

(No Model.)

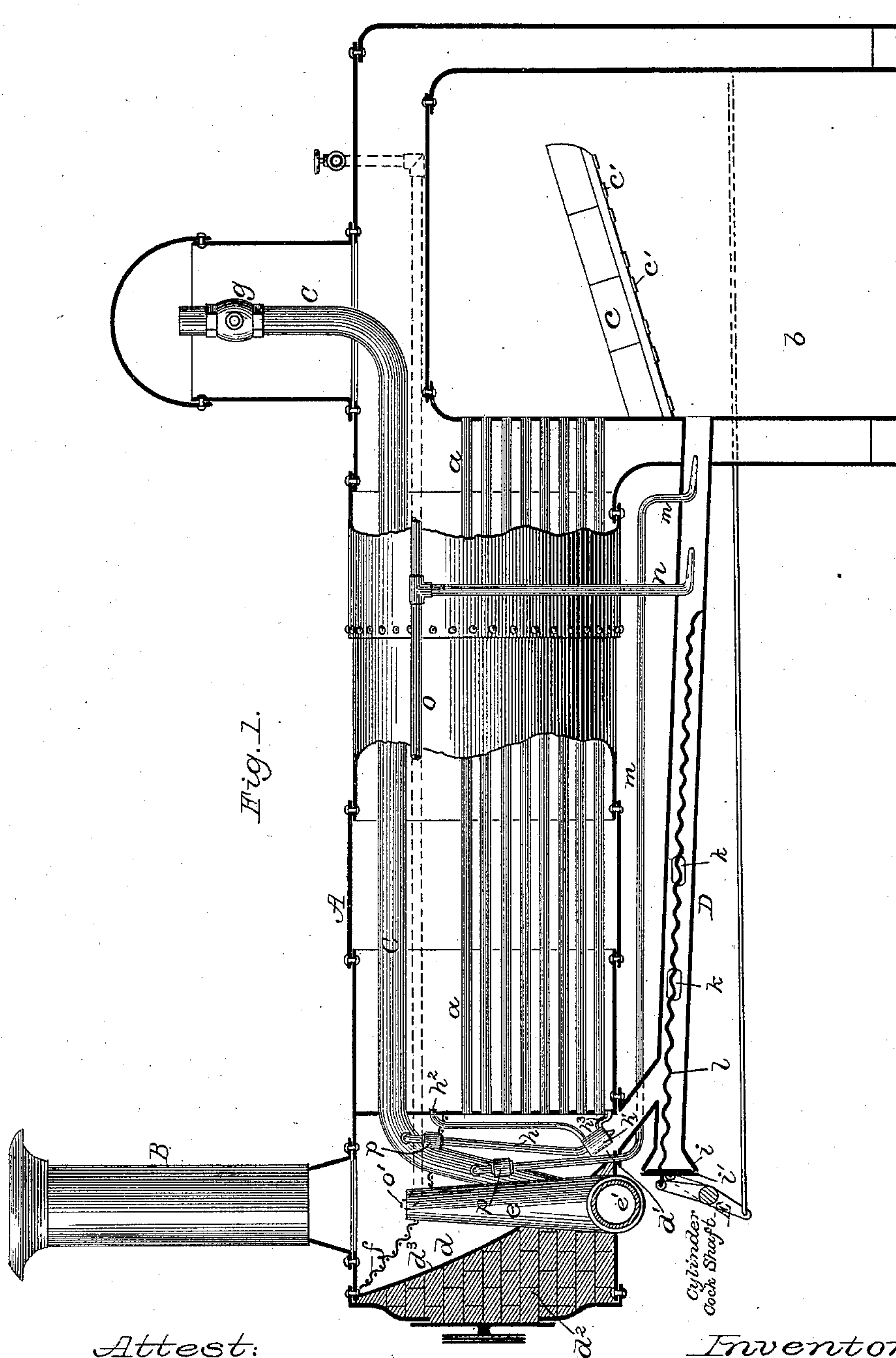
2 Sheets—Sheet 1.

G H. GRIGGS.

LOCOMOTIVE SPARK ARRESTER AND CONSUMER.

No. 316,892.

Patented Apr. 28, 1885.



Attest:
Philip F. Larnier.
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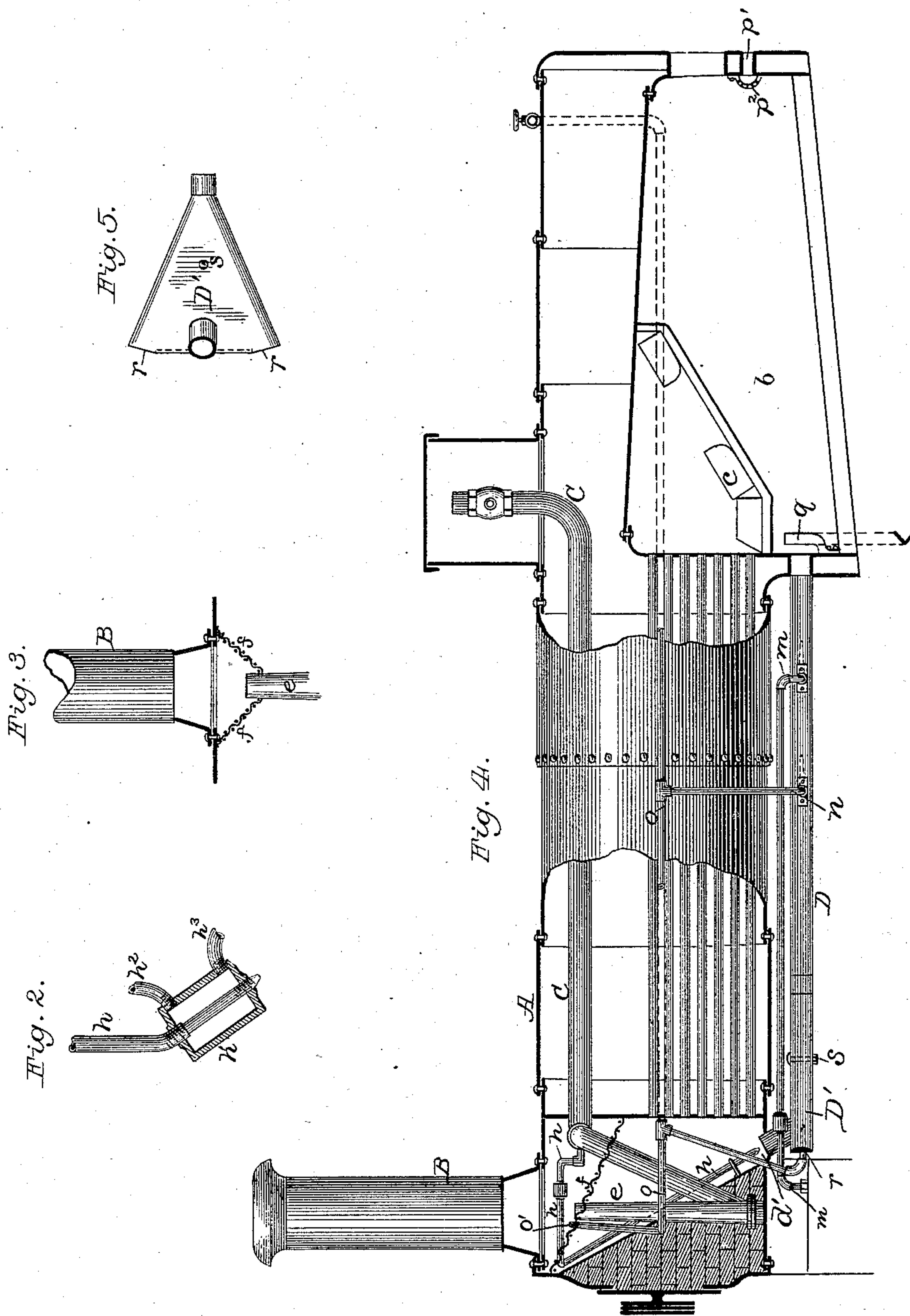
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UNITED STATES PATENT OFFICE.

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LOCOMOTIVE SPARK ARRESTER AND CONSUMER.

SPECIFICATION forming part of Letters Patent No. 316,892, dated April 28, 1885.

Application filed August 6, 1884. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. GRIGGS, of Hornellsville, in the county of Steuben and State of New York, have invented certain new and useful Improvements in Locomotive Spark Arresters and Consumers; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

My said improvements involve the employment of spark-return flues communicating between the smoke-arch and fire-box, and live-steam jets within said flue, both of which features have been heretofore proposed and employed in considerable variety of construction and arrangement. So far as my knowledge extends, however, I am the first to so organize live-steam jets in a spark-return flue that they will of necessity operate variably, according to the varied conditions of service. In other words, all prior steam-jets in spark-flues have derived their live steam directly from the boiler; but I have coupled my jets to the steam-pipe by which the cylinders are supplied with steam, so that said jets will be always proportioned to the blast induced by the column of exhaust-steam from the cylinders, it being obvious that the quantity of sparks to be controlled and conveyed to the furnace will necessarily be varied according to the variable vacuum induced in the smoke-arch by the variable blast of the exhaust-steam, and therefore for my steam-jets I use no more steam than is actually required from time to time. Another advantage due to this novel arrangement is that the steam issuing from said jets is more or less pulsatory in its delivery, due to the intermitting delivery of steam to the cylinders, and especially if the latter be operating when the throttle-valve is partially closed. This pulsatory jet is obviously more effective in driving and otherwise moving solid particles of matter than a continuous jet delivering the same quantity of steam in a given time. Another advantage in this connection is that the delivery of steam into the fire-box is fairly proportioned to the quantity of solid matter in transit in the return-flues, said matter being particles of hot live coals, yielding much inflammable gas, which

is always effectively consumed if a proper proportion of steam be commingled therewith.

Another novel feature devised by me is a spark-return flue having a jet adjacent to its mouth, and a second jet between said first jet and the furnace, and in the combination therewith of a smoke-arch having its floor inclined or funnel-shaped, and terminating at the mouth of the return-flue, so that the first or outer steam-jet serves as a driving element for forcing the solid matter and the gases emanating therefrom into the mouth of the return-flue, and the second jet, within the flue, operates not only as a driver, but also for inducing a vacuum behind it, thus providing for a complete control and the effectual delivery into the fire-box of such highly-heated solid matters as cannot pass the usual screen in the smoke-arch, as well as their gases. As the said first-named jet-pipe is sometimes liable to be exposed to high temperatures by being surrounded by a mass of live sparks, it is liable to injury from melting, and I have therefore provided said jet with a steam-and-water jacket for its protection. Having in the manner described provided for the graduated operation of the return-flue jets while a locomotive is in motion, I have also arranged for the proper control of sparks while the engine is at rest, or whenever steam is not being supplied to the cylinders; but instead of employing a jet directly connected with the boiler, I have coupled it to the usual blower-pipe, so that said jet will always operate within the return-flue with more or less force, proportioned to the blast of steam under which the blower may be operated from time to time, thus not only avoiding waste of steam, but also avoiding the introduction of steam to the fire-box in excess of that which will best contribute to perfect combustion. I have also introduced check-valves into the jet-pipes which connect with the cylinder supply-pipe, for preventing any suction of dirt and abrasive matter into said supply-pipe at such times as the locomotive may be in motion, but with the throttle-valve closed. I have also provided my spark-return flue with readily-accessible ports, having tight but movable covers, which enable the inspection of the interior of said flue at various points in its length, and for enabling a clearance

thereof, if by accident it should become necessary. I have also provided a reciprocating agitator within said flue, and have coupled the same to the cylinder-cock shaft, so that it can be conveniently operated.

As another novel feature, I have provided the return-flue, at its forward end beneath the smoke-arch with a gated opening for the introduction of air, whenever it may be deemed desirable to deliver oxygen to the furnace by way of the return-flue, and have coupled a gate or valve, which controls said opening, with the cylinder-cock shaft for its convenient operation.

As another novel feature, I have provided against unduly wasteful radiation of heat from the sparks and cinders while in the smoke-arch by lining it with fire-brick, and for affording a smooth surface a sheet-iron lining is employed, which overlies said brick-work.

To more particularly describe my said improvements, I will refer to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical section of so much of a locomotive-boiler and accompanying mechanism as is deemed necessary for illustrating my improvements. Fig. 2 illustrates in section the water-jacketed steam-jet tip employed in the entrance to the return-flue. Fig. 3 illustrates an arrangement of the netting within the smoke-arch, which can be employed in lieu of that shown in Fig. 1. Fig. 4 is a longitudinal section illustrating the main features of my invention in a slightly modified form. Fig. 5 is a plan view of the mouth of the return-flue of Fig. 4.

The boiler A can be widely varied in construction without departure from my invention. As here shown, it is provided with the usual tubes *a*, and fire-box *b*, the latter containing a brick arch, *c*, the sections of which are bound together by the T-headed bolts *c'*. The smoke-arch *d* contains several novel features in construction, viz: Its lower surface is funnel-shaped, and terminates in a rearwardly-inclined mouth, as at *d'*, at the bottom of the arch; also, at its sides and bottom it is filled in with fire-brick *d''*, for preventing undue radiation of heat from the interior of the smoke-arch, and enabling the heat and gases contained in the solid matters to be retained therein, and ultimately utilized when delivered into the fire-box. For securing a smooth surface, down which the solid matters can freely slide, a sheet-metal facing, *d'''*, overlies the interior surface of the mass of fire-brick.

Within the smoke-arch, below and in line with the center of the stack B, there is the usual exhaust-pipe, *e*, as heretofore arranged, for connection on each side, as at *e'*, with the exhaust-ports of the locomotive cylinders. (Not here shown.)

The usual netting or screen is employed for preventing the upward escape of solid matters from the smoke-arch. As shown in Fig. 1, the screen *f* extends from the front upper end of the smoke-arch, downwardly and

rearwardly, to the flue sheet or head of the boiler, above the tubes *a* and surrounding the top of the exhaust-pipe *e*, and also surrounding such other pipes as of necessity should pass through it. In lieu of this particular arrangement of the netting, it can be in the form of an inverted cone, as illustrated in Fig. 3, thus obviating the passage through it of any other pipe than the exhaust-pipe, which should of course have a free upward exit.

As usual, the steam-cylinders are supplied with steam from the dome of the boiler by way of the steam-pipe C, which is provided with the usual throttle-valve, as at *g*, and at its forward end it passes through the boiler-head or front flue sheet, down through the smoke-arch, to a point proper for convenient connection with the cylinders.

As a novel feature, I have tapped the steam-pipe C with a steam jet-pipe, *h*, which extends downward into the mouth *d'* of the funnel-shaped lining of the smoke-arch, and have provided said pipe *h* with a jet-aperture. This aperture can be varied in dimensions without departure from my invention; but I find that if it be about one-sixteenth of an inch in diameter it can generally be relied upon for obtaining the results I seek. As another novel feature, I have provided the jet-tip of the pipe *h* with a water-jacket, *h'*, connected by pipes *h''* and *h'''* with the interior of the boiler at points above and also slightly below the water-jacket, so as to secure a good circulation therein, for preventing the heat liable to be developed at that point from injuring the tip whenever steam is not being supplied to the jet-pipe, as, for instance, when the engine is at rest, or when no steam is required while the engine is in motion.

The spark-return flue D is, when broadly considered, not new in so far as it serves as a conduit below the boiler from the smoke-arch to the fire-box for the passage of solid matters. This return-flue D is connected to the downwardly and rearwardly inclined mouth *d'*, at the bottom of the smoke-arch, and at its forward end said return-flue is provided with an enlarged mouth, *i*, similar to return flues as heretofore constructed. As a novel feature in this connection, I have provided said mouth *i* with a damper or cover, *i'*, which is mounted on an arm which projects from the cylinder-cock shaft E, so that when the latter is rocked or rotated as usual, by the engineer in the cab, by way of the usual rod-connections, (as for freeing the cylinders from water,) the damper can be opened or closed. Inasmuch as the cylinder-cock shaft is utilized by me for the purpose indicated, to obviate the necessity for other special mechanism for conveniently opening and closing said damper, it is to be understood that special mechanism may be employed without departure from this portion of my invention, it being obvious that at times it will be desirable to exclude atmospheric oxygen from said flue, and that at

other times a supply thereof will serve a good purpose. As another novel feature in this connection, I have provided the return-flue with a series of openings, *k*, each provided with a sliding or other cover, whereby access may be conveniently had to the interior of the flue for purposes of inspection, and for clearing out the flue if need be. The return-flue D is provided with a reciprocating agitator, *l*, which, broadly considered, is not new; but a novel feature in this connection consists in coupling said agitator (which is in the form of a long light rod of iron bent into wave-line curves, as shown) to the cylinder-cock shaft E, so that whenever the latter is rocked or rotated the rod will be reciprocated and cause a stirring up of such solid matter as may perchance be lodged within the flue. As another novel feature in this connection, I have provided the return-flue, near its entrance into the fire-box, with a second jet-pipe, *m*, which extends from the steam-pipe C within the smoke-arch downward beneath the boiler, above the return-flue, and thence downward and into said flue, its jet-tip being located near the entrance to the fire-box, and centrally within the flue. This jet-pipe *m* should have an aperture of about one-sixteenth of an inch in diameter, although a larger aperture may sometimes be desirable.

As thus far described, it will be understood that I have for the first time not only provided the return-flue with two steam-jets, instead of one, as heretofore, but also that I have for the first time provided said flue with one or more jet-pipes coupled to and supplied from the cylinder steam-pipe. The use of the two jets arranged as described involves a driving force as exerted by the jet *h*, and co-operating therewith the jet *m* involves an exhausting force, both of which are deemed by me to be essential for properly controlling all of the solid matters and gases capable of being conveyed from the smoke-arch to the fire-box, and properly delivering them therein, below the brick arch, in a fit condition for combustion; and it is obvious that many of the advantages of employing these two jets will accrue whether they are coupled to the steam-pipe or directly with the steam-space of the boiler. For obtaining the best results, however, I couple them to the steam-pipe, as shown, because then the operation of the steam-jets is more or less pulsatory or intermitting, corresponding to the intermitting reception of steam by the cylinders. This arrangement of the jets *h* and *m* renders them obviously dependent upon the supply of steam to the cylinders by way of the usual throttle-valve, *g*, and as the control and conveyance of sparks is desirable at all times, I have, as another novel feature, introduced into the return-flue a jet, *n*, which is coupled to the usual blower pipe, *o*, having its jet at *o'*, adjacent to the top of the exhaust-pipe, as heretofore. This jet *n* may have an aperture varied in dimensions, but I get good results if it be

about one-quarter of an inch in diameter, the diameter of the blower-jet *o'* being about three-eighths of an inch in diameter. With the several jets thus organized it will be seen that, should occasion require it, the blower-pipe jet *n*, within the return-flue, can be employed to co-operate with either or both of the other jets, (assuming that but one of them be used therewith,) or by itself alone, as when the engine is at rest, or when on downgrades, no steam is required for the cylinders, and the fire needs draft.

It will be seen that with the throttle closed and the engine in motion the pistons of the cylinders would be liable to induce a vacuum within the steam-pipe, and a consequent liability of a suction of abrasive matter through the jet-pipes *h* and *m* into the valve-chest and cylinders; and to obviate this I have introduced another novel feature, which consists in providing the pipes *h* and *m* with check-valves *p*, of a usual and well-known construction, it being only necessary to say that they open freely to the outward passage of steam, and close as freely when a vacuum has been induced within the steam-pipe.

While I prefer to employ on a locomotive all of the several features of my invention, substantially as shown and described, it is obvious that some of them may be advantageously employed independently, or in connection with other devices differing more or less in construction and arrangement from those specially devised by me.

In Figs. 4 and 5 I illustrate a construction and arrangement which slightly differs from that already described. In this case the fire-box *b* and brick arch *c* are of a different form from those shown in Fig. 1. I show here one or more air-ducts, *p'*, in the fire-box below the furnace-door, and said ducts are guarded at the inner side by a perforated plate or box, *p''*. Opposite the exit-aperture of the spark-return flue D in the fire-box I show a deflecting-plate, *q*, which is V-shaped in cross-section, so as to divide the incoming stream of sparks and divert their course toward the two sides of the fire-box. The spark-return flue D here shown has a laterally widened mouth, *D'*, (shown in plan in Fig. 5,) but it has a central upwardly-inclined mouth-piece, for connection, as before described, with the downwardly and rearwardly inclined mouth-piece *d'* at the bottom of the smoke-arch. At each side of the flaring mouth *D'* there are openings *r* for the admission of air, and a central vertical bolt, *s*, serves as a lateral deflector for the stream of sparks and prevents their massing unduly at any one point. The bottom of the smoke-arch is inclined downwardly and rearwardly in straight lines, instead of being curved, as in Fig. 1, and the jet-pipe *h* is arranged and located somewhat differently from that shown in Fig. 1, but it is connected to the steam-pipe C, substantially as before described. The spark-return flue has no gate or damper at its front end, and no agitator. The jet-pipe *m*,

instead of being connected directly with the steam-pipe C, is connected to the steam-chest above one of the cylinders, as shown, thus affording a supply of steam precisely as when coupled to the steam-pipe, but requiring less pipe, being much more readily connected.

The exhaust-pipe *e*, blower pipe *o*, and its jet *o'*, are constructed and arranged in a manner slightly differing from that shown in Fig. 1; but the return-flue jet *n*, which is supplied from said blower-pipe, is substantially as before described.

Having thus described the several features of my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with a locomotive-boiler and its steam-pipe for conveying steam to the cylinder, of a spark-return flue connecting the smoke-arch with the fire-box, and one or more steam-jets within said return-flue, supplied with steam by way of the cylinder steam-pipe, substantially as described.

2. The combination, with a spark-return flue leading from the smoke-arch to the fire-box of a locomotive-boiler, of two steam-jets within said flue, one operating as a driver for forcing the sparks from the smoke-arch into and along the flue, and the other inducing a vacuum within the flue, between said first jet and the fire-box, substantially as described.

3. The combination, with a spark-return flue, and a steam-jet pipe within the entrance to said flue, of a water-jacket for the tip of said jet-pipe, substantially as described.

4. The combination, with a locomotive-boiler, and a spark-return flue below said boiler entering the fire-box, of a smoke-arch having funnel-shaped sides and bottom, and communicating with the return-flue by a downwardly and rearwardly inclined funnel-mouth, and the exhaust-pipe projecting upwardly through the funnel-shaped bottom of the smoke-arch, substantially as described.

5. The combination, with a locomotive-boiler, a spark-return flue below said boiler entering the fire-box, and a smoke-arch having funnel-shaped sides and bottom and communicating with the return-flue by a downwardly and rearwardly inclined funnel-mouth, of a live-steam-jet-pipe located within said funnel-mouth, substantially as described.

6. The combination, with the boiler and a

spark-return flue, of a smoke-arch having funnel-shaped sides and bottom, and filled in with fire-brick, substantially as described, whereby undue radiation and loss of heat from solid matters while in the smoke-arch are obviated, and enabling said heat to be utilized in the fire-box of the boiler, as set forth.

7. The combination, with the locomotive-boiler, spark-return flue, and blower-pipe, of a steam-jet pipe within the return-flue and coupled to the blower-pipe, substantially as described, whereby the return-flue can be made to properly operate, whether the locomotive is at rest or in motion, as set forth.

8. The combination, with a spark-return flue leading from the smoke-arch to the fire-box, and located below the main portion of the boiler of a locomotive, and provided with an open front end, of a damper or gate at its entrance, which is coupled to a rotating or rocking shaft operated by a rod from the cab of the locomotive, substantially as described, for variably admitting atmospheric oxygen to said flue, and thence to the fire-box, as set forth.

9. The combination, with a spark-return flue located below the main portion of a locomotive-boiler, of an agitating-rod within said flue, coupled to a cylinder-cock shaft, substantially as and for the purposes specified.

10. The combination, with a locomotive-boiler, of a spark-return flue leading from the smoke-arch to the fire-box above the grate, and provided with a series of openings at various points in its length, and with movable covers for said openings, substantially as described, whereby the interior of said flue may be readily inspected and clogged solid matter removed therefrom.

11. The combination of the spark-return flue, the steam-jet within said flue, supplied by steam from the cylinder steam-pipe, and provided with a check-valve which opens freely to the outward passage of steam, and closes under the influences of a vacuum within the steam-pipe, substantially as described, whereby the induction of solid abrasive matters to said steam-pipe and cylinder is prevented, as set forth.

GEO. H. GRIGGS.

Witnesses:

F. M. CRONKRITE,
H. C. SAWYER.