Feb. 18, 1930. E. FALKENTHAL 1,747,820

SPARK ARRESTER

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Fig. 1.

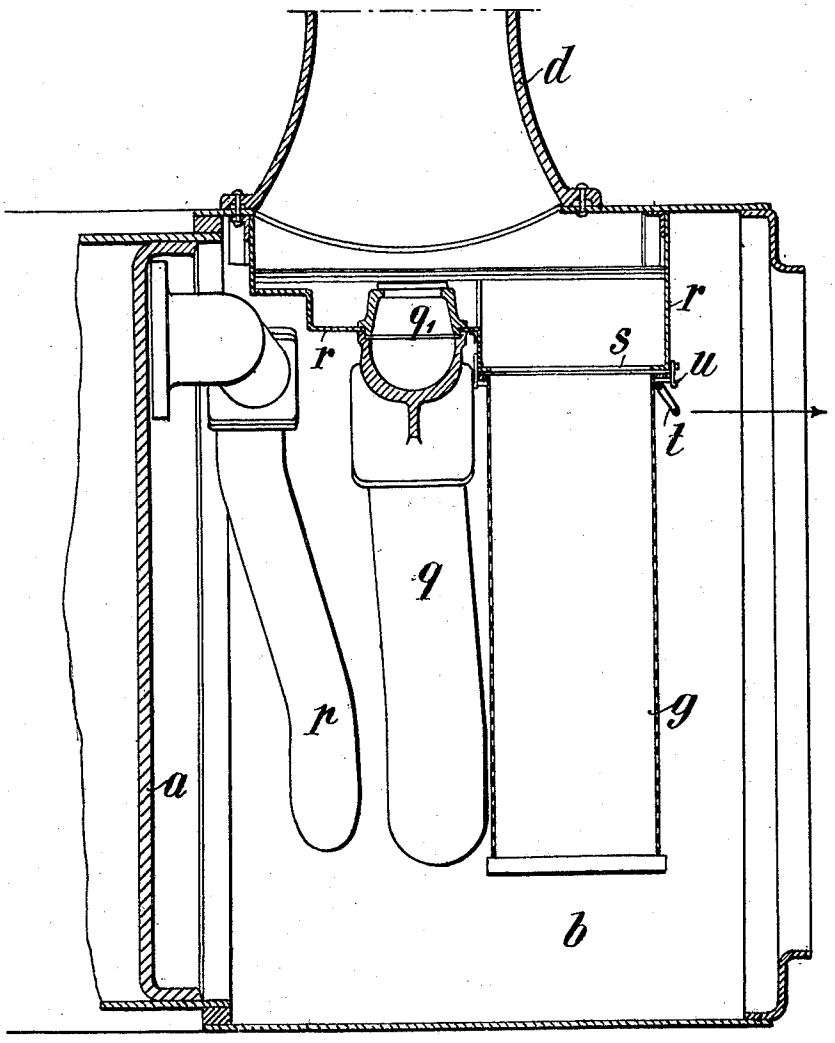

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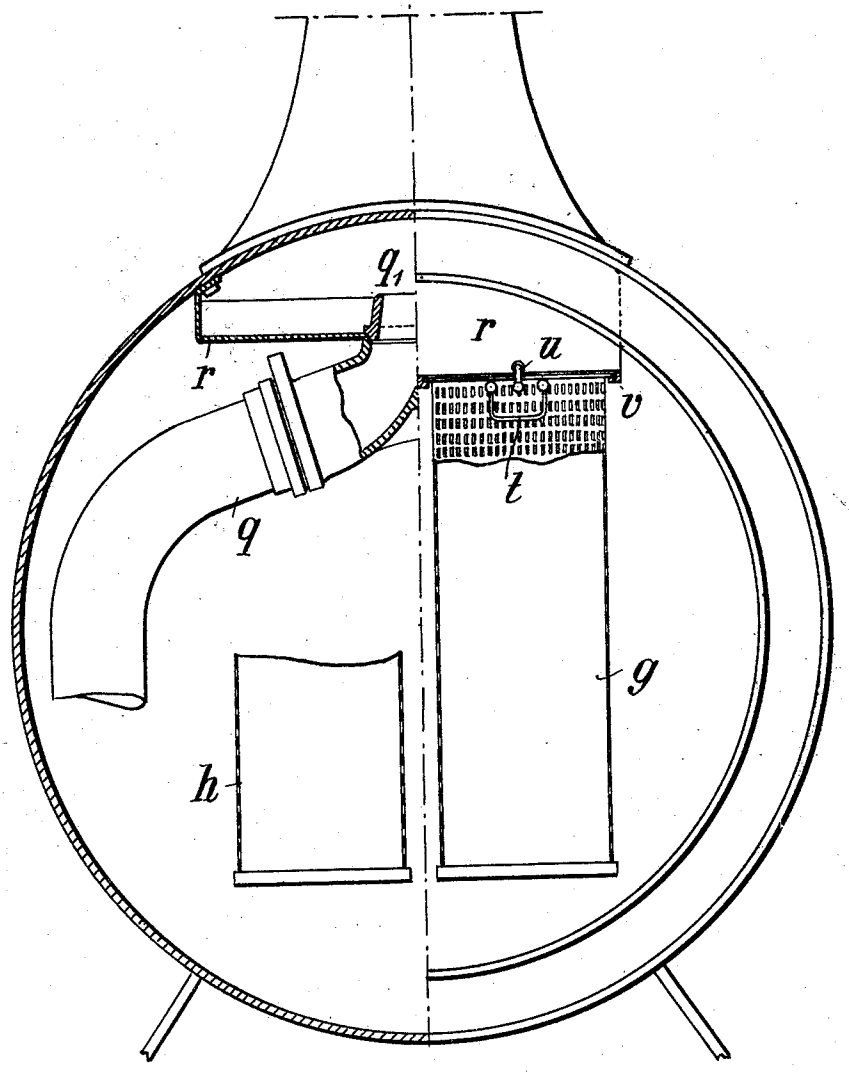
Fig. 2.



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SPARK ARRESTER

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Fig. 3.

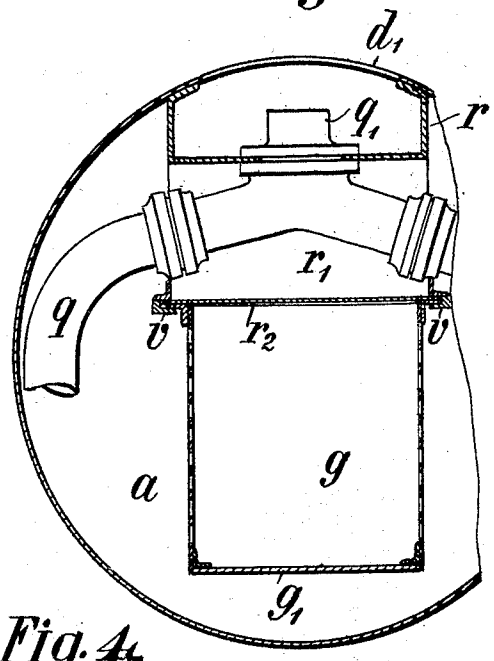
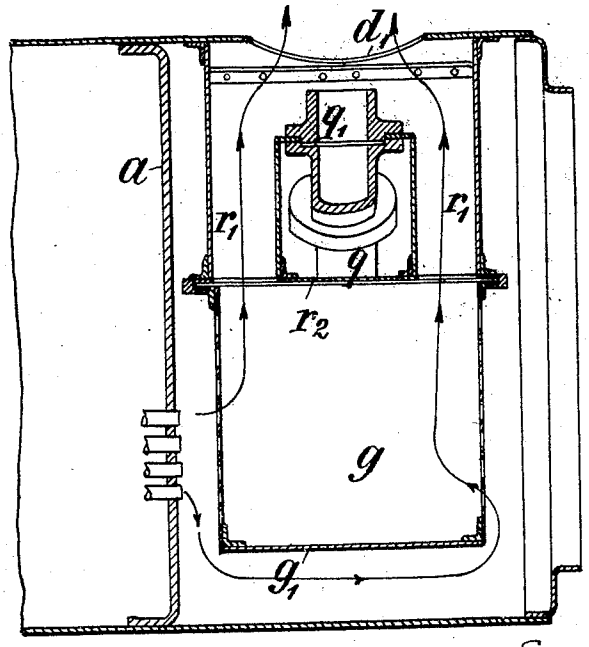


Fig. 4.



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UNITED STATES PATENT OFFICE

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SPARK ARRESTER

Application filed May 11, 1925, Serial No. 29,548, and in Germany June 3, 1924.

This invention relates to devices for arresting sparks which escape from the heating flues of locomotives, and other moving or stationary engines particularly such as have fire tube boiler installations.

The object of my invention is to provide a spark arrester by the use of which the most minute incandescent particles, which are carried along by the hot gases, shall be positively arrested by a sieve, but in such a manner that the putting in operation of the sieve produces no throttling of the air draught necessary for the heating flues. For the purpose referred to, a smoke chamber is constructed in front of the flues with two compartments traversed in succession by the hot gases, so that one of these compartments being connected with the chimney and the other with the flues, the two compartments being completely separated from each other by the sieve in question. This sieve is made of very thin sheet metal and is provided with very fine and very closely-distributed apertures, the total perforated area of which forms 25%–40% of the entire area of the sieve, which is at least four times that of the total cross-sectional area of the fire tubes.

Various devices have already been proposed wherein a sieve is interposed in the path of the hot gases. In these devices the sieve consists of a lattice-work of round wires which, however, has the drawback that, owing to the minuteness of the meshes, the latter soon become choked by soot and ashes.

Attempts have been made to substitute metal sheets in place of the wire latticing, but the plates were so thick that soot and ashes could easily settle in their channel-like openings with the result that these also became choked.

In all the forms of construction known hitherto the superficial area of the sieves has not been great enough, so that their through passage area was insufficient in comparison with the total cross-sectional area of the fire tubes. The result of this was a throttling of the draught, so that, apart altogether from the defect of choking, such sieves could not fulfil the requirements and so never came into general use.

As an auxiliary device it has been proposed to provide, along with the sieve, another open passage for the hot gases on their way from the flues to the chimney, but it is obvious that such a passage would tend to nullify the purpose of the entire installation, as there is nothing to prevent the hot gases, which rush with great energy right through this open passage, from drawing quite large incandescent particles with them to the chimney.

To secure an effective arrest of any incandescent particles of which the smallest liable to start a fire may, according to results obtained with lignite and wood firing have a diameter of 2 to 3 mm., it is necessary that all the hot gases be conducted through the sieve and through the sieve only, and that the apertures in the latter should be of appropriately small width. The throttling of the draught, which would otherwise inevitably occur, is, according to the invention, avoided by arranging that the entire upper surface of the sieve be made equal to at least four times the total cross-sectional area of the fire tubes and that the passage area of the sieve be equal to at least 25% of its entire surface.

By constructing the sieve of very thin sheet metal of approximately only 0.8 to 1.5 mm. in thickness, a channel-like formation of the apertures and their consequent choking by soot and ash are, as experiments have demonstrated, completely avoided.

A peculiar circumstance which assists in producing this effect is the fact that eddies are formed not only in front of, but also behind, the sieve, and that these eddies, in consequence of the regular formation of soot and ash particles which penetrate through the apertures of the sieve and would otherwise readily settle on the rear edges of said apertures, effectively prevent any gradual choking of the openings. In order to prevent rapid combustion of the sheet metal, the latter is preferably constructed from some non-rusting material. Experiments have shown that the most suitable material for this purpose is chrome-nickel steel, which also is not attacked by any of the acids in the hot gases, so that it possesses a practically unlimited life. It has moreover, a materially higher strength than

ordinary sheet metal so that, in spite of the very small thickness referred to, it can be subjected to rough usage without injury. This is important, in view of the fact that the smoke box must frequently be opened for the purpose of cleaning the fire tubes and of removing the soot and ash, and that parts of the sieve must be removed at the same time and are therefore very liable to injury.

It is another object of the invention to provide a sieve of the kind just described, (having a large superficial area) which can be fitted within the narrowest and most confined smoke box, (through which also the live steam pipe and the steam exhaust or blast pipe are frequently led,) in such a manner that it may be removed with the aid of a few handles when the cleaning referred to has to be carried out and reinserted with equal ease.

In cases where the smoke box is unusually small or its available space is diminished by the accommodation of a super-heater or the like, the sieve is not arranged in the smoke box proper, but the latter is partitioned off into two chambers by a solid sheet metal wall, one of the compartments being, as before, connected to the chimney and the other to the tube-plate, the sieve, however, being located inside a casing situated outside these two compartments, and the two compartments into which this casing is divided by the sieve, communicating with the other two, so that the hot gases traverse the entire series of chambers in succession, passing through the sieve on their way.

Generally speaking, it is advantageous to avoid a direct collision of the hot gases, as they issue from the smoke box, with the sieve. To effect this, deflecting surfaces of solid sheet metal are arranged in such a manner as to conduct the hot gases to the upper surface of the sieve tangentially. By reason of the centrifugal action exercised on the particles as they are carried along in such a path, the larger of the incandescent particles are hurled against the deflecting surface and there fall down, without ever reaching the sieve. The duty of the latter is only to arrest the smaller of the incandescent particles which, however, reach it in great numbers, more particularly when the engine is working under light load.

In the drawings:—

Fig. 1 is a longitudinal section and Fig. 2 a part sectional end elevation of a locomotive smoke box with a blast pipe forked directly below the chimney outlet, and detachable sieve-pipes situated in front of the blast pipe.

Fig. 3 is a part sectional end view and Fig. 4 a longitudinal section (both diagrammatic) of a locomotive smoke box with a blast pipe forked directly below the chimney outlet, and a detachable sieve-pipe lying below the blast pipe.

Fig. 1 shows the smoke box b of a locomotive, in which a main steam pipe p and a forked blast pipe q are situated, directly in front of the flue sheet a. In this figure, the fire tubes or flue sheet a are omitted from the drawing but must be assumed to be present. In order to mount a sieve according to the invention, the mouth of the chimney d has been tightly closed by a multiple-stepped box r, which has two circular apertures s on its front under surface. To these two apertures are applied cylindrical sieve-pipes g and h, both closed at the bottom end and by means of a handle t after releasing the bolt u, each sieve pipe can be drawn out in the direction of the arrow (Fig. 1), sliding, for this purpose, in the grooves v of the box r (see Fig. 2).

The blast nozzle q_1 of the forked exhaust pipe q passes through and makes a tight joint with the under floor of the box r. The hot gases passing through the fire tubes of the flue sheet a proceed thence in parallel streams through the large-surfaced sieve-pipes g, h into the inner chamber of the box r, and thence to the chimney d.

In Figs. 3 and 4 a smoke box similar to that shown in Figs. 1 and 2 is illustrated. The blast nozzle q_1, of the forked exhaust pipe q is carried through the bottom of a box r, which, as in Figs. 1 and 2, tightly closes the chimney mouth d_1. The box r in this case, is furnished with two ducts r_1, extending downward fore and aft of the forked pipe q and embracing the same. These ducts terminate in a plate r_2 furnished with corresponding apertures. Grooves v are provided on this plate, into which the sieve-pipe g is pushed, as in Figs. 1 and 2. The sieve-pipe g is closed at the bottom end by a plate g_1, constructed of solid sheet metal or else provided with sieve apertures like the sieve-pipe itself. The path of the hot gases is shown by the arrows. This construction is useful where the smoke box has very little depth from front to rear.

Although the present invention has herein been described mainly in its application to locomotives and although it is particularly well adapted for boilers of the locomotive or portable type, I desire it to be understood that I do not limit myself to such particular applications of my improved spark-arresting device. Thus the apparatus of my invention is advantageously applicable to various kinds of stationary boilers, heating plant and the like and in such cases an improved smoke box, in accordance with the objects of my invention is arranged behind the boiler and its flues or fire tubes, with its sieve interposed in the path of the hot gases on their way to the chimney stack.

What I claim is:—

1. In a fire tube boiler, a flue sheet, a smoke box, a blast pipe therein, a chimney outlet therefor, a sieve constituting a complete spark arresting barrier between the flues and chimney outlet, an auxiliary box fixed below the chimney outlet and supporting said sieve arrangement, the latter having its lower end closed and spaced from the walls of the smoke box, said sieve being detachably secured to said box, and a blast pipe discharging into said auxiliary box.

2. In a fire tube boiler, a flue sheet, a smoke box, a bifurcated blast pipe therein, a chimney outlet therefor, a cylindrical sieve constituting a complete spark arresting barrier between the flues and chimney outlet, an auxiliary box fixed below the chimney outlet and having a transverse channel, the blast pipe discharging into said box with the bifurcation in the channel, said sieve being detachably secured to said box below the channel.

3. In a fire tube boiler, the combination with a smoke box, a blast pipe therein, a flue sheet forming the rear wall of said box, a chimney outlet therefor and a blast pipe; of an auxiliary box in said smoke box below the chimney outlet and to which the discharge end of the blast pipe is secured for discharge thereinto upwardly to the chimney outlet, and a sieve removably connected to and discharging gases into said auxiliary box, said sieve being out of the path of said pipe and the exhaust steam therefrom and having its lower end closed and spaced from the walls of the smoke box to permit ready and free removal of said sieve device for emptying.

4. In a fire tube boiler, the combination with a smoke box, a blast pipe therein, a flue sheet forming a rear wall of said box, a chimney outlet therefor and a blast pipe; of a stationary imperforate auxiliary box fixed below the chimney outlet and in which the blast pipe terminates, a sieve device open at its top and closed at its bottom, the latter being spaced from the walls of the smoke box and communicating directly with said auxiliary box, said device depending therefrom out of the path of said pipe and the steam from the latter.

5. In a fire tube boiler, the combination with a smoke box, a blast pipe therein, a flue sheet forming a wall of said box, a chimney outlet therefor and a blast pipe; of an imperforate auxiliary box secured at and immediately below the outlet in which the blast pipe terminates, a depending sieve device connected to the bottom of said auxiliary box and having its lower end closed and spaced from the walls of the smoke box, a sliding connection between the bottom of the auxiliary box and the open top of said device consisting of slide flanges and clamping levers for easily removing said sieve device from the said box.

In testimony whereof I have signed my name to this specification.

ERWIN FALKENTHAL.