No. 871,551. PATENTED NOV. 19, 1907.

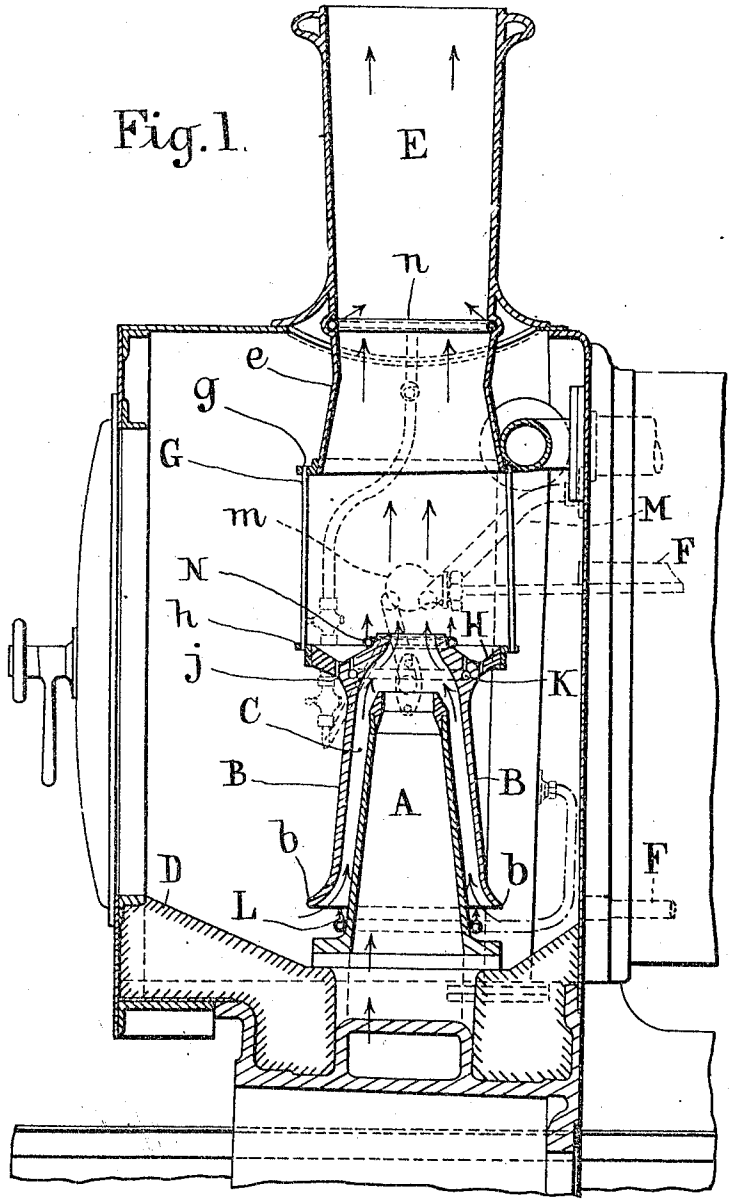
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SMOKE BOX OF LOCOMOTIVE ENGINE AND SIMILAR BOILERS.

APPLICATION FILED JULY 25, 1906.

4 SHEETS—SHEET 1.

Fig. 1.



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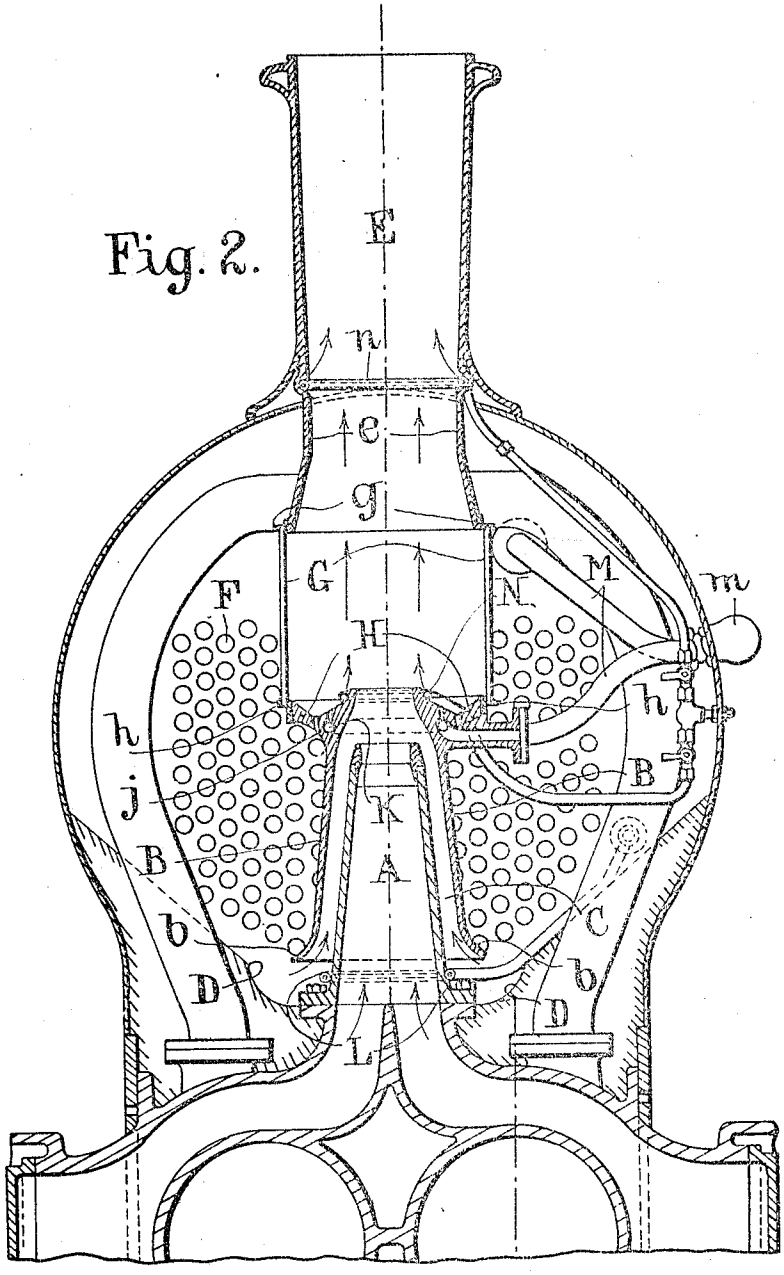
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4 SHEETS—SHEET 2.

Fig. 2.



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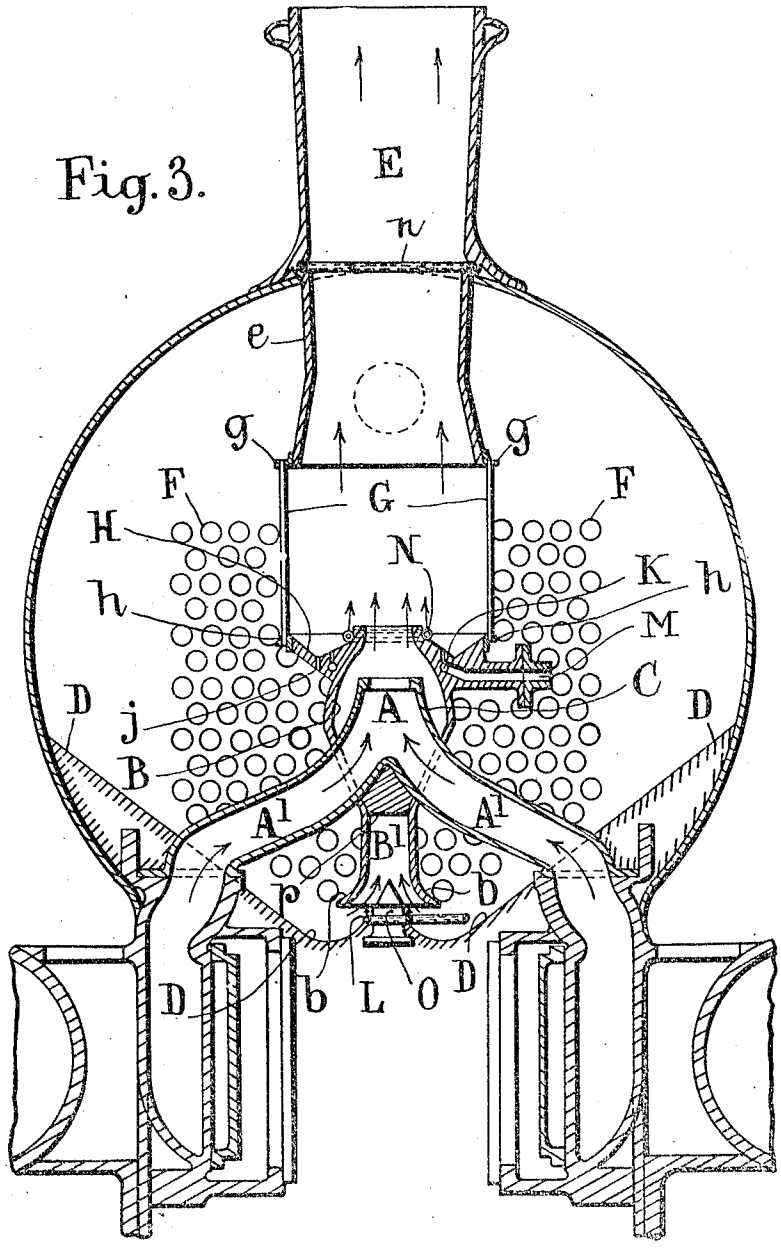
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4 SHEETS—SHEET 3.

Fig. 3.



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APPLICATION FILED JULY 25, 1906.

4 SHEETS—SHEET 4.

Fig. 4.

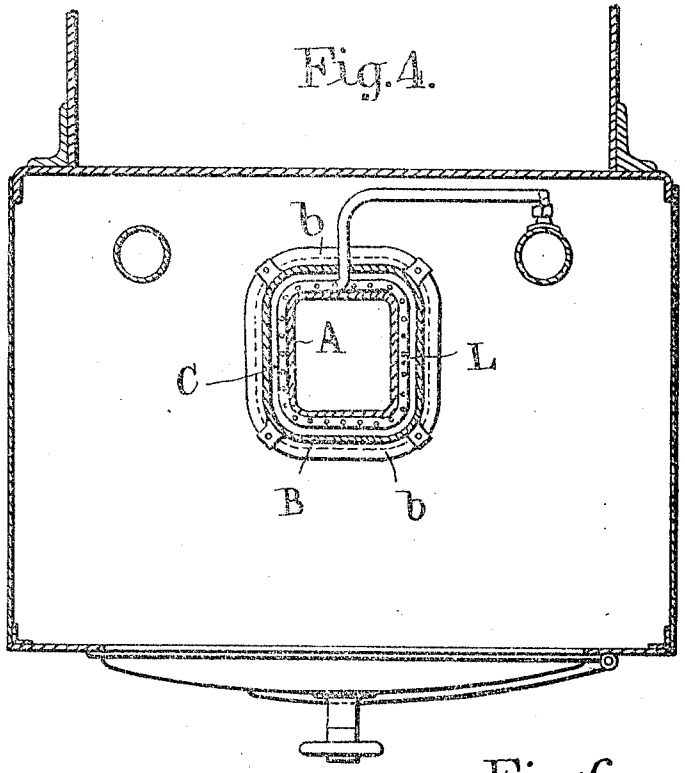


Fig. 5.

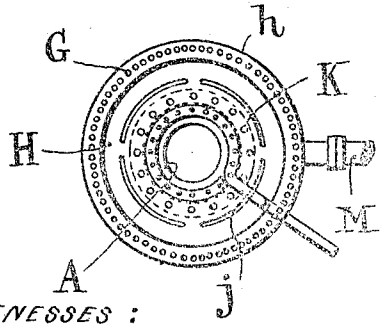
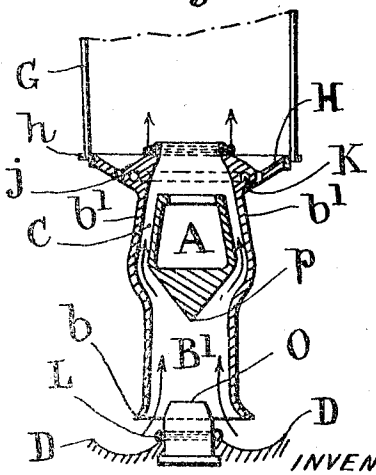


Fig. 6.



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UNITED STATES PATENT OFFICE.

SAMUEL SMITH YOUNGHUSBAND, OF DARLINGTON, ENGLAND.

SMOKE-BOX OF LOCOMOTIVE-ENGINE AND SIMILAR BOILERS.

No. 871,551. Specification of Letters Patent. Patented Nov. 19, 1907.

Application filed July 25, 1906. Serial No. 327,664.

To all whom it may concern:

Be it known that I, SAMUEL SMITH YOUNGHUSBAND, a subject of the King of Great Britain, residing at Granville Terrace, Woodlands Road, Darlington, in the county of Durham, England, engineer, have invented certain new and useful Improvements in or Relating to the Smoke-Boxes of Locomotive-Engine and Similar Boilers, of which the following is a specification.

The primary object of my invention is to prevent the accumulation of ashes in the smoke-boxes of locomotive engine and similar boilers, a further object being to diminish the risk of the hot cinders ejected from the chimney setting fire to surrounding objects.

To these ends my invention consists essentially in providing ejector apparatus whereby the ashes which pass into and tend to settle at the bottom of the smoke-box will be continuously and automatically removed therefrom by the exhaustive action of the blast, the apparatus whereby this effect is produced being adapted to cause the larger cinders to become broken up or reduced in size so that their capability of setting fire to objects upon which they may chance to alight will be reduced to a minimum.

In the accompanying drawings Figures 1 and 2 are longitudinal and transverse vertical sections of the smoke-box and adjacent parts of a locomotive engine having inside cylinders, showing the application of the invention. Fig. 3 is a view similar to Fig. 2 showing the application of the invention to a locomotive engine having outside cylinders. Figs. 4 and 5 are horizontal sections near the base and above the top of the petticoat pipe respectively, as shown in Figs. 1 and 2, and Fig. 6 is a section of the blast pipe shown in Fig. 3, taken on the central longitudinal vertical plane of the engine.

Similar letters of reference denote corresponding parts throughout the drawings.

According to my invention the blast pipe A is surrounded by a so-called "petticoat" pipe B having a diameter sufficient to leave a somewhat narrow annular space C between the two pipes, the petticoat pipe B preferably conforming to the usual upwardly tapering form of the blast pipe A as in Figs. 1 and 2. The petticoat pipe B extends from a short distance above the floor D of the smoke-box (where it is suitably bell-mouthed as at *b*) to a short distance beyond the upper end or nozzle of the blast pipe, where its diameter is contracted to approximately that of the mouth of the blast pipe, the blast and petticoat pipes thus forming in combination an ejector apparatus whereby the ashes, cinders etc. lodging at the bottom of the smoke-box will be drawn up into the annular space between the two pipes in consequence of the partial vacuum created in said space by the exhaustive action of the blast, and will be ejected along with the latter through the chimney E.

For the purpose of the present invention the floor D of the smoke-box is downwardly inclined from all directions towards the base of the blast pipe A so as to constitute in effect a hopper whereby the cinders etc. which lodge upon it may be caused to descend automatically to a position immediately beneath and around the flaring mouth *b* of the petticoat pipe, whereby their accumulation within the smoke-box will be effectually prevented. The floor D may be formed of sheet iron covered with cement or fire-clay on its upper surface, and supported in any convenient manner, care being taken to avoid obstruction of any of the fire tubes F of the boiler.

The annular opening between the upper ends of the two pipes A and B may be made of such form that the larger cinders will become broken up or reduced in size in passing through it, and being thus rendered capable of cooling more rapidly on exposure to the atmosphere, will cease to be such sources of danger as usual.

In order to insure that the larger cinders and other solid matters, which pass with the blast from the fire-box into the smoke-box, shall be prevented from reaching the chimney E except by way of the ejector apparatus, a screen may be employed whereby the cinders etc. drawn from the fire-box will be arrested and caused to fall to the bottom D of the smoke-box, whence they will be sucked up by the ejector apparatus as already described. This screen (or spark-arrester) may consist of a cage G formed of upright rods connecting a flange *g* on the lower end of the skirt *e* of the chimney E which depends within the smoke-box, with a flange *h* on the outer edge of a tray H which surrounds the upper end of the petticoat pipe B so as to close the lower end of the cage. The rods forming the cage G are set sufficiently close together to prevent any but the smallest cinders etc. from passing

between them and thus reaching the chimney E directly. The tray H is dished to form an annular channel whose bottom is pierced with narrow segmental slots as at *j* through which any matter that may accumulate within the cage can be swept out in cleaning the apparatus.

A removable nozzle (shown in Figs. 1 and 2) may be provided on the upper end of the blast pipe for enabling the area of the latter to be adjusted as may be found necessary in order to produce the best effect whether as an ejector or as a means of breaking up the larger cinders which pass through the petticoat space C.

For the purpose of assisting in the discharge of ashes etc. from the smoke-box and clearing the chimney top of smoke, more especially when the blast happens to be weak or the engine is not running, a row of upwardly directed jets of live steam may be provided in connection with the blast pipe, or the petticoat pipe, or both, the jets being in either case supplied with steam from an annular passage surrounding the pipe and suitably connected to the boiler under the control of a valve. The discharge of live steam from the jets on the blast pipe will tend to create a vacuum within the petticoat space and thus draw up and discharge ashes from the bottom of the smoke-box, while the jets on the petticoat pipe will assist in clearing the chimney of smoke.

In the examples illustrated, the upper end of the petticoat pipe B is surrounded by an annular steam passage K connected with the boiler steam space by means of a pipe M controlled by a valve *m*, the passage K having a number of small upwardly opening holes through which steam may be allowed to issue around the mouth of the petticoat pipe so as to assist in creating a vacuum within the petticoat space C. A similar row of upwardly directed steam jets may be provided as at L within or just beneath the flaring lower mouth *b* of the petticoat pipe for the purpose of quickening the draft through the space C.

In order the better to insure the effectual quenching of any sparks or incandescent cinders as they escape to the chimney E, an annular row of upwardly directed water jets may be provided as at N around the upper end of the petticoat pipe, a supplementary similar row of water jets being if desired provided as at *n* around the lower part of the interior of the chimney E. All the jet apparatus, whether steam or water, would be under the control of valves whereby to regulate the supply of live steam, or of water under pressure from the boiler, to the jets.

In the arrangement shown in Figs. 3 and 6, the blast pipe is divided immediately below the exit nozzle into a pair of laterally divergent "breeches pipes" A^1 A^1, so that the petticoat pipe B can only actually surround the upper extremity or nozzle portion A of the blast pipe. This however is sufficient to constitute the requisite ejector nozzle, the petticoat pipe B extending downwards past the front and rear sides of the pipe A, as indicated at b^1 b^1 in Fig. 6, and being continued alone, as at B^1, from beneath the bifurcation of the twin blast pipes A^1 A^1 to near the bottom of the smoke-box, where it terminates in a bell mouth *b* as before. In order to increase the exhausting effect at this end of the petticoat pipe, its flaring lower end may be partly filled by an upwardly tapered plug O which extends into the bell mouth *b* from beneath and serves also to support the annular pipe L from which issue the lower row of steam jets before referred to. The underside of the bifurcation of the pipe A where the branches A^1 A^1 meet is also preferably made to taper downwards so as to present a knife edge *p* to the ascending current within the pipe B^1 and assist in dividing the stream into the two branches b^1 b^1. In other respects the arrangement shown in Fig. 3 is substantially similar to that shown in Figs. 1 and 2.

Claims.

1. In ejector apparatus for effecting the removal of the ashes from the smoke-box of a locomotive boiler, the combination of a blast pipe, a petticoat pipe surrounding the blast pipe at a distance therefrom, and a smoke-box inclosing the two pipes and having a hopper-shaped floor, the blast pipe being mounted on the lower part of the floor, whereby the cinders are caused to collect about the lower end of the petticoat pipe and the cinders thus collected are caused to pass between the two pipes by the action of the blast and become disintegrated before being finally ejected, substantially as specified.

2. In ejector apparatus for effecting the removal of the ashes from the smoke-box of a locomotive boiler, the combination of a blast pipe, a petticoat pipe surrounding the blast pipe at a distance therefrom, a smoke-box inclosing the two pipes and having a hopper-shaped floor, and a perforated steam pipe at the lower end of the blast pipe, whereby a supplementary forced draft is brought into operation at the lower end of the petticoat pipe for assisting in causing the cinders to pass between the two pipes and become disintegrated before being ejected, substantially as specified.

3. In ejector apparatus for effecting the removal of the ashes from the smoke-box of a locomotive boiler, the combination of a blast pipe, a petticoat pipe surrounding the blast pipe at a distance therefrom, and provided at its upper end with a number of perforations connected with an annular conduit formed in the said upper end whereby an additional forced blast is brought into operation at the

upper end of the petticoat pipe for assisting in causing the cinders to pass between the two pipes and become disintegrated before being ejected, substantially as specified.

4. In ejector apparatus for effecting the removal of the ashes from the smoke-box of a locomotive boiler, the combination of a blast pipe, a petticoat pipe surrounding the blast pipe at a distance therefrom, and a perforated water pipe at the upper end of the petticoat pipe for insuring the complete extinction of the cinders which have been disintegrated between the two pipes, before being finally ejected substantially as specified.

5. Ejector apparatus comprising a blast pipe, a petticoat pipe surrounding the blast pipe at a distance therefrom and provided with a perforated annular tray at its upper end, a downwardly projecting chimney portion, a circular cage connecting the upper end of the petticoat pipe with the chimney portion, and a smoke-box having a hopper-shaped floor, the blast pipe being arranged in the center of the said floor so that the cinders are caused to collect around the blast pipe and be disintegrated between the two pipes and ejected substantially as specified.

6. Ejector apparatus comprising a petticoat pipe having a reduced upper end and an enlarged lower end and provided at its upper end with an annular apertured tray and a thickened portion, the latter having formed in it an annular conduit and a number of perforations connected therewith, a blast pipe surrounded at a distance by the petticoat pipe and partly inclosed at its upper end by the reduced end of the petticoat pipe, a downwardly projecting chimney portion, a circular cage connecting the upper end of the petticoat pipe with the chimney portion, and a smoke-box having a hopper-shaped floor for disintegrating the cinders and ejecting them from the smoke-box, substantially as specified.

7. Ejector apparatus comprising a petticoat pipe having a reduced upper end and an enlarged lower end and provided at its upper end with an annular apertured tray and a thickened portion, the latter having formed in it an annular conduit and a number of perforations connected therewith, a blast pipe surrounded at a distance by the petticoat pipe and partly inclosed at its upper end by the reduced end of the petticoat pipe, a downwardly projecting chimney portion, a circular cage connecting the upper end of the petticoat pipe with the chimney portion, a smoke-box having a hopper-shaped floor, and a perforated steam pipe at the lower end of the blast pipe, for disintegrating the cinders and ejecting them from the smoke-box, substantially as specified.

8. Ejector apparatus comprising a petticoat pipe having a reduced upper end and an enlarged lower end and provided at its upper end with an annular apertured tray and a thickened portion, the latter having formed in it an annular conduit and a number of perforations connected therewith, a blast pipe surrounded at a distance by the petticoat pipe and partly inclosed at its upper end by the reduced end of the petticoat pipe, a downwardly projecting chimney portion, a circular cage connecting the upper end of the petticoat pipe with the chimney portion, a smoke-box having a hopper-shaped floor, a perforated steam pipe at the lower end of the blast pipe, and an annular perforated water pipe fitted on the upper end of the petticoat pipe, for disintegrating and extinguishing the cinders and ejecting them from the smoke-box, substantially as specified.

9. Ejector apparatus comprising a petticoat pipe having a reduced upper end and a splayed out lower end and provided at its upper end with an annular apertured tray and a thickened portion, the latter having formed in it an annular conduit and a number of perforations leading thereinto, a blast pipe consisting of a pair of breeches pipes having a common nozzle, the nozzle portion being surrounded at a distance by the petticoat pipe, a downwardly projecting chimney portion, a circular cage connecting the upper end of the petticoat pipe to the lower end of the chimney portion, a smoke-box having a hopper-shaped floor, a conical plug projecting into the lower end of the petticoat pipe, an annular perforated steam pipe fitted on the plug, and an annular perforated water pipe fitted on the upper end of the petticoat pipe, for disintegrating and extinguishing the cinders and ejecting them from the smoke-box, substantially as specified.

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