J. BAIRD & A. STIRLING.

Exhaust Mechanism for Locomotives.

No. 215,427. Patented May 20, 1879.

Fig 1.

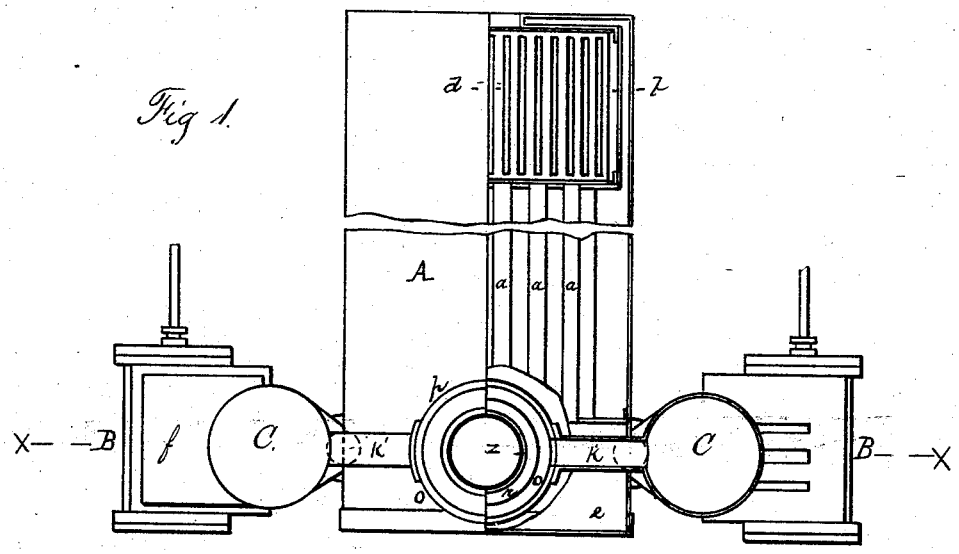
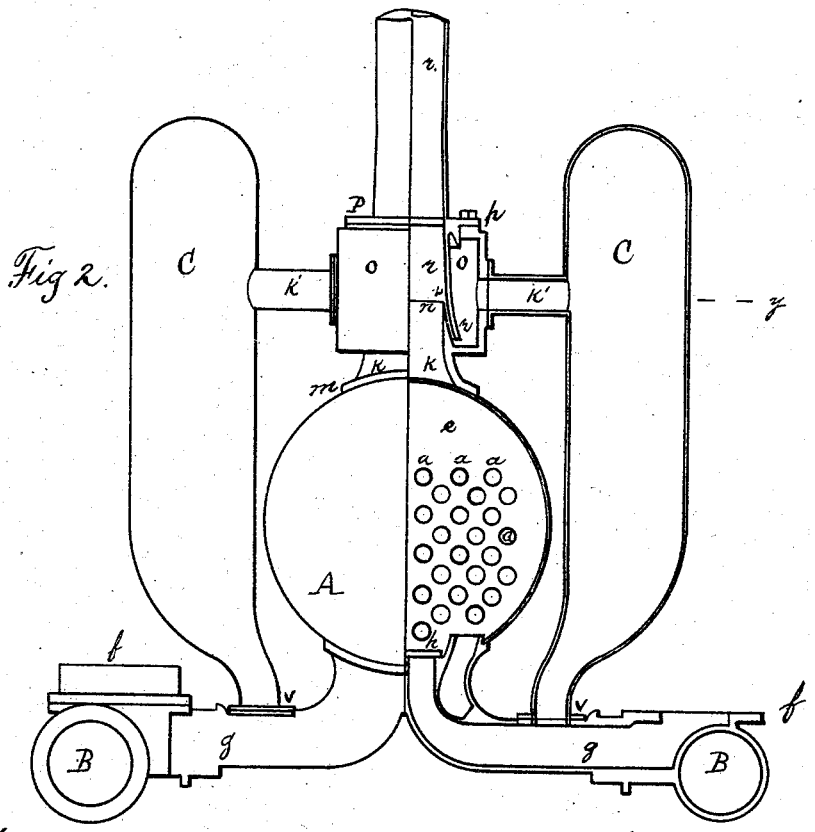


Fig 2.



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IMPROVEMENT IN EXHAUST MECHANISMS FOR LOCOMOTIVES.

Specification forming part of Letters Patent No. **215,427**, dated May 20, 1879; application filed February 20, 1879.

To all whom it may concern:

Be it known that we, JOHN BAIRD and ALLAN STIRLING, both of the city, county, and State of New York, have jointly invented a new and useful Improvement in Exhaust Mechanisms for Locomotives; and we do hereby declare that the following is a full, clear, and exact description and specification of the same, reference being had to the annexed drawings, making part thereof.

Our invention relates directly to the means for causing draft through the tubes of boilers on locomotives and such like engines.

From the time of the first successful use of locomotives the exhaust from the cylinders of their engines has been used to cause the draft by the blast of the exhaust-steam discharged intermittently through contracted nozzles in pipes centrally located in the smoke arch or chamber, so as to act in the line of the direction of the rising smoke.

Although the construction above referred to has been universally adopted and serves a most useful purpose, yet there are various disadvantages which our present invention is designed to overcome, and which have been removed by our improvements.

The exhaust from two cylinders the pistons of which are connected with cranks on one shaft set at right angles to each other is regular and intermittent; but as the area or capacity of the pipes and nozzles as compared with the area of the cylinders is small, and as the duration of the blast is necessarily short, the pressure of the blast is heavy, and a heavy back-pressure is thrown against the piston on the exhaust side, and materially reduces the power of the engines.

Again, the blast, as above described, is for the moment excessive and severe, draws the products of combustion through the boiler-tubes, tends to raise the coals from the grate-bars or the surface of the fire and tears the fire injuriously, causes incomplete combustion, and draws sparks and pieces of coal through and discharges them from the smoke-pipe to annoy passengers and endanger property. Finally, for some places where locomotives are used, the noise caused by the intermittent blast is a serious inconvenience and cause of complaint.

Our improvements remedy all these defects to a great extent, while at the same time we gain advantages never before realized, which render the locomotive more efficient and more economical in the use of coal.

In order that persons skilled in the art may understand, make, and use our invention, we will proceed to describe the same by reference to the drawings, in which—

Figure 1 represents a top view of a locomotive-boiler, partly in horizontal section, with two cylinders, one on each side, and having our improvements attached. Fig. 2 represents a front-end view of the same, also partly in vertical section, on the line *x x* of Fig. 1.

A is a locomotive-boiler, made in the usual way, with tubes *a* running longitudinally through from the fire-box *b* to the smoke-chamber *e*. *d d* are the grate-bars of the fire-box, and are of the usual construction. B B are the cylinders, connected to the frame and boiler in the ordinary way. *f f* are the valve-chests, containing the common slide-valves, for admitting and exhausting the steam to and from the ends of the cylinders.

g g are the exhaust-pipes, leading from the central exhaust of the cylinder valve-seats, and connecting with the exhaust-cups of the valves. *h h* are caps covering the ends of the said exhaust-pipes *g g*, where the blast-pipes with nozzles are usually attached. The caps *h h* prevent any part of the exhaust-steam from going into the smoke-chamber in the usual manner. *k* is the smoke-pipe, leading from the smoke-chamber *e* upward. It is attached to the boiler-shell by rivets or bolts passing through the flange *m*. Its inside is circular and extends up to line *n*. Around the pipe *k* is constructed an enlarged chamber, *o*, provided with two openings, one on each side, connecting with the pipes *k' k'*, which lead to the exhaust-reservoirs C C. The chamber *o* is closed on the top by a flange, *p*, to which is centrally attached the smoke-pipe *r*, being in effect a continuation of smoke-pipe *k*, and extending up above the boiler to the usual height; but the part *r* is shaped at the lower end so as to encircle the upper end of pipe *k*, leaving a ring-shaped channel, *z*, between them. The outside of pipe *k* is tapered from the bottom of *o* to the line *n*, to correspond with the enlarge-

ment of the lower end of pipe *r*, which does not extend entirely to the bottom of the cylinder *o*, but is raised enough to permit the exhaust-steam to pass under and between the bottom of *r* and to the top of *k*, as shown in the drawing. This ring-shaped channel *z* may be made of any desired area, and may be made adjustable to increase or diminish the pressure of the exhaust.

The exhaust-reservoirs C C are flanged at the bottom, as shown at *v*, and are attached by bolts to the exhaust-pipes *g g*, so that the exhaust from each engine is independent of the other until they unite in chamber *o*, after passing through the pipes *k' k'*, reservoirs C C, and exhaust-pipes *g g*.

The operation is as follows. The products of combustion from the fire in the fire-box *b* pass through the tubes *a* into the smoke-chamber *e*, thence through the pipes *k* and *r* to the air.

The exhaust-steam, being discharged by the valves in the steam-chests *f f* into the exhaust-pipes *g g*, fills the reservoirs C C and the exhaust-chamber *o*, and passes through the channel *z*, which, being of less area than the exhaust-pipes, checks and holds back the exhaust sufficiently to produce a back-pressure in the reservoirs C C and on the pistons of the engines. The pressure of the exhaust-steam, passing through the channel *z* and entering the pipe *r* on the circumference, causes practically a continuous draft through the tubes *a* from the fire-box, and from the smoke-pipe *r* to the air.

Thus, by the interposition of our apparatus between the cylinders and the exit smoke-pipe, we smother the pulsations from the cylinders at the time of the opening of the exhaust-ports, and at the same time both reduce the noise and produce a continuous action of the draft on the fire when the engines are in action, and we avoid the injurious effects which arise from the intermittent exhaust.

But there is another very important result obtained from our construction, since we find from experience that the pressure required to maintain the draft, when continuous, as we have practically demonstrated, is very much less than is required when the pressure is intermittent, as in the usual construction, and consequently a great saving of power is effected.

Again, by the use of our improvements a great gain is made in the power of the engines at the time when the locomotive is first started on account of the small amount of back-pressure, since it takes some time to fill the reservoirs C C with exhaust-steam, and to create the back-pressure on the pistons. When the exhaust-pipes connect directly with contracted nozzles, back-pressure is produced in them by starting the locomotive before any appreciable length of time has elapsed. At such time, however, the steam in the boiler is usually at a high pressure, and therefore less draft is required than at any time after getting under way.

We have found in practice that the annular or circumferential discharge-opening *z* gives the best results when its area is about equal to the area of the nozzles now in use on locomotives as usually constructed.

It will be obvious that the exhaust-pipes may be carried direct to the chamber *o*, suitably enlarged to have the proper capacity to act as a reservoir, thus dispensing with the reservoirs C C.

Such modifications would still contain the substance of our invention, and on some locomotives would be more conveniently applied, the most important feature of our invention being the interposition of an enlarged reservoir or reservoirs between the cylinders and the smoke-pipe to receive and reduce the pressure of the exhaust-steam and equalize the blast, discharging the same continuously through an annular or circumferential opening into the smoke-pipe of the boiler.

Having now described the manner in which we have constructed our improvements, what we claim as our invention, and desire to secure by Letters Patent, is—

The combination, substantially as hereinbefore set forth, of one or more enlarged reservoirs with the exhaust-pipes of the engine-cylinders and the smoke-pipe of the boiler, provided with an annular or circumferential contracted exhaust-steam-discharge passage, inclosing the smoke-passage, all constructed and connected in such a manner as to receive the exhaust-steam in the reservoir, and then discharge it continuously into the smoke-pipe to aid the draft, substantially as described.

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