the circulation ceases so soon as the upper portion of the internal tubes is uncovered with water, and the steam formed in the lower part of the tubes expels all the water from them violently, and the external tubes frequently become warped or bent from their proper form, so that the internal tubes are no longer concentric with the external tubes, and the generator is rendered unfit for use until repaired.

In this invention, should the tubes E become warped or bent, the spiral guides, being flexible, remain concentric with them, the water-level is ascertained, and the steam-pressure regulated, and the water-supply introduced, and the water blown off for the purpose of keeping the boiler clean by the same appliances that are in general use for other steam generators or boilers.

The tanks formed in compartments as I have described may be used with cylindric or prismatic tubular guides, instead of the spiral guides that I have described within the tubes E E.

I do not herein claim to have invented a sectional boiler with tubes suspended in the furnace; nor do I broadly claim to have invented spiral guides for use in such tubes, they having, as I am aware, been proposed in combination with the internal tubes of double-tube boilers; but

What I do claim as my invention, and desire to secure as such by Letters Patent, is—

1. Steam-generating tubes provided with helical guides of uniform or varying pitch when formed with a central channel, H.

2. The combination of the tubes suspended in the furnace with the tanks formed into intercommunicating compartments, so as to produce a circulation of currents in the tanks.

3. The flues formed between the tanks, dis-

tributing the effect of the draft over the entire grate, in combination with the suspended tubes supplied with water through internal guides from the upper vessel, and placed in the furnace, as described.

4. The feed-inlet in the compartment supplying water to the guides, located near to the steam-outlet and remote from the rising current from the lower compartment.

5. In boilers formed of tubes suspended from tanks formed in compartments intercommunicating with each other, so locating the steam-outlet as to draw the steam from the upper chamber at a point remote from the rising current or currents discharged from the lower compartment into the upper compartment.

S. LLOYD WIEGAND.

Witnesses:
WM. P. THOMPSON,
ADAM J. BOSWELL.