No. 646,821. Patented Apr. 3, 1900.

E. FOURÉ & H. THUILE.

STEAM BOILER.

(Application filed Dec. 30, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

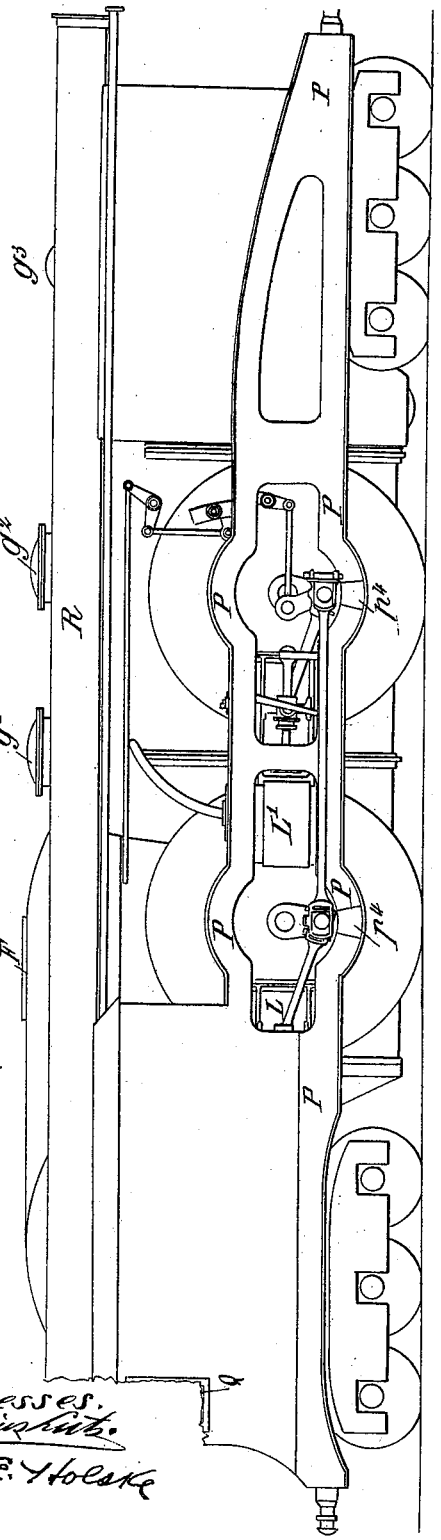

Fig. 4.

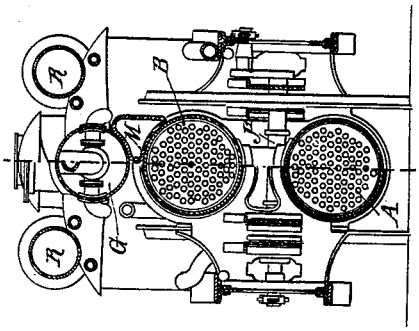

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Fig. 2

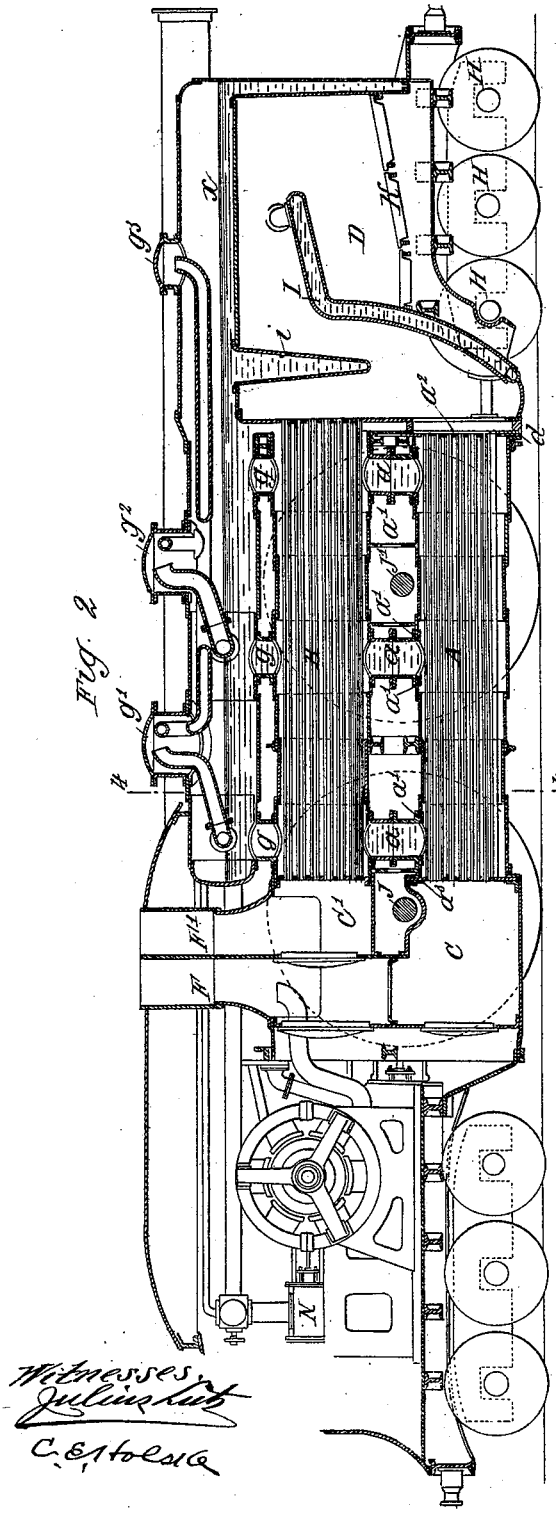
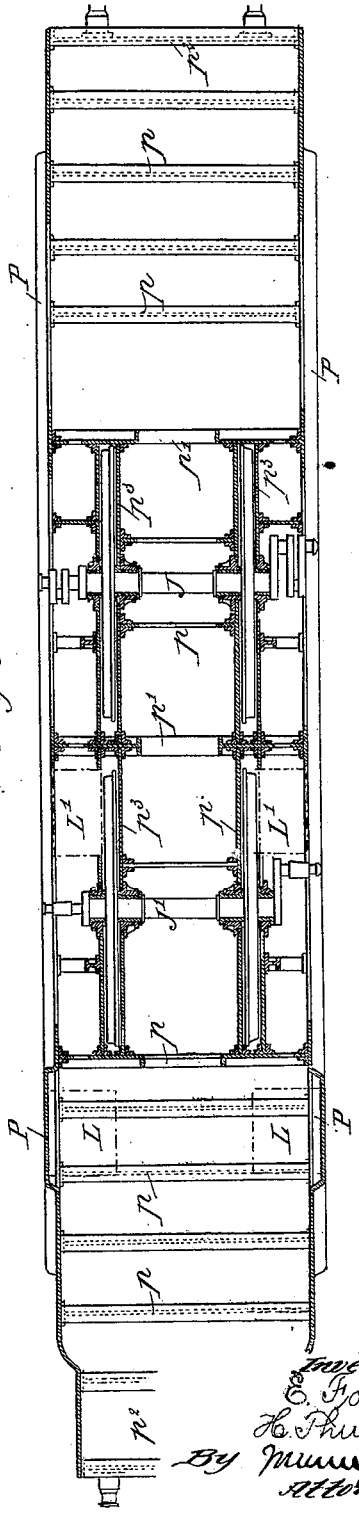


Fig. 3



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UNITED STATES PATENT OFFICE.

EMMANUEL FOURÉ AND HENRI THUILE, OF ALEXANDRIA, EGYPT.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 646,821, dated April 3, 1900.

Application filed December 30, 1897. Serial No. 664,660. (No model.)

To all whom it may concern:

Be it known that we, EMMANUEL FOURÉ and HENRI THUILE, citizens of the Republic of France, residing at Alexandria, Egypt, have invented a Steam-Boiler, of which the following is a specification.

Our invention relates to steam-boilers, and has for its object to provide a construction capable of generating a considerable amount of steam. Such a construction is of especial advantage for locomotive-engines and will now be described in detail in its application to such engines. The novel features by which we secure the desired result will be pointed out specifically in the appended claims.

To furnish an exact and clear description, we have shown on the annexed drawings a locomotive having its boiler built according to our plan. These drawings are of course only diagrammatic and are only intended to illustrate the general arrangement.

On the drawings, Figure 1 is a side elevation of the locomotive. Fig. 2 is a longitudinal section. Fig. 3 is a plan view of the framework. Fig. 4 is a section on line 4 4 4′ 4′ of Fig. 2.

The engine shown in the drawings consists of a large-wheeled steam-locomotive and an electrical locomotive whose motor-dynamos are driven from an electrical plant arranged upon the main frame, steam being furnished to the motors of the generating-dynamos and to the steam-locomotive's cylinders by a single boiler of special construction and capable of generating a considerable amount of steam. The locomotive is supported, first, at the center by two steam-driven axles and wheels of large diameter, and, second, forward by a truck provided with three electrically-driven axles having small wheels, and, third, rearwardly by three pairs of trailing wheels of small diameter. The propulsion of the locomotive is obtained in a continuous manner by the steam-driven wheels, as in ordinary locomotives. It is also assisted in a temporary or, if desired, in a continuous manner by the electric truck. This combination of the steam-locomotive and of the electrical locomotive gives a wide range of power to the engine by allowing a supplementary and optional force to be employed, which latter can be put into use only on inclines, so as to maintain the speed of the train or to facilitate its starting. With this locomotive the advantages of a steam-locomotive and an electrical locomotive are obtained at the same time. The locomotive not being wholly electrical and the largest portion of the original power being steam, furnished directly to the main driving-axles, the inconveniences of electrical locomotives generating their own current, in which a loss results from the double conversion of the steam-power before being applied to the driving-axles, are avoided.

The use of the electrical truck allows us to construct a locomotive of great power—such as two-thousand-horse power—with only two steam-driven axles. If it were wished to obtain an engine of this power driven by steam only, it would be necessary to have more than two driving-axles and to use a triple-expansion engine, which would present serious inconveniences. Further, the presence of an electrical installation does away with the necessity of using storage batteries for accessory purposes, such as lighting the train. With such an arrangement the steam-power employed may, for example, equal fifteen-hundred-horse power and the electrical power be equal to five-hundred-horse power, thereby allowing a power of from fifteen-hundred to two-thousand horse power to be used.

Unquestionably the most important adjunct of an engine is the boiler. Until now a locomotive-boiler of two-thousand-horse power has never been made. Our method allows this power to be attained in working practice and continuously. It is characterized by the use of three superposed cylinders or chambers, the lower two of which are wholly tubular. Between these two tubular chambers are situated the steam-driven axles. This arrangement is very advantageous, because it allows us to have driving-wheels of large diameter. It is well known that at very high speeds steam is completely wiredrawn in its passage across the ports. Now the tangential speed of the working parts of a locomotive having wheels of three meters diameter, as our system allows traveling at one hundred and twenty kilometers an hour, is the same as that of those of a locomotive having wheels two meters diameter and traveling at eighty kilometers an hour. Consequently slide-valve mechanism in use on present-day locomotives

for medium speeds of eighty kilometers can be used without alteration upon this improved type of locomotive, which ought to normally work at one hundred and twenty kilometers, this naturally necessitating higher speeds at certain times.

The lower chamber A is detachable. It is connected to the middle one B by necks or communications $a\ a$, to which it is joined by bolts a', so that it can easily be separated, and it is held in loose engagement at a^2 and a^3 with the fire-box and the smoke-box, respectively. The two upper chambers are fixed and riveted to the fire-box and to the smoke-boxes. The lower one opens forwardly into the smoke-box C and rearwardly into the fire-box D through an opening leading through the water-jacket d between the tube-head and shell of the boiler. The middle chamber B opens forwardly into the smoke-box C' and rearwardly directly into the fire-box.

The smoke-box is divided into two independent parts C C', each intended for one of the two tubular chambers A B and each furnished with a blast-pipe E (Fig. 2 being a longitudinal section allows only one to be seen) and having independent chimneys F F' of rectangular section. This arrangement allows the cleaning of the tubes of the cylindrical chamber in spite of the unfavorable situation of the lower chamber. The upper chamber G communicates with the middle chamber by necks $g\ g\ g$ and extends over and above the fire-box. It is not tubular, but is furnished with several steam-domes $g'\ g^2\ g^3$ to draw off steam for the cylinders of the driving-axles and the engines driving the generating-dynamo. The fire-box is of the maximum width allowed by the rail-gage and extends above the trailing-wheels H H H. It is provided with a Ten Brinck boiler-tube I, of approximately the shape shown on the drawings. This tube, besides forming a heater, constitutes a bridge-wall.

The above-described construction of the boiler allows the axles J J' of the driving-wheels to be arranged between the lower and middle chambers, which gives the advantage of having driving-wheels of large diameter (three meters, at least) without endangering the stability of the engine by necessitating the raising of the boilers above the axles. These large wheels are indispensable for high speeds, for the speed of the parts in motion—pistons, slide-valves—not being excessive no wiredrawing of the steam is produced and the steam-engine works under favorable conditions.

At the top of the fire-box and dependent from its arch is a second bridge i, communicating with the upper boiler and reaching down to the level of the channels or portion between the two upper chambers. This, besides acting as a screen, for which purpose it has already been used, serves also to distribute the gases from the fire-box more evenly toward the two tubular chambers, so as to mitigate their tendency to concentrate on the central chamber.

The grate-bars K may be of any desired construction, and by arranging the grate over and above the trailing wheels and by the general construction of the boiler the grate can be of large area, which is especially advantageous, for it is well known that the larger the extent of the grate the greater the evaporation per kilogram of fuel.

The level of water in the upper chamber should be at about x, covering the arch of the fire-box. The steam driving apparatus works after the compound system. The engine has four cylinders outside the framework, two of which, L' L', are high pressure and two, L L, are low pressure, arranged tandemwise according to Woolf's system. The high-pressure cylinders work the rear driving-axle J, and the low-pressure cylinders actuate the front driving-axle J'. This arrangement would allow of doing away with the coupling of the axles and wheels by means of cranks. However, coupling is preferable, because it renders constant the relative angular position of the two axles, better balances the weight of the moving parts, and facilitates starting. The high-pressure cylinders L' L' are placed between two longitudinal bars P, and the low-pressure cylinders L L rest on the front truck. Between the high-pressure cylinders and the low-pressure cylinders is an intermediary reservoir or receiver M, which is placed laterally to the upper chambers and in the center of the boiler, having in section the shape given on Fig. 4. The three chambers of the boiler can thus be inclosed in the same heat-retaining casing with the receiver.

On the fore part of the locomotive is the electric installation, which drives the axles of the front truck. This installation consists of two ordinary compound steam-engines N, symmetrically arranged on each side and driving a dynamo O, placed between them. These engines receive their steam-supply from the front dome g' of the upper chamber of the boiler. These steam-engines, the generating-dynamos, plant, and motor-dynamos are of any usual type and present no special features. The escape-steam of these engines can be employed to heat water in the tender, and in this case the whole of the locomotive will act as condensing-engine. All the parts of the locomotive are carried on a very rigid framework of special construction, which insures a fair division of the weight and a free rotation of the driving-axles. The framework consists of two longitudinal beams or side frames P P of the shape shown on the drawings, braced together by cross-bars $p\ p$, tie-pieces p' under the steam-generator, and two struts or end pieces p^2 before and behind. The steam driving-wheels are sheathed inwardly and outwardly by walls or plates p^3, carrying grease-boxes for each axle or bearing and riveted to the end tie-pieces of the boiler. With the exception of the boiler tie-pieces,

which carry at their ends movable and bolted parts to facilitate the detaching or removal of the axles and of the lower chamber of the boiler, all the parts of the framework are riveted together. The whole is therefore exceedingly rigid. The side frames P P carry in that portion situated under the driving-axles a detachable guard or a slide p^4, allowing of the withdrawal of the axles when desired. The frame and all the parts thereby supported rest on oil-boxes by means of springs and accessory parts arranged in the usual manner for the purpose of lessening shocks due to irregularities of the track and allowing the division of the weight fairly when at rest. The distribution of the weight in traveling is insured by longitudinal and transverse beams in the usual way. The front driving-axle is joined by a longitudinal beam to the axis of the front truck, and the two driving-axles are also coupled together. Beside the longitudinal beams the driving-axles and the trucks are connected by cross-beams. These arrangements are well known, and we do not confine ourselves to any particular pattern.

The driver's cab is placed in front of the locomotive at Q. The rear portion includes a shelter for the fireman attending to the stoking. This position of the driver facilitates his view of the signals and allows him to better inspect the track.

At the upper part of the locomotive are arranged two cylinders R R, opening in front of the engine and rearwardly put into communication with a ventilating-pipe for the coaches or carriages.

We do not limit ourselves to the particular details shown in the drawings. It will be evident that our improved boiler as defined in the claims can be used for locomotive-engines of various types, also for stationary or marine engines.

We claim—

1. A boiler consisting of two superposed communicating sections, in combination with a common fire-box at one end of the boiler, separate smoke-boxes at the other end of the boiler, and separate chimneys connected with said smoke-boxes.

2. The combination with the fire-box and the smoke-box, of a boiler consisting of superposed tubular sections located between the fire-box and the smoke-box, and an upper section communicating with the tubular sections and extending over and above the fire-box, the projecting portion of said upper section having a water-screen extending downwardly in the fire-box to a level approximately between the tubular sections.

3. In a steam-locomotive, a boiler consisting essentially of three superposed chambers, the lower chambers being tubular, the upper chamber being provided with domes for drawing off steam, and each tubular chamber being furnished with a smoke-box and a chimney, independent of those of the other chamber, as above described and set forth with regard to the accompanying drawings.

4. The combination of the fire-box, the boiler composed of superposed sections, and the screen depending in the fire-box to a level approximately between the boiler-sections.

5. A locomotive-boiler having plural tubular sections placed one above the other and provided with smoke-flues, a fire-box at one end and separate chimneys and smoke-boxes at the other end communicating with said smoke-flues, and water connections between the tubular sections, providing a space adapted to receive the axles of the driving-wheels, said connections being formed in two parts secured to each other by clamping-bolts, whereby the lower section may be readily removed.

6. A locomotive-boiler, comprising two superposed tubular sections each provided with smoke-flues, and having water connections between them, separating the sections and providing laterally-extending spaces adapted to receive the driving-wheel axles, a common fire-box connected with one end of said sections, a tubular section located above the first-named sections, having water connections thereto and extending over the fire-box, said fire-box having water-legs connected with the upper tubular section.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

EMMANUEL FOURÉ.
H. THUILE.

Witnesses:
ANT. GEYHETZ,
F. MONTHEIM.