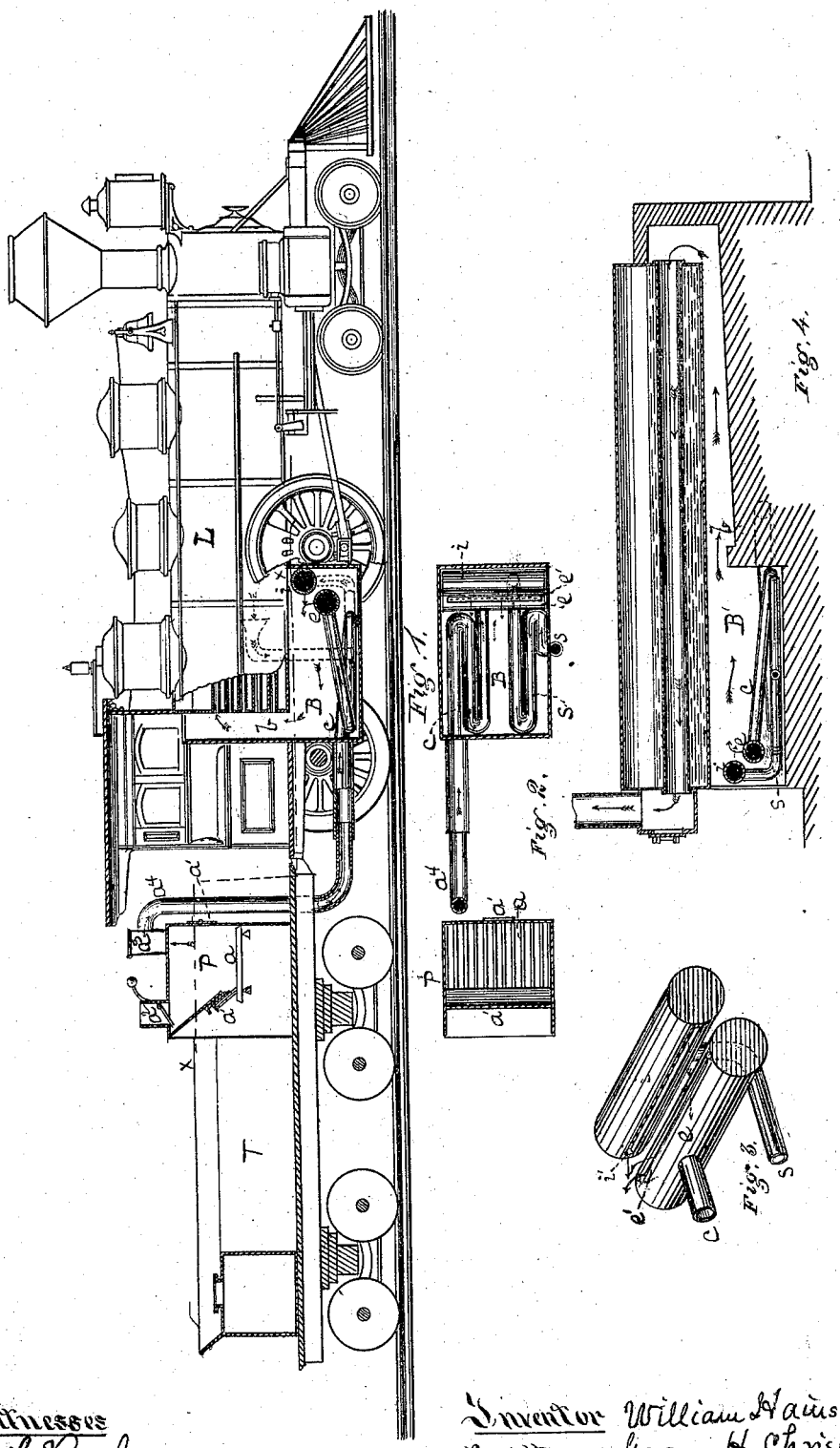
W. HAINSWORTH.

APPARATUS FOR UTILIZING GAS AS A FUEL.

No. 187,756. Patented Feb. 27, 1877.

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# UNITED STATES PATENT OFFICE.

WILLIAM HAINSWORTH, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO HIMSELF, HENRY W. PATTERSON, AND JAMES IRWIN, OF SAME PLACE.

## IMPROVEMENT IN APPARATUS FOR UTILIZING GAS AS A FUEL.

Specification forming part of Letters Patent No. 187,756, dated February 27, 1877; application filed February 3, 1877.

*To all whom it may concern:*

Be it known that I, WILLIAM HAINSWORTH, of Pittsburg, county of Allegheny, State of Pennsylvania, have invented or discovered a new and useful Improvement in Apparatus for Utilizing Gas as a Fuel; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a side elevation, partly in section, of a locomotive and tender with my improved apparatus applied thereto. Fig. 2 is a sectional view of the apparatus detached, in the line *x x*, Fig. 1. Fig. 3 is an enlarged view, in perspective, of a detached portion of the apparatus, as presently to be explained; and Fig. 4 is a longitudinal vertical sectional view of a flue-boiler, and of my improved apparatus applied thereto.

In the ordinary mode of utilizing soft or bituminous coal as a fuel, the waste by smoke and unconsumed gases is enormous. This is especially the case on railway-locomotives, where the strength of the blast is such as to draw through and blow out not only unconsumed gaseous products, but also solid matter in considerable quantities. As a means of avoiding such waste, or a considerable part of it, I employ a gas-producer, to convert the solid fuel into gaseous fuel, arrange such producer on the tender or other convenient part of the train, and conduct the gases and smoke directly therefrom to the fire-box, and there ignite it in connection with a supply of oxygen. I have also devised an improved apparatus for heating and burning such gases and gaseous products in connection with heated air, so as to secure as perfect a combustion of the carbonaceous elements thereof as possible.

The locomotive L and tender T are of the usual or any known construction. In the fire-box B I arrange the apparatus presently to be described, or other suitable gas-burning and air-supplying apparatus suitable for burning the gases, smoke, &c., given off by the gas-producer. On the tender or other convenient part of the train I make a gas-producer, P, of any approved construction, one convenient form being shown in Figs. 1 and 2, where *a* represents the grate-bars; $a^1$, the dampers; $a^2$, the charging-hole and valve; $a^3$, the gas-chamber, from which the pipe $a^4$ leads to the burner in the fire-box B. My improved gas-burner, as shown in all the figures, takes the gas, smoke, &c., from the producer-pipe $a^4$ through a pipe, *c*, which has one or more coils or zigzag or return pipes inside the fire-box B or B′, Fig. 4, and which terminates in a cross-tube or drum, *e*, such cross-tube or drum being arranged at the end of the fire-box opposite to or most distant from the flue or passage *b*, which conducts the products of final combustion out of or away from the fire-box, and the pipe *c* being arranged wholly or chiefly between such cross-pipe or drum and such escape flue or passage, so that the products of final combustion, in passing from the place of ignition at or near the drum to the escape flue or passage, shall pass along not only in contact with the boiler or other object to be heated, but also over or around and along the exterior of the pipe *c*, and, heating it, shall still further heat the gases, smoke, &c., which are passing through it to the drum. This drum *e* has a long narrow slot or equivalent perforations, *e′*, Fig. 3, for the introduction into the fire-box of the smoke, gases, &c., from the gas-producer in a thin sheet or small jets at the desired point of ignition. The air necessary to supply oxygen at this point of ignition is introduced from without, and conducted along in or back and forth inside of the fire-box by a pipe, *s*, arranged with reference to being heated in like manner as already described with reference to the pipe *c*, and so as to heat the ingoing air, which then passes into the cross-pipe or drum *i*, which latter is arranged in like manner as the drum *e*, and has a like slit or series of perforations, *i′*, as also shown in Fig. 3. These exit-passages for the heated gases and air are in such juxtaposition and relatively so arranged that the air and gases shall quickly and readily commingle, and then, being ignited, will result in the perfect or almost perfect combustion of all

carbonaceous elements. The maximum heat thus evolved passes over or along the pipes *c s* as and with the effect already described, and then, entering the flue *b*, continues its work as a heating agent with a minimum percentage of loss. Fig. 4 is intended to show merely one way of using the apparatus described in connection with a flue-boiler. But the kind or class of boiler, or the kind or form of heating-chamber or fire-box, in or in connection with which the apparatus is used, or the purpose to which the heat, when generated, is to be applied, is not a material element in this part of my invention. The gas and air pipes and the slitted and perforated drums may be similarly arranged with reference to the same heating result, and a like operation in or in connection with any fire-space, without other change than such as can be made by the skilled mechanic. Additional supplies of heated air may, by like means, be furnished at the entrance to the flues *b*, or at subsequent points, if found desirable. With stationary heaters, stationary gas-producers are to be employed. Instead of air, any oxygen-bearing gas or vapor may be employed in like manner, and for the purposes of this case I include the latter in the term used. Also, with stationary heaters, where natural gas is available, the producer may be dispensed with, and the natural gas be conducted directly into the pipes *c* and drum *e*, with the operation and result above described.

I claim herein as my invention—

1. The pipes *c s* and slitted or perforated cross-tubes or drums *e i*, arranged in the fire-space of a heating apparatus, with the drums opposite the exit-flue, and the pipes in the line of draft between the drums and exit-flue, substantially as set forth.

2. A gas-producer, a gas-heater, and burner apparatus connected therewith, and an air heating and supply apparatus for perfecting the combustion of the gas, arranged on and combined with a locomotive and tender, substantially as set forth.

In testimony whereof I have hereunto set my hand.

WILLIAM HAINSWORTH.

Witnesses:

J. J. McCORMICK