(No Model.) 4 Sheets—Sheet 1.

I. T. DYER.

LOCOMOTIVE ENGINE.

No. 568,019. Patented Sept. 22, 1896.

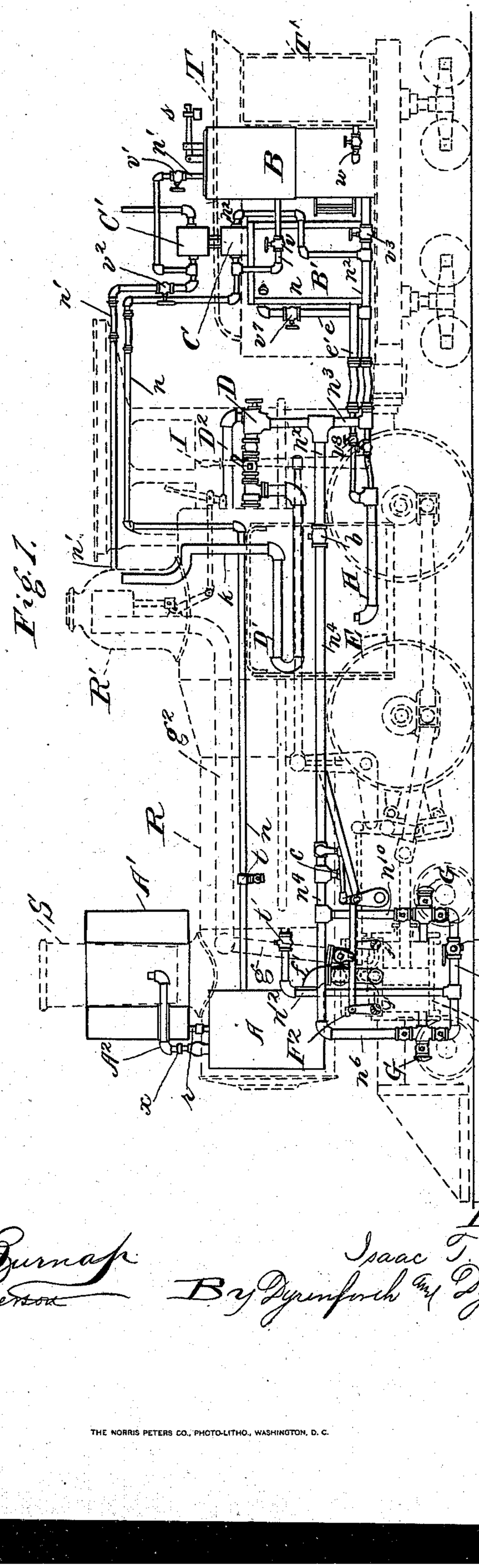

Fig. 1.

Witnesses:
Charles E. Burnap
Reuben Anderson

Inventor:
Isaac T. Dyer
By Dyrenforth & Dyrenforth,
Atty's.

(No Model.)

4 Sheets—Sheet 2.

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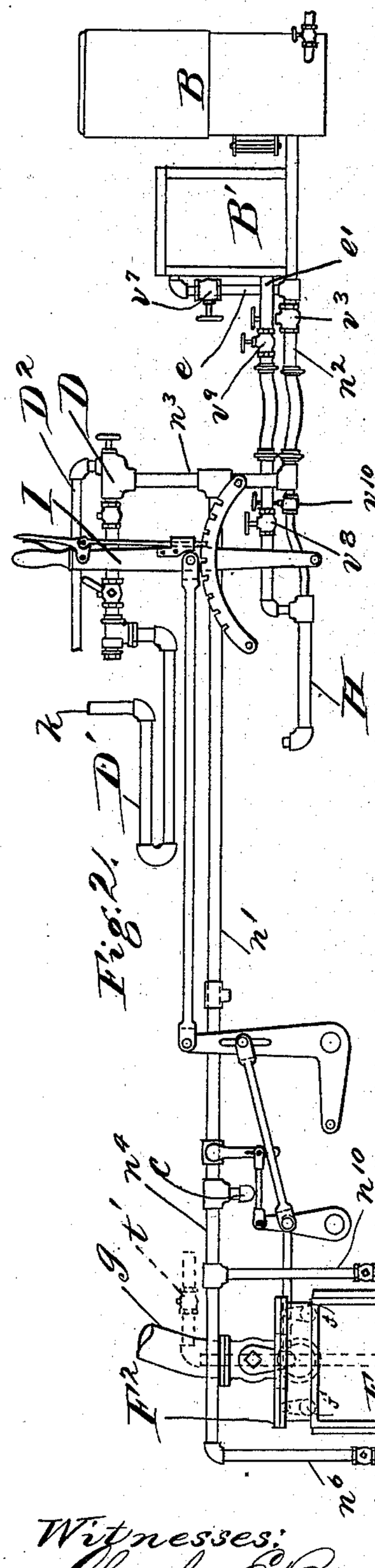

Fig. 2.

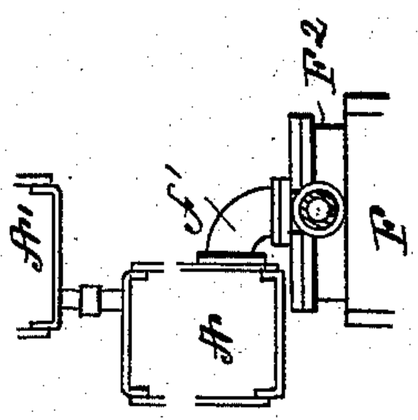

Fig. 2a.

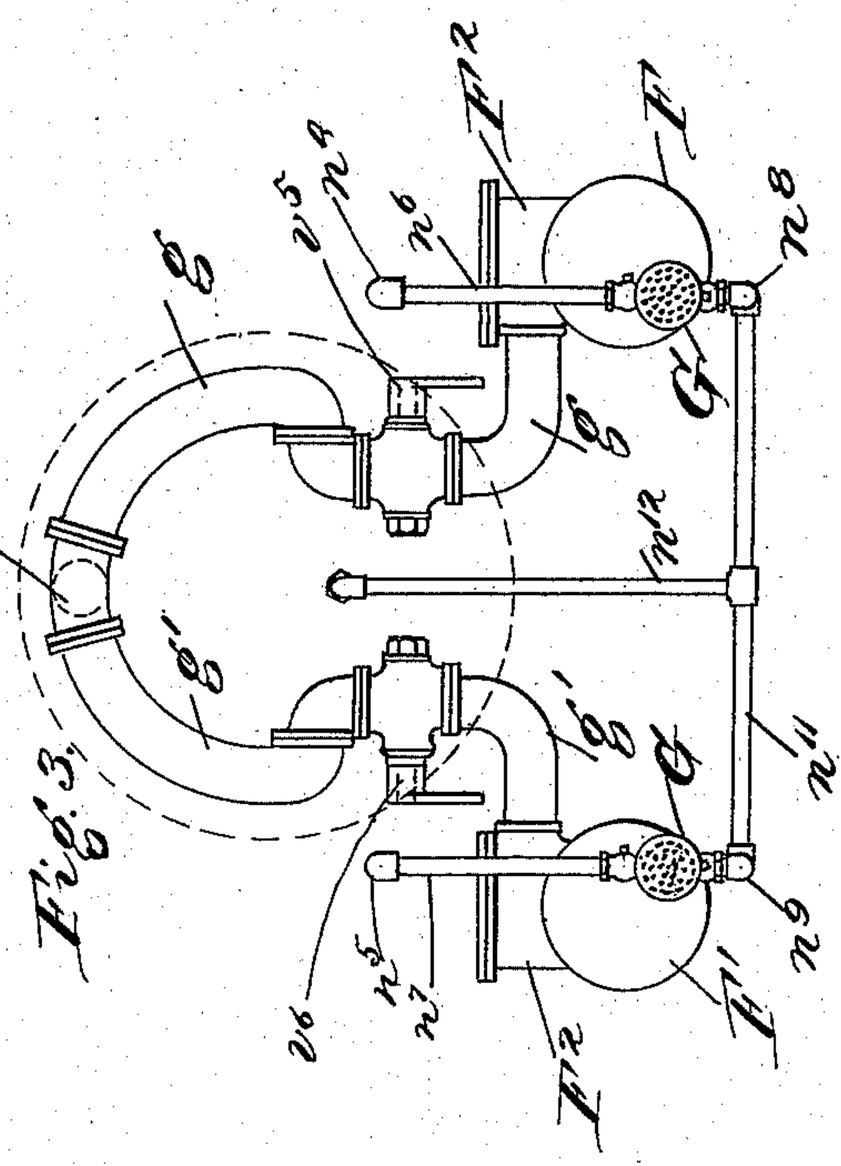

Fig. 3.

Witnesses:
Charles E. Burnap
H. T. Holmes.

Inventor:
Isaac T. Dyer
By Dyrenforth and Dyrenforth
Attys.

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I. T. DYER.

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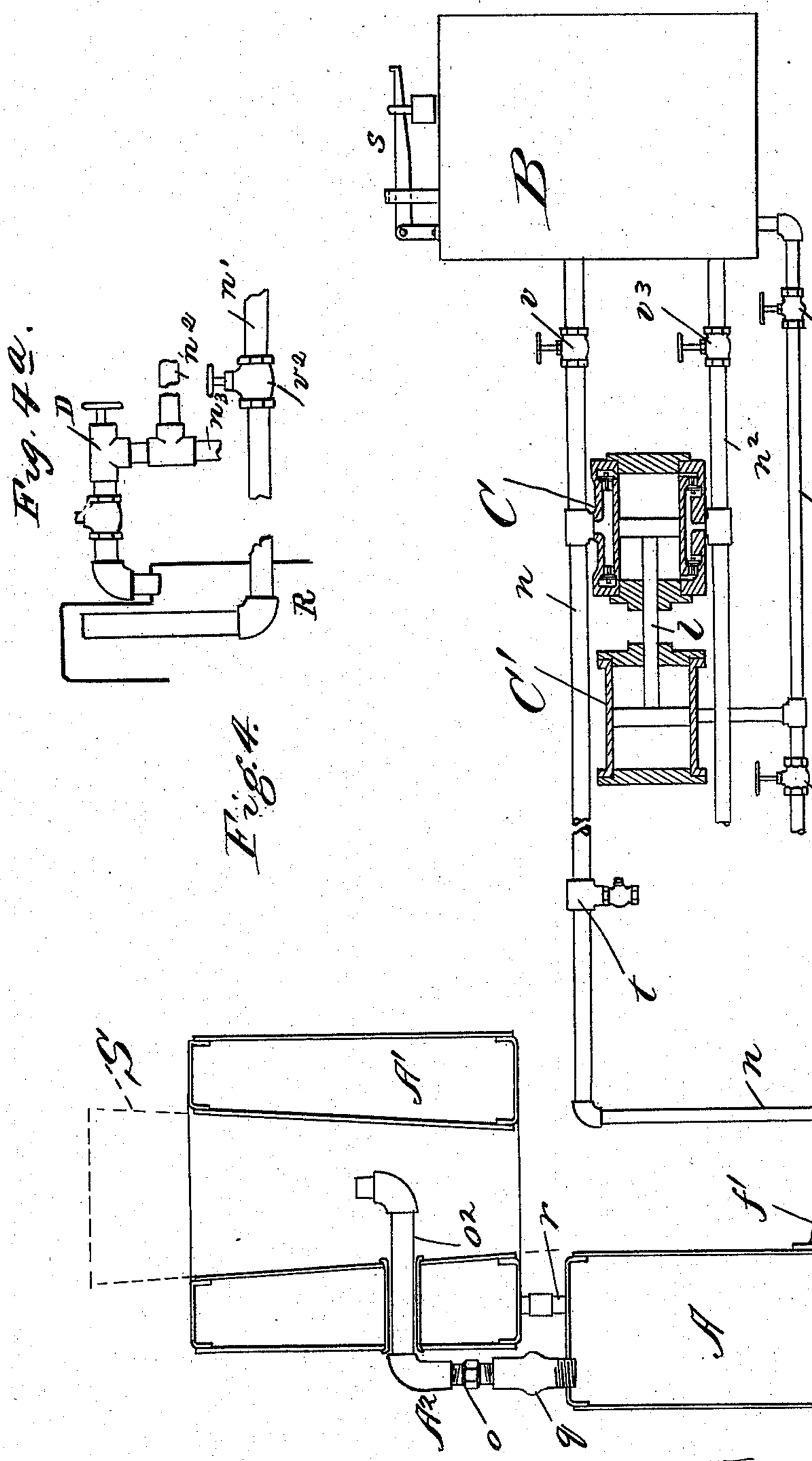

Fig. 4a.

Fig. 4.

Witnesses:
Charles E. Burnap
H. T. Holmes.

Inventor:
Isaac T. Dyer
By Dyrenforth & Dyrenforth
Attys.

(No Model.) 4 Sheets—Sheet 4.

I. T. DYER.

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Fig. 5

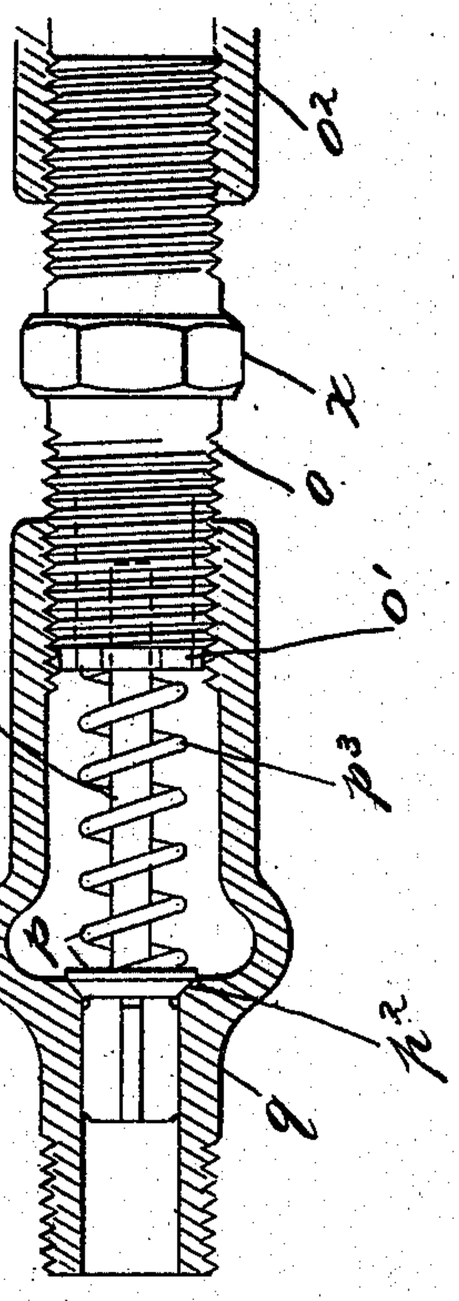
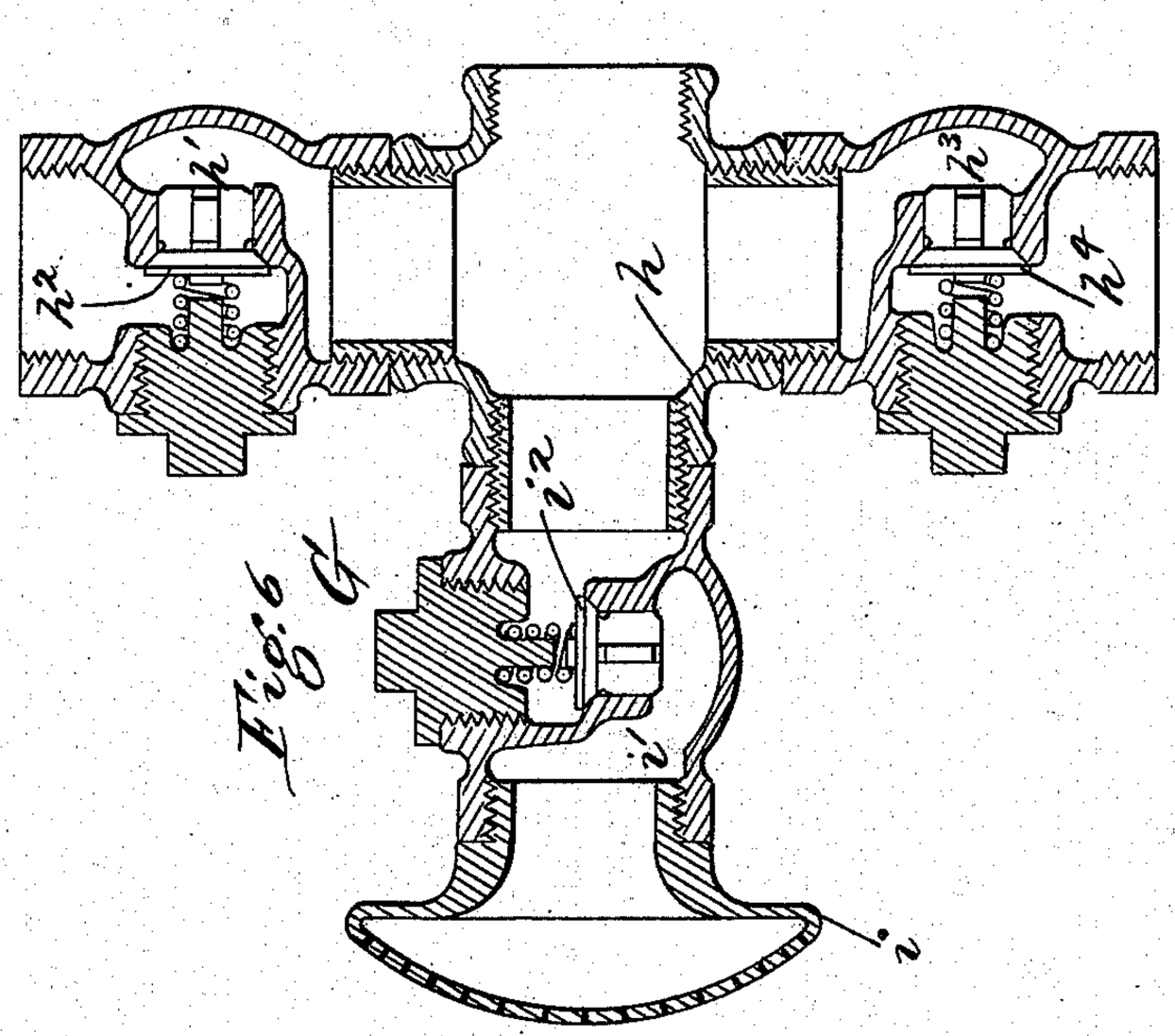


Fig. 6



Witnesses:
Charles E. Burnap
H. T. Holmes

Inventor:
By Isaac T. Dyer
Dyrenforth & Dyrenforth,
Attys.

UNITED STATES PATENT OFFICE.

ISAAC T. DYER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE DYER POWER COMPANY, OF SAME PLACE.

LOCOMOTIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 568,019, dated September 22, 1896.

Application filed May 13, 1895. Serial No. 549,046. (No model.)

To all whom it may concern:

Be it known that I, ISAAC T. DYER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Locomotive-Engines, of which the following is a specification.

The primary object of my invention is to provide a locomotive-engine with attachments for storing under pressure the exhaust-steam from the engine and reutilizing it for power or blast purposes on the locomotive, that is to say, for purposes wherein fluid-pressure is useful on a locomotive; and my further object is to utilize the inertia of the locomotive in motion while its steam is shut off, as when it is being slowed up or brought to a standstill, or when it is running down-grade, to compress atmospheric air and store it for use on the locomotive, particularly by way of supplementing the stored pressure from the exhaust.

My improvement may be applied to a locomotive of standard type without materially changing it or interfering with the ordinary action of its parts, and as the particular construction of a locomotive, as such, forms no part of my invention, but is old and well known, there is no need herein of especial description of or reference to its parts, except where they are modified for the application of my invention.

Referring to the accompanying drawings, Figure 1 is a view in side elevation showing the locomotive and cylinders in dotted lines with my improved attachments and pipe and valve connections in full lines for clearer illustration; Fig. 2, a broken view in the nature of a diagram showing parts of my improved mechanism in side elevation in their relatively operative positions, but detached from a locomotive; Fig. 2^a, a broken view showing the connection of the cylinders with the storage-tank into which they exhaust; Fig. 3, an end view, enlarged, of the cylinders and their connections at the front of the locomotive-boiler, indicated by a dotted representation; Fig. 4, a view of the same nature as that presented by Fig. 2, but showing, on an enlarged scale, mainly, parts of my improved mechanism not included in the last-named figure; Fig. 4^a, a view like that presented by Fig. 4, but showing extensions, omitted from the latter, of details; Fig. 5, an enlarged longitudinal sectional view of a safety-valve detail, and Fig. 6 an enlarged sectional view of the attachment with which each cylinder of the locomotive is provided for taking and compressing atmospheric air by the inertia of the locomotive in motion with its driving power shut off.

In the so-called "extended front" of the locomotive is contained a storage-tank A, (represented by dotted lines in Fig. 1 and by full lines in Fig. 4,) and A′ is a supplementary storage-tank, which I prefer to provide, though it is not indispensable, surrounding the smoke-stack S and having open communication with the tank A through a pipe connection *r*, Fig. 4, between the two at the top of the tank A and bottom of the tank A′.

A^2 is a safety-valve or back-pressure-valve device extending from the tank A′ into the smoke-stack, and the preferred construction of which (shown in detail mainly in Fig. 5) comprises the nipple *q*, screwed into the top of the tank A and affording a valve-chamber containing a valve *p* on a stem *p′* and held against its seat p^2 by a spring p^3, coiled about the stem and confined at its ends between the valve and a guide *o′* for one end of the stem, which enters a screw-coupling *o*, connecting the nipple *q*, containing the valve-chamber, with a discharge-pipe o^2 passing through the supplemental tank A′ into the stack. By turning the coupling *o* at its nut *x* the spring p^3 may be set to resist any predetermined pressure exerted against the valve *p* and permit it to be opened only by excess of such pressure, which is thus enabled to escape through the stack.

On the locomotive-tender (shown at T in Fig. 1) is supported another storage-tank B, which should be provided with a safety-valve, as indicated at *s*.

The two storage-tanks A and B are connected by a pipe *n*, containing an inwardly-opening check-valve (indicated at *t*) and a shut-off valve *v*, adjacent to the tank B. From the storage-tank on the tender there proceeds a pipe *n′*, containing the shut-off valves *v′* and v^2, and the pipe *n′* enters the

boiler R of the locomotive at any desired point therein.

C is a pump which may involve the usual or any suitable construction of suction and exhaust pump. It communicates at its suction side with the pipe n and at its exhaust side with a pipe n^2, containing a shut-off valve v^3, and leading from the tank B into the boiler, as hereinafter described.

C′ is an engine for working the pump C, with which it has a common piston-rod l, the engine comprising a cylinder, which may exhaust into the atmosphere and which communicates with the pipe n' and a piston connected by the rod l with the piston in the cylinder of the pump C. In Fig. 1 the pump C and engine C′ are indicated by full lines and represented as located above an oil-tank B′ on the tender, but this is merely to show them without overcrowding the drawing, as they may be located in any convenient position; and behind the tank B there is indicated a water-tank T′, communicating through a valved pipe w with the tank B to receive from the latter any condensation therein on opening the valve in the pipe.

The pipe n^2 leads to a vertical branch n^3, (see Figs. 1 and 2,) opening at its upper end into an injector device D of ordinary or any suitable construction, which discharges into a convoluted pipe D′, supported in the fire-box E of the locomotive (over the grate therein) and having its leg k extended upward into the dome R′ of the locomotive-boiler. From the rear end of the boiler there leads into the injector D, behind the junction therewith of the branch n^3, a pipe D², for a purpose hereinafter described. From the branch n^3 there proceeds an extension $n^\times$ of the pipe n^2, having the branches n^4 and n^5 at opposite sides of the boiler and connected across the base of the boiler by a pipe c, said extension $n^\times$ containing a check-valve b, which opens toward the tank B. Thus the branch n^4 lies along one side of the locomotive-boiler, as shown in Fig. 1, and the other, n^5, lies along the opposite side thereof, both being indicated in the end view presented by Fig. 3, and they reach beyond the forward ends of the cylinders F and F′, where they are provided with depending branches n^6 and n^7, connected at their lower ends with pipes n^8 and n^9, containing valves v^4 and extending lengthwise backward underneath and beyond the rear ends of the cylinders, where they are met by branches n^{10}, depending from the pipes n^4 and n^5, but only one of which (that at the cylinder F, presented to view in Figs. 1 and 2) is shown, owing to the nature of the view selected for illustration. The pipes n^8 and n^9 are connected across the locomotive from the plane of one cylinder to that of the other by a pipe n^{11}, having an upward-extending branch n^{12}, which leads into the front end of the boiler R, near which it contains an inwardly-opening check-valve t'. In each pipe n^6 and n^7, and also in each pipe n^{10}, there is inserted a valved head G, involving the construction represented in detail in Fig. 6, and of which the following is a description: A strainer-cap i is screwed into the outer end of a chamber i', containing an inwardly-opening check-valve i^2, and this chamber is screwed upon one end of a four-branch coupling h, the opposite branch of which connects it with one end of a cylinder at an opening near its bottom. The lateral or upper and lower branches of each coupling h contain, respectively, the chamber h', having seated in it an outwardly-opening check-valve h^2, and the chamber h^3, having seated in it an outwardly-opening check-valve h^4. Thus at each end of each of the cylinders F and F′ there is inserted into it one of the heads G, with its check-valved strainer-cap flanked by the check-valves h' and h^3, the branches of the coupling h containing these check-valves being coupled into the pipes n^6, n^7, and n^{10}, respectively.

The steam-chests F² on the cylinders, containing the usual slide-valve cut-off devices for controlling the inlet and exhaust ports, receive their supply of steam from the boiler R through the pipes g and g', Fig. 3, which should contain shut-off cocks v^5 and v^6 and communicate at their junction with a pipe g^2, leading through the boiler into the steam-dome R′.

The cylinders exhaust into a pipe f', Figs. 4 and 2ª, opening into the storage-tank A.

The oil-tank B′ communicates from its upper end with the pipe n^2 through a pipe e, containing a shut-off valve v^7, and through which to introduce pressure on the top of the contents of the tank to force the hydrocarbon oil out through a pipe e', containing a shut-off valve v^8 and discharging into an oil-burner or blowpipe H, leading into the fire-box E underneath the coil D′ and connected from its rear end with the pipe n^2.

As usual in a locomotive, when the lever I is in the vertical position in which it is illustrated its connections with the slide-valves in the steam-chests F² are such as to cause them to be shut off from the admission of steam to work the pistons, and the lever is turned in either direction, depending on that in which it is desired to run the engine, to admit steam to the chests for working the pistons. When the locomotive is running with the steam on its cylinders, the exhaust from the latter is all discharged through the pipe f' into the storage-tank A A′, whence the pressure enters through the pipe n and fills the tank B, and when the pressure in either tank exceeds that for which its particular safety-valve is set (say twenty pounds) it blows off through the latter.

The condensation in the cylinders F and F′ can never accumulate therein to be churned by the action of the pistons, owing to the provision of the openings into the heads G being at the bottoms of the cylinders, through which openings the condensation is forced, by the action of the pistons, past the check-valves

h^4 into the pipes n^8 and n^9 and, by the pressure, when it exceeds that in the boiler, back into the latter through the pipe n^{12}. The petcock v^4 in the pipe n^8 enables the condensation therein to be drawn off, when the locomotive is not running, to prevent its freezing in the pipes. Between each steam-chest and its cylinder are provided the valves j and j', which are ordinary rotary plug-valves, linked to the reversing-gear to be closed when the lever I is in its normally vertical position and to be opened by turning the lever either forward or backward. When these valves are closed, no steam can enter the cylinders from the chests. When the steam is thus cut off, the continued running of the locomotive until it is brought to a standstill works the pistons, each stroke sucking in air through a strainer-cap i at one end of each cylinder and forcing it out at the opposite end thereof past the check-valves h' and through the pipes n^5, n^6, n^{10}, n^4, $n^\times$, n^3, and n^2 into the storage-tank B, wherein it supplements the pressure of exhaust-steam, if there be such pressure stored in the tank, and, if not, it alone affords a supply of pressure for use as power.

While the locomotive is running under steam, the pressure from the store in the tank B enters the boiler through the pipe n^2, (the valve v^3 being open,) branch n^3, and injector D, the action of which is superinduced by steam admitted into it from the boiler through the pipe D^2, and the injector forces the pressure through the coil D', in which it is superheated by the heat in the fire-box, and from which it discharges through the leg k into the dome R' to be used as power for driving the locomotive. If it be desired to fire the furnace with the liquid fuel from the tank B', the valve v^7 in the pipe e is opened to admit pressure from the pipe n^2 upon the oil in the tank to discharge it through the pipe e' (having its contained valves v^8 v^9 open) into the burner H, wherein it is mixed with steam under pressure, or compressed air, or both, admitted to the burner from the pipe n^2 on opening the valve v^{10} in the latter.

Whenever the pressure in the tank B exceeds the boiler-pressure, on opening the valves v' and v^2 in the pipe n' the excess of pressure in the tank will enter the boiler through the pipe.

When the tank B is shut off from the tank A by closing the valve v in the pipe n, (a condition which may arise when the store of tank-pressure has been exhausted, or when, soon after starting the locomotive to run, only enough exhaust-steam pressure has been generated to supply, or partly supply, the tanks A A',) the engine C' is worked, on closing the valve v' and opening the valve v^2 in the pipe n' to admit steam from the boiler (see Fig. 4^a) into the engine to actuate it, whereby it works the pump C to suck from the pipe n either exhaust-steam from the tank A, or, if there be none therein, atmospheric air through the check-valve t, and force it out through the pipe n^2 (the valve v^3 in which is then closed) into its branch n^3 to supply the injector D, to which the branch n^3 leads, and burner H, if the latter be used.

What I claim as new, and desire to secure by Letters Patent, is—

1. In combination with a locomotive, a storage-tank into which the exhaust-steam from the cylinders discharges, a second storage-tank having a pipe connection with said exhaust-steam storage-tank, a pipe-coil in the locomotive fire-box and discharging into the boiler, and an injector device communicating with said second storage-tank and discharging into said pipe-coil, substantially as and for the purpose set forth.

2. In combination with a locomotive, a storage-tank into which the exhaust-steam from the cylinders discharges, air-inlets on the cylinders, a second storage-tank communicating through a valve-controlled pipe with said exhaust-steam storage-tank and with the cylinders through said air-inlets by pipe connections equipped with check-valves opening toward said second storage-tank, a pipe-coil in the locomotive fire-box and discharging into the boiler, and an injector device communicating with said second storage-tank and discharging into said pipe-coil, substantially as and for the purpose set forth.

3. In combination with a locomotive, a storage-tank into which the exhaust-steam from the cylinders discharges and provided with a valve device A^2 opening into the locomotive-stack, air-inlets in the opposite ends of the cylinders at their lowest points affording discharge-openings for condensation and controlled by inwardly-opening check-valves, and pipe connections between the said discharge-openings and the locomotive-boiler and provided with check-valves opening against the back pressure from the boiler, substantially as described.

4. In combination with a locomotive, a storage-tank into which the exhaust-steam from the cylinders discharges, air-inlets in the cylinders, a second storage-tank communicating through a valve-controlled pipe with said exhaust-steam storage-tank and with the cylinders through said air-inlets by pipe connections equipped with check-valves opening toward said second storage-tank, a pipe-coil in the locomotive fire-box and discharging into the boiler, an injector device communicating with said second storage-tank and discharging into the pipe-coil, and a liquid-fuel supply-tank having a valve-controlled outlet-pipe provided with a burner attachment extending under the fire-box and communicating with the pressure supply of said second storage-tank, substantially as and for the purpose set forth.

5. In combination with a locomotive, a storage-tank A into which the exhaust-steam from the cylinders discharges, a second storage-tank B connected with said tank A by a pipe n containing a valve, a pipe-coil in the loco-

motive fire-box and discharging into the boiler, an injector device discharging into said pipe-coil, a pipe n^2 containing a valve and leading from the tank B into said injector device, a valve-controlled pipe n' leading from said tank B into the boiler, a pump C communicating from its suction side with the pipe n and from its discharge side with the pipe n^2, and a compressor C′ operatively connected with the pump and communicating, for its pressure supply, with the pipe n', substantially as and for the purpose set forth.

6. In combination with a locomotive, a storage-tank A into which the exhaust-steam from the cylinders discharges, a second storage-tank B connected with said tank A by a pipe n containing a shut-off valve v and an inwardly-opening check-valve t, a pipe-coil in the locomotive fire-box and discharging into the boiler, an injector device discharging into said pipe-coil, a pipe n^2 containing a valve and leading from said tank B into said injector device, a pipe n' containing the shut-off valves v' and v^2 and leading from said tank B into the boiler, a pump C communicating from its suction side with the pipe n and from its discharge side with the pipe n^2, and a compressor C′ operatively connected with the pump and communicating, for its pressure supply, with the pipe n', substantially as and for the purpose set forth.

7. In combination with a locomotive, a storage-tank A into which the exhaust-steam from the cylinders discharges, air-inlets in the opposite ends of the cylinders at their lowest points affording discharge-openings for condensation and each provided with a head G formed with a strainer-cap i and chambers i', h' and h^4 provided, respectively, with the check-valves i^2, h^2 and h^4, pipe connections between said chambers h^3 and the locomotive-boiler, a second storage-tank B communicating through a pipe n with the tank A, a pipe-coil D′ in the locomotive fire-box, and discharging into the steam-dome, an injector device discharging into said pipe-coil, a valve-controlled pipe n' leading from the tank B into said injector device, and extensions n^4 and n^5 of the pipe n^2 leading to the chambers h' of the heads G at the opposite ends of the cylinders, the whole being constructed and arranged to operate substantially as and for the purpose set forth.

ISAAC T. DYER.

In presence of—
J. H. LEE,
J. N. HANSON.