

No. 727,481.

PATENTED MAY 5, 1903.

S. STOIANOFF.
LOCOMOTIVE BOILER.

APPLICATION FILED APR. 12, 1902.

NO MODEL.

5 SHEETS—SHEET 1.

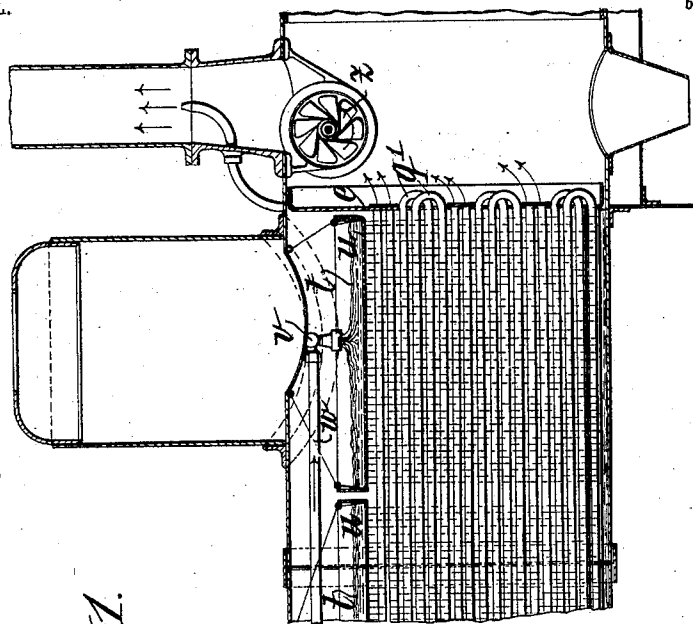
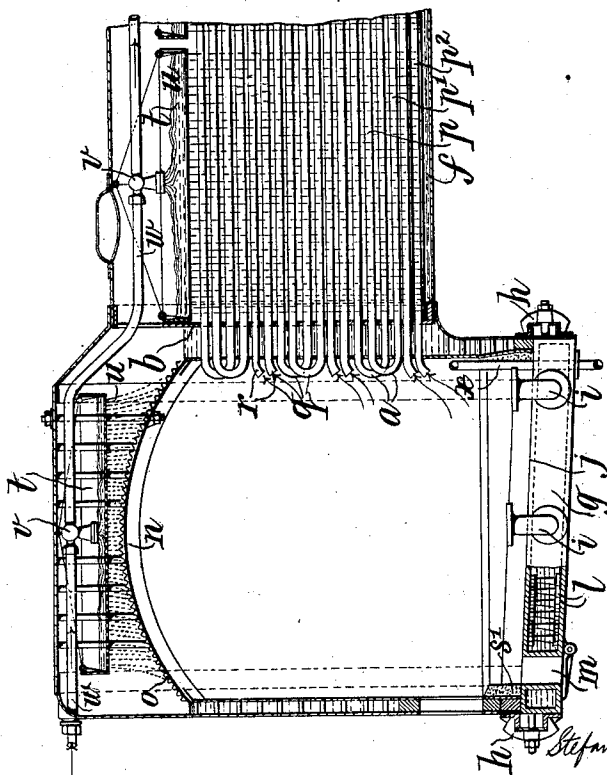


Fig. 1.



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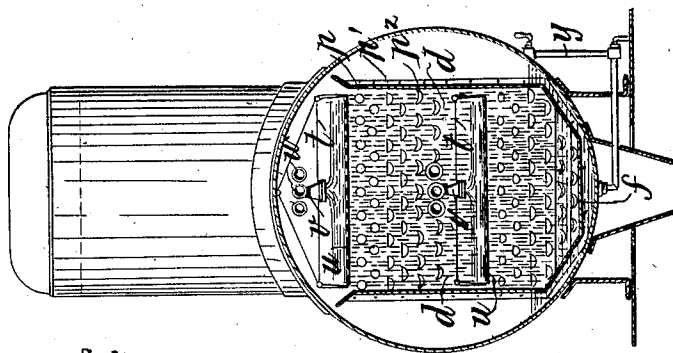


Fig. 6.

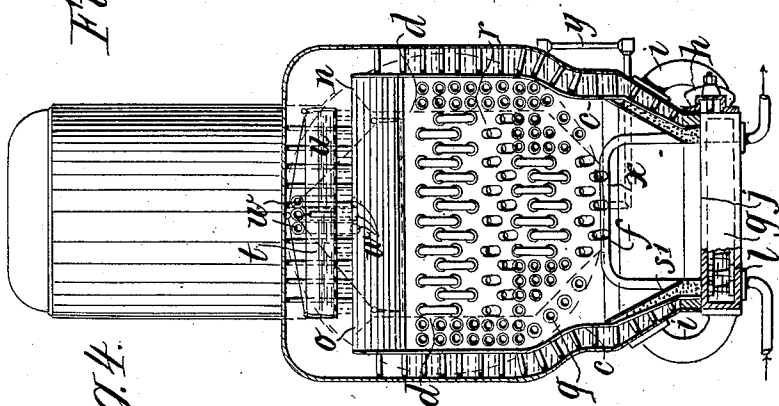


Fig. 4.

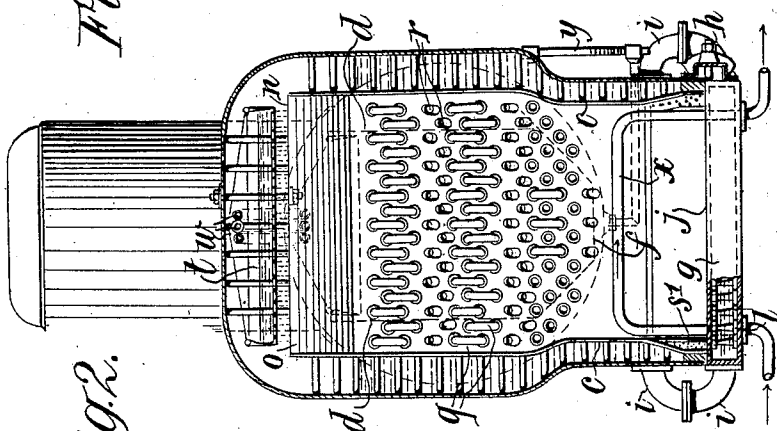


Fig. 2.

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5 SHEETS—SHEET 3.

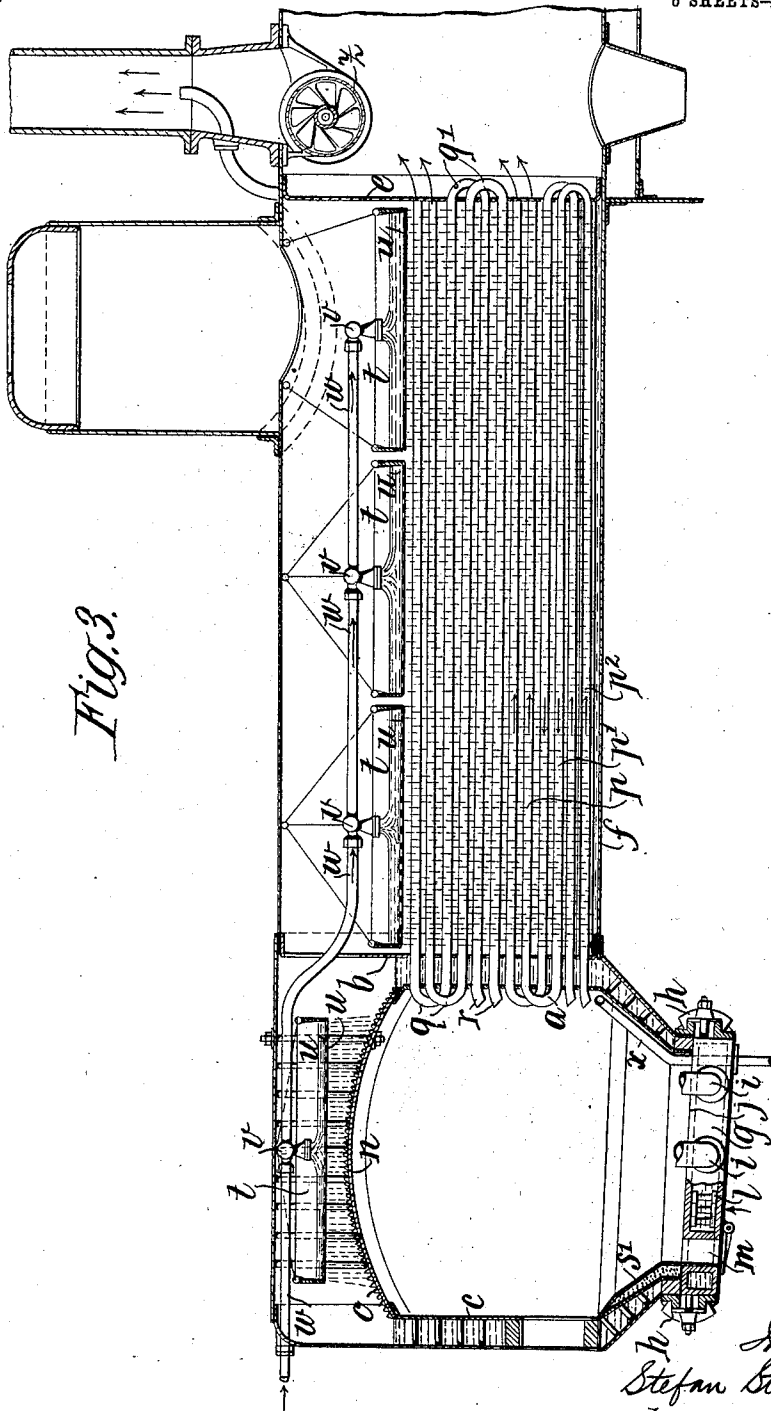


Fig. 3.

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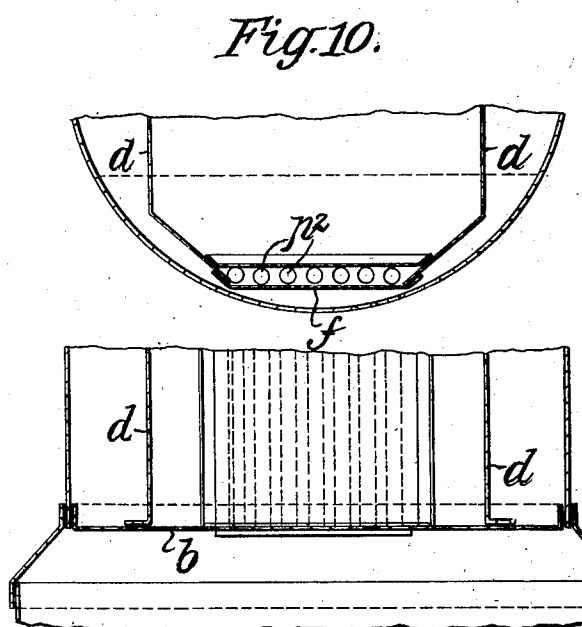
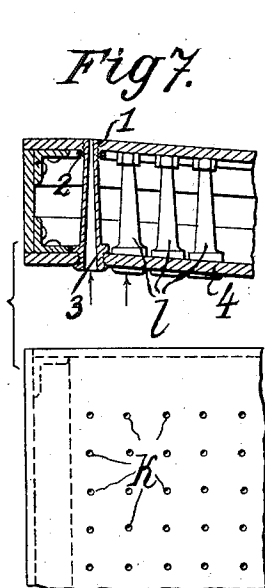
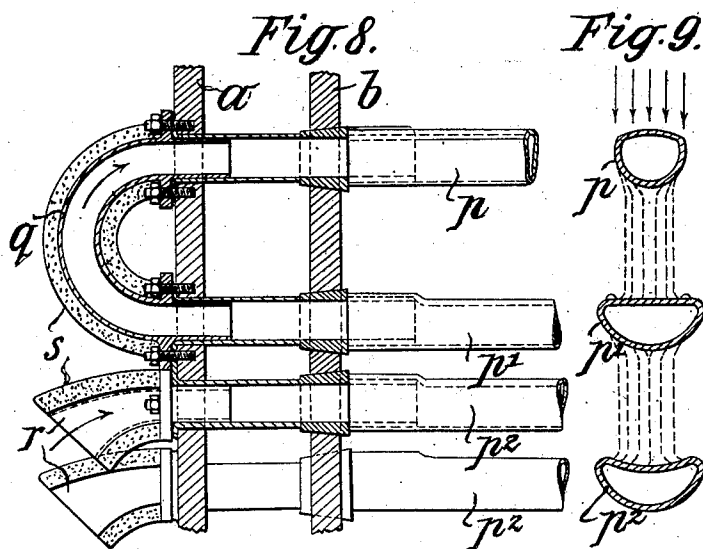
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5 SHEETS—SHEET 5.



Witness:
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UNITED STATES PATENT OFFICE.

STEFAN STOIANOFF, OF GALATZ, ROUMANIA.

LOCOMOTIVE-BOILER.

SPECIFICATION forming part of Letters Patent No. 727,481, dated May 5, 1903.

Application filed April 12, 1902. Serial No. 102,651. (No model.)

To all whom it may concern:

Be it known that I, STEFAN STOIANOFF, a subject of the Prince of Bulgaria, residing at Galatz, in the Kingdom of Roumania, have invented certain new and useful Improvements in Locomotive-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as 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 letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in locomotive-boilers, having for its object to secure an economical utilization of the fuel, a rapid heating, and particularly a rapid steam production which can be easily regulated according to the requirements arising in each particular case. By these improvements, which can also be readily fitted to existing locomotive-boilers of known systems, the feed-water is introduced into the boiler in a highly-heated condition, a brisk circulation takes place, and by far the greatest part of the water reaches the effective heating-surface in a finely-divided condition in the form of separate drops. The hot gases are caused to travel over an increased heating-surface with controllable speed and to pass the boiler repeatedly before reaching the smoke-box, so that they give off to the water in the boiler by far more of their heat and are consequently exhausted into the atmosphere at a relatively lower final temperature than has hitherto been the practice with boilers of known construction. For attaining the desired rapid evaporation even a temperature of 200° centigrade in the interior of the boiler is sufficient. The working of the improved boiler will therefore require a very small quantity of fuel as compared with the boiler hitherto in use. The burning through of the boiler-plates, deterioration of the fire-box, and boiler explosion are *a priori* rendered impossible. According to this invention the whole boiler-space is divided by a partition-wall arranged near the rear tube-plate into two compartments—viz., a water-chamber surrounding a fire-box and an evaporating-chamber inclosing the nest of tubes in the

longitudinal boiler-space. In the fire-box instead of the flat grate usually employed a flat water-chamber is provided, which at the same time acts as a grate, is provided with air-inlets and mud-holes, and communicates with the water-compartment of the boiler by means of curved or bent pipes. Instead of the flat top of the fire-box usually employed the fire-box of the improved boiler is provided with an arched top curved in the longitudinal direction of the boiler, and in order to increase the surface of the same its upper side is covered with an undulated or corrugated plate whose corrugations run in the transversal direction of the fire-box and at the same time retain the water on the ground. The nest of tubes passing through the boiler is inclosed by a chamber which is higher than the nest itself, the said chamber being constituted by the previously-mentioned division-wall, two side walls, the front tube-plate, and a bottom plate. Over the crown of the fire-box and over, or when desired also between, the tubes of the nest I arrange flat water-pans with sieve-like bottoms, which are fed separately from a piping with highly-heated water and from which the water can be allowed to fall in a finely-divided state in the shape of rain-drops onto the crown of the fire-box or onto the tubes, as may be necessary. The fire-tubes are joined in groups of three or more by means of easily-attachable ends or pipe-bends which open on one side into the fire-box and on the other side into the smoke-box in order to compel the fire-gases to pass more than once to and fro through the length of the boiler or evaporating-space before they emerge toward the chimney. In addition to the ordinary blast-pipe arranged in the usual manner in the chimney a fan is fitted in the smoke-box near to the neck of the chimney, so as to produce a forced draft.

The accompanying drawings represent a locomotive-boiler or ordinary construction provided with the above-mentioned improvements.

Figure 1 shows the boiler in longitudinal section. Fig. 2 is a vertical cross-section through the fire-box. Fig. 3 is a longitudinal section of a boiler provided with a modified arrangement of the fire-box. Fig. 4 shows a vertical cross-section through the fire-box.

Fig. 5 is a longitudinal section through the boiler, with a modified arrangement of the nest of tubes. Fig. 6 presents a vertical cross-section through the body of the boiler. Figs. 7, 8, and 9 represent details of the arrangement of the water-chamber and of the steam-tubes, and Fig. 10 shows in a vertical cross-section and in a horizontal section the lower part of the body of the boiler with the evaporation-space of the same.

In order to provide an existing boiler of usual construction with the said improvements, the entire space of the boiler is divided into two compartments by means of a partition-wall *b*, arranged near the rear tube-plate *a*—viz., into a front compartment constituting the water-space which surrounds the fire-box *c* and the rear compartment constituting the evaporating-space proper, the latter being formed by a plate-box which incloses and overreaches the nest of tubes and is composed of the partition-wall *b*, the two longitudinal side walls *d*, Figs. 6 and 10, the front tube-plate *e*, and the bottom plate *f*. First of all the old grate is removed from the boiler, and a flat riveted water-chamber *g*, fitting the lower slanting edge of the fire-box *c*, is attached onto the latter by means of cross-bar bolts *h*. Both longitudinal sides of the chamber *g* are provided with bent tubes *i*, by means of which the chamber *g* is maintained constantly in communication with the water-space surrounding the fire-box, so that a brisk circulation of water is thereby produced. The top side or cover *j* of the said water-chamber *g* forms the grate-surface proper, and in order to allow the admission to the fuel of a sufficient quantity of air it is provided with numerous small openings *k*, Fig. 7. These openings are preferably formed in conical hollow upright bolts *l*, which permit an easy circulation of the air, cannot be choked up with ashes, and besides prevent the bending through of the top *j* of the water-chamber. Fig. 7 shows a form of execution of these upright bolts. The top end 1 of each bolt is screwed into the top *j* of the water-chamber *g* and secured by means of a nut 2, while the bottom end 3, provided with a collar, is secured in the chamber-bottom 4 by pressing. For the purpose of the removal of the waste products of combustion a mud-hole *m* is provided, which can be closed by a flap.

The cover *n* of the fire-box is strongly vaulted or curved and is provided on its outer side with an undulated plate *o* in order to cause the water to flow over the vaulted cover as slowly as possible.

In order to enable the heating-gases to be retained as long as possible within the nest of tubes, and thereby to increase the amount of heat transmitted from the same, the nest of tubes, is separated into groups of three or more tubes in such a manner that, for instance, three tubes *p p' p²* are connected together by the insertion of two bent pipes *q q'*

in the tube-plates *a e*, so as to form a tubular coil. In this manner the heating-gases are compelled to travel through the whole length of the boiler three or more times in each group of tubes, as indicated by arrows. For facilitating the admission of the heating-gases the open end of each tubular coil situated at the rear tube-plate *a* is provided with a funnel-shaped mouthpiece *r*. The cross-sectional form of the tubes *p p' p²* of each group or coil is preferably such that the tube *p²*, traversed by the hottest gases, has a cross-section similar to a flat segment, with the upper edge somewhat bent inward, the tube *p'* has in cross-section a half-circular form, with straight upper edge, and finally the tube *p*, through which flow the already somewhat cooled gases, is of nearly circular cross-section.

In order to prevent the rear bent pipe *q'* and the funnel-shaped mouthpiece *r*, exposed to the flame-jets, from being rapidly burned through, they are coated with a sufficiently thick layer *s* of fireproof material, Fig. 8. The inner wall of the fire-box is likewise provided directly over the grate or cover of the water-chamber with a fireproof protecting-covering of about thirty centimeters in height.

Over the vaulted and corrugated top *n* of the fire-box and, if desired, also between the tubes of the nest of tubes flat water-pans *t* are arranged, said pans being suspended on cords and provided with a sieve-like perforated bottom *u*. Each of these pans has a feed-pipe *w*, provided with an automatically-closing valve *v*. The water is discharged from the pans in separate drops in the shape of a fine rain, and in this manner the separate drops of water when falling upon the corrugated fire-box top, as well as upon the hot tubes, are compelled to evaporate with great rapidity. In order to render possible the introduction into the pans or into the water-space of the fire-box of the feed-water previously heated to a considerable degree, the cold feed-water taken from the tender is conducted through the fire-space by means of the heating-tubes *x*. The feed-tubes *w* leading to the heating-pans, as well as the feed-tubes leading to the water-space, (the latter tubes not being shown in the drawings,) branch off from the said heating-tube *x*.

For ascertaining at any given moment the level of the small quantity of water accumulating in the boiler-space in consequence of the condensation of the steam the boiler is provided laterally with a water-gage *y*, Figs. 2 and 6.

As the ordinary steam-blast pipe arranged in the usual manner in the chimney will only in a few cases produce a sufficient draft through the numerous tubular coils, a fan *z* is arranged in the smoke-box in proximity of the neck of the chimney. This fan supports the action of the blast-pipe and pro-

duces a forced draft. The fan *z* can be operated in any desired manner—for instance, by the gear of the machine-crank.

For facilitating the cleaning of the interior space of the water-chamber *g* and the removal of scales and mud the curved pipes *i* are made removable.

The fire-tubes of the nest of tubes become sometimes obstructed near the bent tubes by soot and ashes in consequence of the combination of three individual tubes, which form a continuous coil, as above mentioned. When such an obstruction occurs, the two bent tubes are taken off, and the heating-tubes can then be easily cleaned from the side of the smoke-chamber.

I claim—

1. In a locomotive-boiler, a fire-box, a bottom therein formed of oppositely-situated perforated plates and tubular bolts connecting the plates at the perforations to form a water-chamber, a trap in said bottom to discharge ash, a water-chamber surrounding the sides of the fire-box and communicating with the water-chamber in the bottom, a corrugated arched crown-sheet, a sieve over said sheet, means to admit feed-water thereto, a forward water-chamber, reverted fire-tubes therein, one or more sieves over the tubes and means to admit feed-water to the sieves, said chambers having their steam-spaces communicating, substantially as described.

2. In a locomotive-boiler, a fire-box having

a corrugated arched crown-sheet, a water-chamber surrounding the fire-box, a sieve suspended over said sheet, means to admit feed-water to said sieve, a forward water-chamber, fire-tubes arranged in groups of different elevation through the latter water-chamber, sieves over each group of fire-tubes and means to admit feed-water to the sieves, substantially as described.

3. In a locomotive-boiler, a fire-box, a water-chamber forming the sides thereof, a flue-sheet having a water-space formed therein, a corrugated arched crown-sheet, a sieve suspended over said crown-sheet, a forward water-chamber, flues therethrough having enlarged downwardly-projecting ends in the fire-box, one or more sieves over the flues and means to admit feed-water to said sieves, substantially as described.

4. In a locomotive-boiler, reverted flues of substantially semicircular section, the longitudinal portions of said tubes of different widths, a downwardly-projecting flaring entrance to each tube, a sieve over the tubes and means to admit feed-water to them, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

STEFAN STOIANOFF.

Witnesses:

C. TIEBRECHT,
R. JANSEN.