

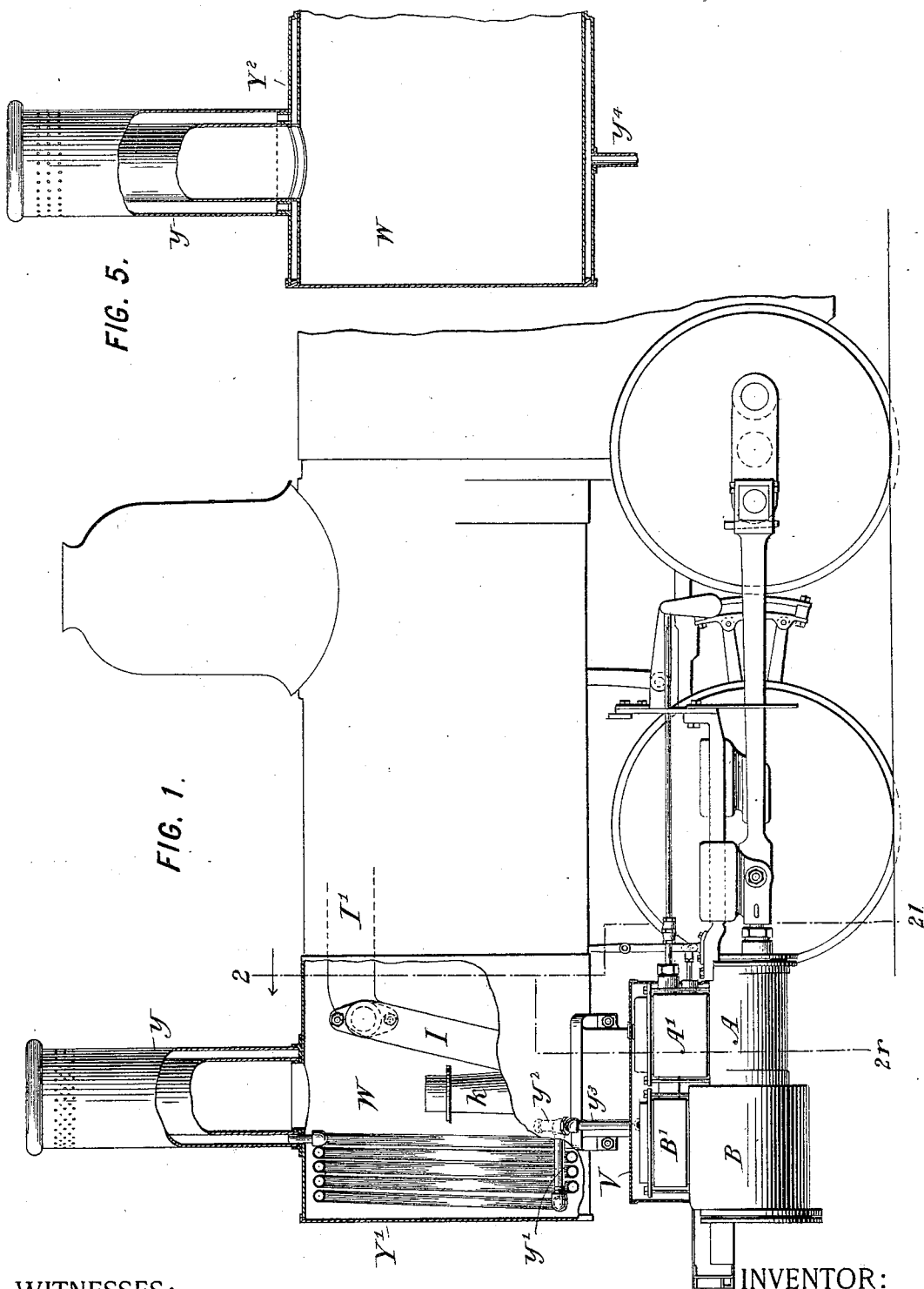
(No Model.)

3 Sheets—Sheet 1.

C. A. BALL.
LOCOMOTIVE ENGINE.

No. 520,839.

Patented June 5, 1894.



WITNESSES:

Fred White
E. K. Fraser.

INVENTOR:

Charles A. Ball,
By his Attorneys,

Arthur C. Fraser & Co.

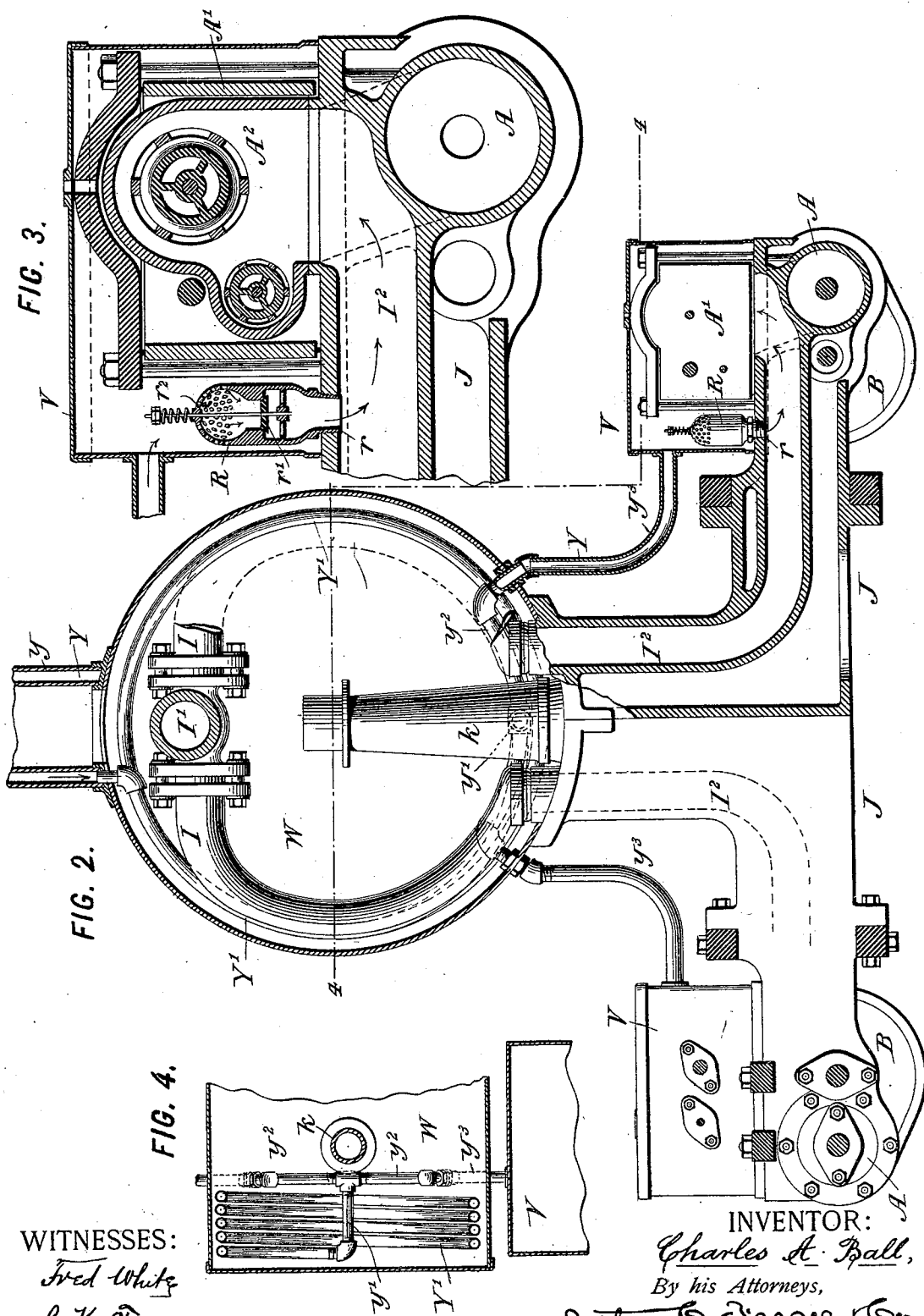
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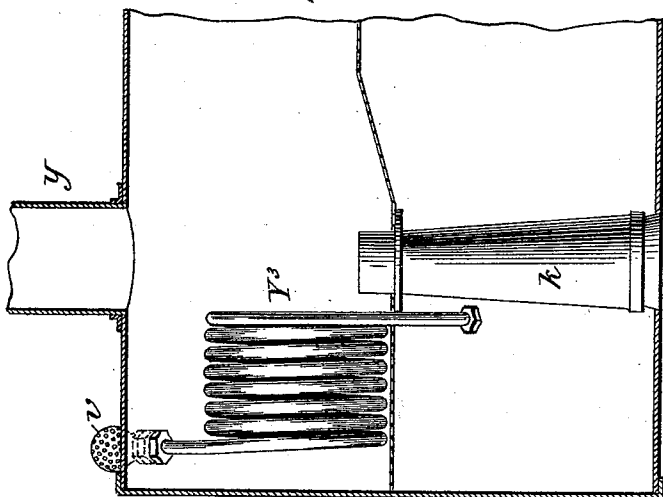


FIG. 7

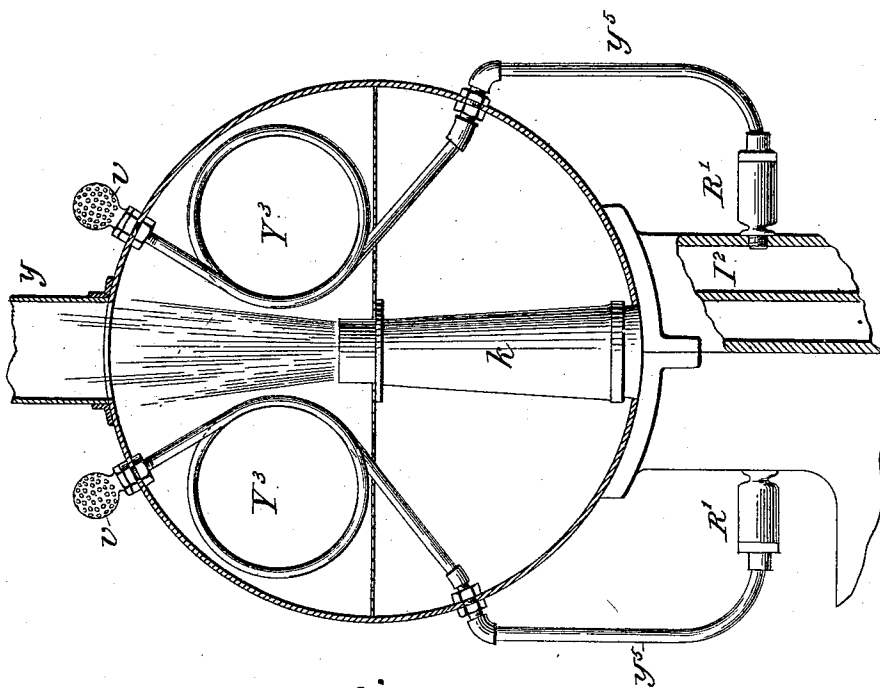


FIG. 6.

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UNITED STATES PATENT OFFICE.

CHARLES A. BALL, OF BROOKLYN, ASSIGNOR OF ONE-HALF TO CHARLES H. GREEN, OF NEW ROCHELLE, AND HERMAN KNUBEL, OF NEW YORK, N. Y.

LOCOMOTIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 520,839, dated June 5, 1894.

Application filed July 22, 1893. Serial No. 481,165. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. BALL, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Locomotive-Engines, of which the following is a specification.

In the running of a locomotive, whenever steam is shut off while the engine continues in motion, the action of the pistons moving in the cylinders is to exert a suction or pumping effect tending to draw steam through the throttle and expel it at the exhaust nozzles. In engines having unbalanced slide valves, the suction thus created is largely overcome by the slight lifting of the valve from its seat, but in engines employing either piston valves or balanced slide valves, or any other construction of valves wherein such lifting of the valve from its seat is impossible, it is necessary to provide what is called a relief valve for relieving the suction by admitting air into the live steam passage leading to the steam chests or valve chests, so that the running of the engine acts to pump air in through these relief valves and expel it through the exhaust nozzles. The application of such relief valves overcomes the difficulty of the formation of a vacuum within the valve chests, but at the same time introduces a new difficulty, namely, that large volumes of cold air are drawn into the heated steam passages and steam chests, and flow through the cylinders, thereby seriously cooling them, so that by the contraction of the walls of the steam chests the joints between them and their covers are somewhat opened, thereby causing leakage, and when steam is again turned on, it condenses at a rapid rate within the steam passages, chests and cylinders, until these parts have been again heated up to the normal temperature, this condensation of steam not only causing a loss of power, but also being liable by the rapid accumulation of condensed water in the cylinders, to damage them, as by forcing off the cylinder heads or straining their fastenings.

The object of my invention is to overcome these disadvantages incident to the use of relief valves. To this end my invention provides that the air drawn in through the re-

lief valves shall be taken from a source of heated air, in order that the suction of the engine shall draw hot air through the valve chests and cylinders instead of cold air. By this means the steam passages, chests and cylinders, instead of being cooled, are maintained at approximately their normal temperature, so that when steam is again turned in, no unusual or undue condensation can result.

In carrying out my invention I utilize as a means for heating the air, the hot gases or smoke traversing the smoke-box, to which end I arrange the air passage or passages communicating with the relief valve or valves in conductive contact with the smoke-box, so that the heat from the contents thereof shall be communicated through the intermediate layer or septum to the air, the most convenient and practical construction being to arrange one or two coils of pipe in the smoke-box where it will occupy the least available room, connecting one end of the coil with the relief valve and the other end with a suitable opening, protected by a strainer, through which to draw in the air. Instead of directly connecting the hot air pipe to the relief valve, the preferable construction is to arrange the relief valve within the usual valve chest casing which incloses the valve chest for the purpose of keeping it hot and protecting it from contact with the cold outer air, and to connect the hot air pipe to this casing so that it discharges the hot air into the chamber formed by this casing, from which chamber the hot air is drawn in through the relief valve.

Having thus given a general indication of the nature and object of my invention, I will now proceed to describe its practical application more in detail with reference to the accompanying drawings, wherein—

Figure 1 is a side elevation of the forward part of a locomotive engine partially broken away in vertical mid-section. Fig. 2 is a transverse section, the left half being cut in the planes denoted by the dotted lines 2—2' and the right half denoted by the lines 2—2' in Fig. 1, the view being on a larger scale. Fig. 3 is a fragmentary transverse section on a still larger scale, through one of the cylinders and valve chests. Fig. 4 is a horizontal sec-

tion of the forward part of the smoke-box in the plane of the line 4—4 in Fig. 2. Fig. 5 is a fragmentary longitudinal mid-section of the smoke-box showing a modified construction. Fig. 6 is a transverse section through the smoke-box showing a further modification. Fig. 7 is a longitudinal section through the smoke-box showing the same construction shown in Fig. 6.

10 The particular type of locomotive engine shown in the drawings is the balanced compound locomotive the construction of which is shown in detail in my application filed July 3, 1893, Serial No. 479,540, for United States
15 patent for improvements in compound locomotive engines. As the details of this compound locomotive engine have no relation to my present invention, they are not shown in the accompanying drawings. I would remark
20 that my present invention is equally applicable to single expansion engines, and may advantageously be applied in connection with any construction of locomotive engine with which it is desirable to use relief valves.

25 Referring to the drawings, let A designate the high pressure cylinder and B the low pressure cylinder, A' the high pressure valve chest and B' the low pressure valve chest, and A² in Fig. 3 the high pressure valve. Steam
30 is taken from the boiler in the usual manner through a pipe I', which branches into two pipes I I leading through the smoke-box W, and communicating with live steam passages I² I² (Fig. 2) formed through the respective
35 cylinder half-saddles J J, each passage I² leading in the usual manner to the steam chest A' of the high pressure cylinder, and opening in communication with the high pressure valve A², as shown in Fig. 3. Steam is admitted
40 through this valve to the high pressure cylinder, the exhaust from this cylinder flowing into the low pressure valve chest B', and through the low pressure valve to the low pressure cylinder, while the exhaust from
45 this cylinder passes through the usual exhaust passage and escapes by the exhaust nozzle k, being directed up the stack in the usual manner.

All of the features thus far described are
50 common to compound locomotives of the type described in my aforesaid application, and require no detail description here.

According to the preferred form of my present invention, the valve chests A' B' are covered and inclosed by a valve chest casing V,
55 which makes a substantially air-tight fit with the cylinder casting or top of the saddle J, and the relief-valve R, which is or may be of any ordinary construction, is arranged within this casing V, being screwed into a hole or opening r formed in the top of the saddle and communicating with the live steam passage I². In the construction shown the relief
60 valve R consists of a casing having a perforated top forming a strainer through which the air enters, and formed beneath this with a valve seat against which seats a valve-

disk r', which is normally drawn to its seat by a spring r², as shown in Fig. 3, the valve
constituting in substance a check-valve opening inwardly. A hot air pipe or passage,
70 which as a whole is lettered Y, terminates in communication with the interior of the casing V. In the preferred construction this hot air passage consists of a pipe coiled within
75 the smoke-box W, as shown at Y' in Figs. 1, 2 and 4. The smoke-stack is surrounded at a little distance by a tubular casing γ having near its upper end a series of small perforations, as shown in Fig. 1, preferably formed
80 by employing perforated steel plate for this upper portion of the casing. When air is being drawn in through the relief-valve R, it enters through these perforations and flows
85 down through the annular space within the casing γ , whence at the base of the stack it enters the coil of pipe Y', as shown in Fig. 2, and circulates around through this coil until from the opposite end thereof it passes
90 through a straight pipe γ' , which divides as shown in Fig. 4 into two branch pipes γ^2 , which pass out from opposite sides of the smoke-box and are coupled to branch pipes γ^3 which lead to the respective casings V.
95 The air is somewhat heated in passing through that portion of the passage Y which is within the casing γ , but is chiefly heated while passing around in the coil Y', so that when delivered finally from the hot air passage Y into the casings V, it is highly heated, so
100 much so that on passing in through the valve R it does not chill or cool the steam passages, valve chests or cylinders.

The hot air passage may be variously constructed in order to cause the air passing
105 through it to be heated from the hot products of combustion in the smoke-box. One modified means for heating the air is to carry the passage Y around the outside of the smoke-box in the form of a jacket, as shown
110 in Fig. 5. Here the tubular jacket γ around the stack is unchanged, but instead of communicating with a coil inside the smoke-box, it communicates at the bottom with a jacket Y² extending annularly around the smoke-box
115 W, so that the air in flowing around within this jacket is highly heated from the smoke-box, and from the under side of the jacket, or other convenient location, the air is conducted away by a pipe or pipes γ^4 , by which
120 it is led to the relief-valve or valves.

Another construction is shown in Figs. 6 and 7. Here the air is heated by being carried through coils within the smoke-box, but the arrangement of the coils is different from
125 that first described, and in lieu of employing a single coil and branching it to supply the air to the relief valves on both sides of the locomotive, two separate coils are employed each independently supplying the relief
130 valve on its own side. The two heating coils lettered Y³ Y³ are arranged in the forward part of the smoke-box and on opposite sides so as to be out of the way of the blast from the ex-

haust nozzle. One end of each coil is carried out through the top of the smoke-box, and has fitted on it a strainer *v*, while its opposite end is carried downwardly and out through the side of the smoke-box, where it is coupled to a pipe *y*⁵ leading to the relief valve, which is here lettered R'. This figure also illustrates a modified arrangement of the relief valve, which, instead of being placed within the casing V, is arranged exteriorly thereto, being screwed horizontally into the upper portion of the live steam passage, and the pipe *y*⁵ being joined directly to the casing of the relief valve.

My invention may be otherwise greatly modified without departing from its essential features. All that is necessary is, that an air pipe or passage shall be conducted through a suitable heater, in order that the air drawn through it may be heated in transit, and that such air pipe or passage shall terminate in communication with the relief valve, in order that when air is drawn in through the relief valve by the pumping action of the engine, the air so drawn in shall be heated in order not to chill the steam passages, valve chests and cylinders.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. The combination with a steam engine and relief valve of an air heating device communicating with said valve, whereby the suction of the engine draws hot air through the valve chest and cylinder.

2. The combination with a steam engine and relief valve of an air-passage communicating with said valve, and a heater traversed by said passage to heat the air therein, whereby the suction of the engine draws air through

said passage and the air is heated before entering said valve.

3. In a locomotive, the combination with its cylinder, valve chest, relief-valve and smoke-box, of an air-passage communicating with said valve and extended into conductive relation with the smoke-box for imparting heat from the contents thereof to the air drawn through said passage to the relief valve.

4. In a locomotive, the combination with its cylinder, valve chest, relief-valve and smoke-box, of an air-passage communicating with said valve and extended within the smoke-box, to be heated by the hot gases therein, whereby air drawn through said passage to the relief-valve is heated.

5. In a locomotive, the combination with its cylinder, valve chest, relief-valve and smoke-box, of a casing inclosing the valve chest and relief-valve, and a hot air passage extended into conductive relation with the smoke-box for heating the air drawn through said passage and terminating in communication with the interior of said casing for conducting the heated air to the relief-valve.

6. In a locomotive, the combination with its cylinder, valve chest, relief-valve, smoke-box and stack, of a hot air passage communicating with said relief-valve, and constructed in part by a tubular casing inclosing the stack, and perforated near one end for the admission of air which is heated in passing through the space between said casing and the stack.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

CHARLES A. BALL.

Witnesses:

ARTHUR C. FRASER,
GEORGE H. FRASER.