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AIR AND GAS LOCOMOTIVE.

No. 401,218. Patented Apr. 9, 1889.

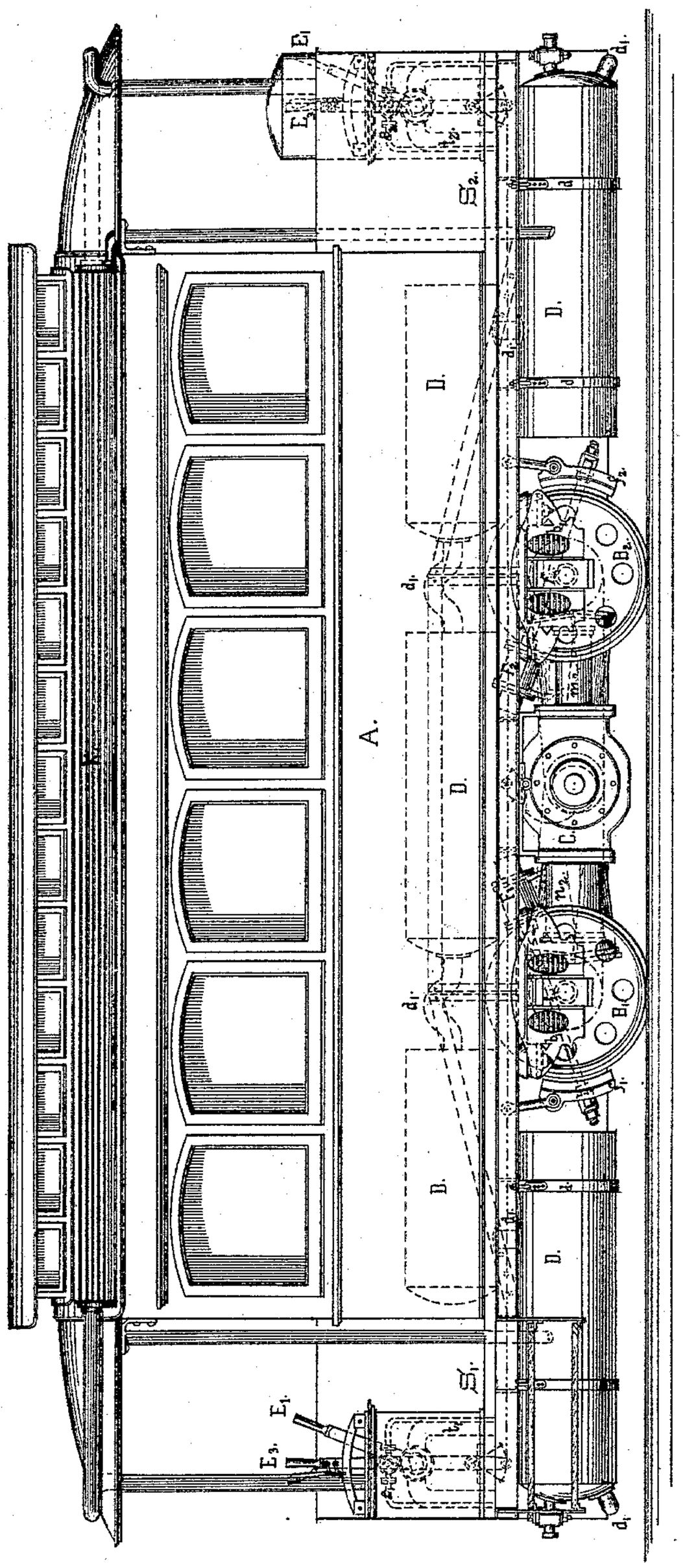

Fig. 1.

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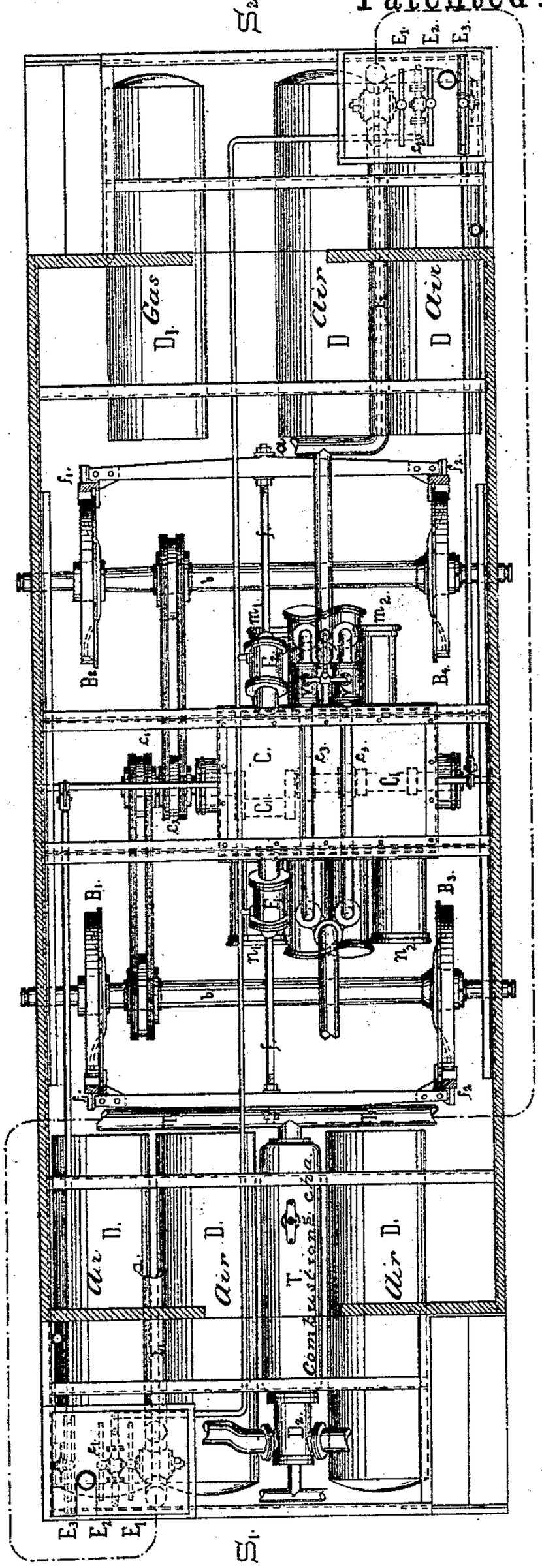

Fig. 2.

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AIR AND GAS LOCOMOTIVE.

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Fig: 4.

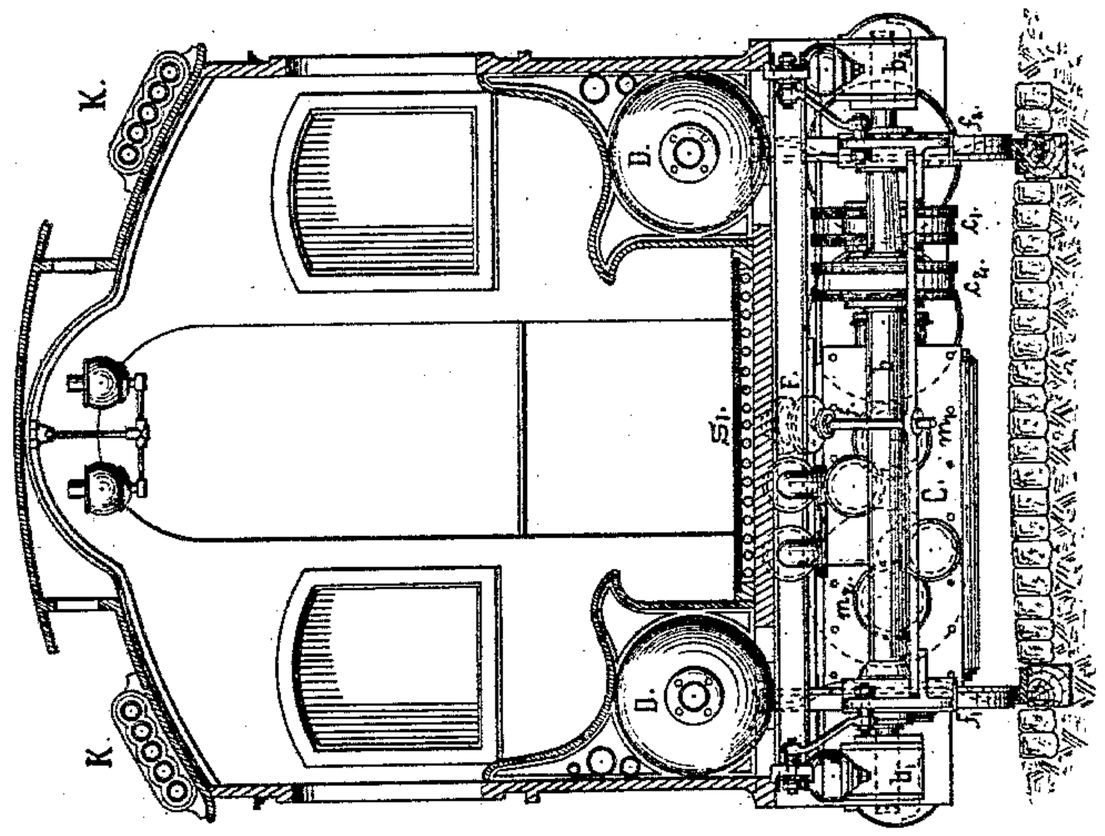

Fig: 3.

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AIR AND GAS LOCOMOTIVE.

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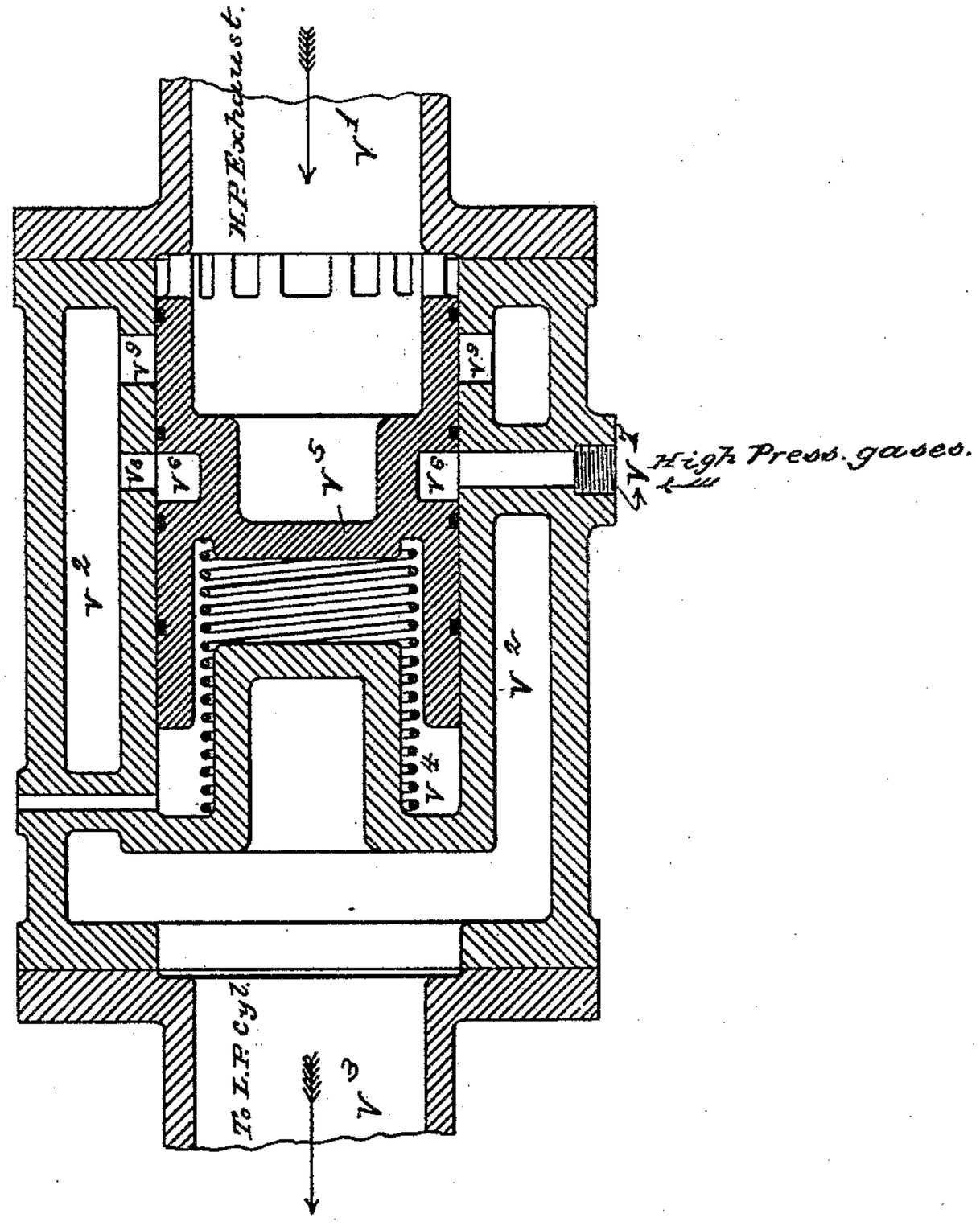
Fig: 5.



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UNITED STATES PATENT OFFICE.

ALBERT SCHMID, ROBERT SIEGFRIED, AND JOHN CHARLES BECKFELD, OF ALLEGHENY, PENNSYLVANIA; SAID SIEGFRIED ASSIGNOR TO SAID SCHMID.

AIR AND GAS LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 401,218, dated April 9, 1889.

Application filed December 14, 1888. Serial No. 293,569. (No model.)

To all whom it may concern:

Be it known that we, ALBERT SCHMID and ROBERT SIEGFRIED, citizens of Switzerland, and JOHN CHARLES BECKFELD, a citizen of the United States, all residing in Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Air and Gas Locomotives, of which the following is a specification.

Our invention relates especially to the construction of the class of locomotives or cars designed for street-railway purposes and driven by engines operated by the combustion of mingled air and gas.

The object of the invention is to provide a simple and efficient form of locomotive of this character upon which a sufficient quantity of compressed air and gas can be carried for driving the car a required distance, and for feeding the same to the combustion-chamber in the proper proportions and communicating the power thus obtained to the driving-wheels in a convenient and efficient manner.

It also involves the construction of suitable apparatus for controlling the operation of the engine and the direction of movements and the application of the brakes and for illuminating and heating the car.

In the accompanying drawings, illustrating the invention, Figure 1 is a side elevation of the complete car equipped with the tanks containing gas and air and the combustion apparatus or generator and the engine for converting the power into motion. Fig. 2 is a plan of the same. Fig. 3 is an end view of the car. Fig. 4 is a transverse section of the same, and Fig. 5 is an enlarged detail of the starting-valves of the engine.

Referring to the figures, A represents the body of the vehicle; B' B^2 B^3 B^4, the driving-wheels of the truck. The truck is preferably constructed with an iron frame and provided with axle-boxes b' b^2 b^3 b^4 for the axles b b in the usual manner. The motor or engine C operates upon a crank-shaft, C′, which carries two pulleys, c' c^2, for communicating motion to the axles b b. The motion may be communicated through belts, or chains, or friction-wheels, or in any other convenient manner.

For operating the engine, the products of the combustion of air and gas are employed. For this purpose a suitable number of tanks D are distributed about the body of the car. In this instance six tanks D are placed beneath the seats of the car, and five more are attached to the iron frame of the truck in any suitable manner—as, for instance, by the wrought-iron bands d. These eleven tanks all communicate with each other through suitable pipes, d'. Another tank, D′, is also attached to the truck, and it contains gas only. The others contain air under pressure. The volumes of the air and gas tanks are so proportioned as to afford the proper relative amounts for combustion when united. The gas and air are separately conveyed into the generator or combustion-chamber T, being properly mingled as they enter. For this purpose they pass through a suitable mixer, D^2, upon the way to the combustion-chamber. In the combustion-chamber they burn with a continuous flame under pressure, and thus fill the combustion-chamber with the products of combustion. The pressure in the combustion-chamber is maintained at a proper amount—*i. e.*, less than the pressure in the tanks. This can be accomplished by means of automatic pressure-regulators of any well-known type. These regulators are inserted into the pipes which feed the gas and air to the combustion-chamber or generator, and a safety-valve, s, is employed on the generator for relieving it in case the pressure becomes too great. The volume obtained by the combustion is about five times as great as the original volume. In this manner a sufficient volume is obtained for economically operating the engine. The hot gases or products of combustion are led from the combustion-chamber through insulated pipes T' T^2 to the two platforms, S' S^2, upon either of which the driver or engineer may stand. Suitable governing-levers, E′, E^2, and E^3 are placed on each platform for controlling the engine and the admission of products of combustion. The levers E′ serve to admit and check the flow of the products of combustion to the engine through pipes t' t^2. The levers E^2 are respectively connected with three-way cocks e' e^2, which allow the hot gases from the gener-

ator to enter two small cylinders, F′ F², the pistons of which are connected by means of suitable rods, *f*, with the brake-shoes *f′ f²*. The levers E³ serve to change the cut-off of the engine and to reverse the engine by turning the eccentric sheaves *e³* through an arc of one hundred and eighty degrees in a manner well understood.

The engine itself is a double-compound single-acting machine, and the connecting-rods of each pair of engines act upon the same crank, as already stated. The cranks of the two engines are set at an angle of ninety degrees to each other, so as to avoid dead-points. The two high-pressure cylinders *m′ m²* are upon one side and the two low-pressure cylinders *n′ n²* upon the other. In the pipes which connect the high-pressure with the low-pressure cylinders there are placed valves *v v*, which, when the engine is at rest and the pipes are opened to admit the products of combustion thereto, act to automatically admit the high-pressure gases into the low-pressure cylinders, so as to start the engine in whatever position the cranks may be. These valves are constructed in the manner shown in Fig. 5. Exhaust-gases from the high-pressure cylinder enter *v′* and pass when the apparatus is in operation through ports *v⁹* into the surrounding chamber *v²* and out at *v³* into the low-pressure cylinder. When, however, the engine is at rest, a spring, *v⁴*, forces the movable cylinder or cut-off *v⁵* forward, thus bringing the port *v⁶* opposite an inlet, *v⁷*, which communicates with the source of high-pressure gases. These gases then passing through the inlet *v⁷* and port *v⁶* pass through an opening, *v⁸*, into the chamber *v²*, and thus to the escape *v³*, whence they pass to the low-pressure cylinder. As soon, however, as the engine is in such position that the exhaust-gases from the high-pressure cylinder may reach the inlet *v′*, the cut-off is forced against the spring, closing the opening from the pipe *v⁷*, and thus shutting off the high-pressure gases from the low-pressure cylinder.

The engines are entirely covered to prevent undue radiation of heat and for protection, and the crank-chamber is filled with oil and water. The exhaust-gases are used, if required, for heating the car, being led through suitable pipes, *s′*, along the floor of the car.

The exhaust from the low-pressure cylinders may be carried through condensing-pipes K K upon the roof of the car and then allowed to escape. For illumining the car gas is obtained from the gas-tank.

We claim as our invention—

1. In an air and gas motor car, the combination of tanks for containing air under pressure, one or more other tanks for containing gas under pressure, a combustion-chamber with which said tanks communicate and in which the air and gas burn continuously, an interposed mixing-chamber, an engine driven by the products of combustion, and a controlling-lever upon each end of the car for governing the flow of the products of combustion from the combustion-chamber to the engine.

2. In an air and gas motor car, the combination of a double-compound single-acting reversible engine, tanks for containing air and gas under pressure, a combustion-chamber in which the mingled air and gas are consumed, pipes leading from the combustion-chamber to the respective ends of the car, and levers for controlling the flow of the products of combustion through said pipes to the engine located on the car.

3. In an air and gas motor car, the combination of a double-compound single-acting engine, tanks for containing air and gas under pressure, a combustion-chamber in which the mingled air and gas are consumed, pipes leading from the combustion-chamber to the respective ends of the car, levers for controlling the flow of the products of combustion through said pipes to the engine located on the car, brakes applied to the wheels of the car, cylinders having their pistons connected with the brake-levers, pipes communicating with the combustion-chamber and leading from the respective platforms to said brake-cylinders, and levers located upon the respective platforms for controlling the flow of the products of combustion from said combustion-chamber through said pipes.

4. In an air and gas motor car, the combination of a double-compound single-acting engine, tanks for containing air and gas under pressure, a combustion-chamber in which the mingled air and gas are consumed, pipes leading from the combustion-chamber to the respective ends of the car, levers for controlling the flow of the products of combustion through said pipes to the engine located on the car, a reversing-gear on the engine, and levers located upon the respective platforms for operating the reversing-gear.

5. In an air and gas motor car, the combination of an engine, tanks for containing air and gas under pressure, a combustion-chamber in which the mingled air and gas are consumed, pipes leading from the combustion-chamber to the respective ends of the car, and levers for controlling the flow of the products of combustion through said pipes to the engine located on the car.

6. In a double-compound single-acting engine, two high-pressure cylinders and two low-pressure cylinders located upon opposite sides of the driven crank-shaft, in combination with a vehicle carrying the engine and apparatus for supplying the products of combustion to said engine.

7. In a double-compound single-acting engine, two high-pressure cylinders and two low-pressure cylinders located upon opposite sides of the driven crank-shaft, in combination with a vehicle carrying the engine and apparatus

for supplying the products of combustion to said engine, and valves intervening between the high-pressure and low-pressure cylinders, whereby the latter are used automatically as high-pressure cylinders in case the valves of the small cylinder are in such a position as not to admit gases to their respective cylinders.

In testimony whereof we have hereunto subscribed our names this 3d day of December, A. D. 1888.

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