(No Model.) 3 Sheets—Sheet 1.

Q. J. HOKE.

SPARK EXTINGUISHER AND ARRESTER.

No. 397,363. Patented Feb. 5, 1889.

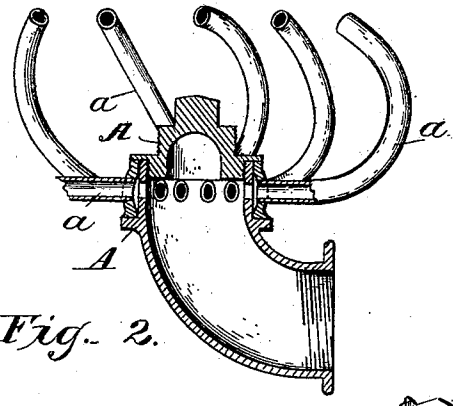


Fig. 2.

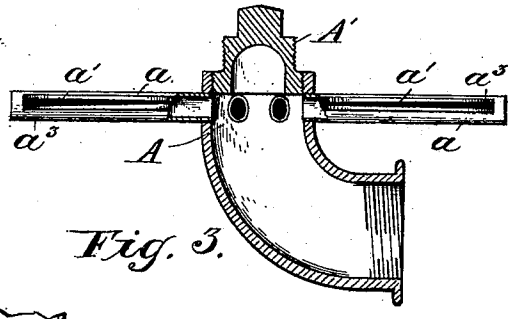


Fig. 3.

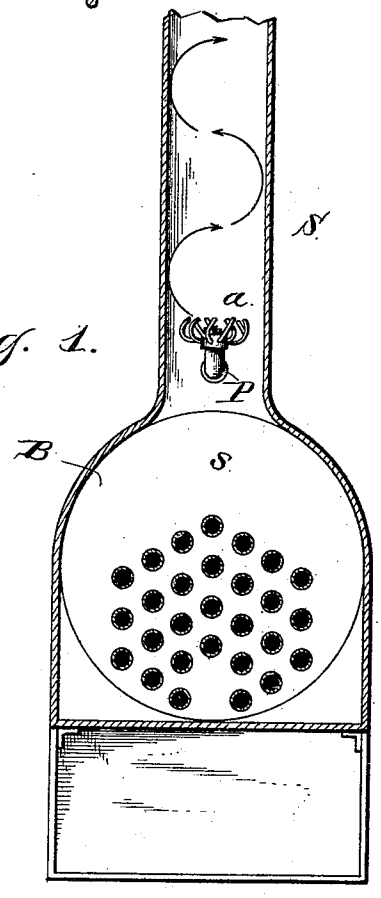


Fig. 1.

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Inventor:
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per Henry Orth
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N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

Q. J. HOKE.

SPARK EXTINGUISHER AND ARRESTER.

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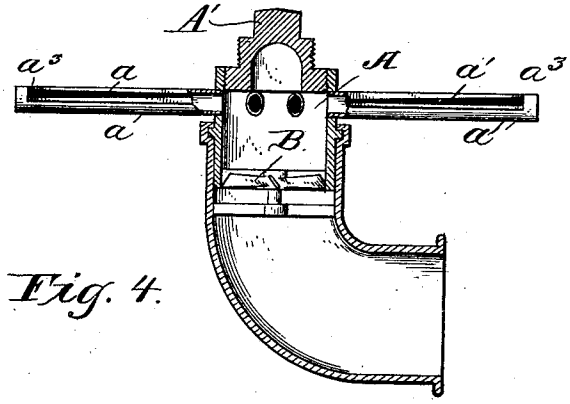


Fig. 4.

Fig. 5.

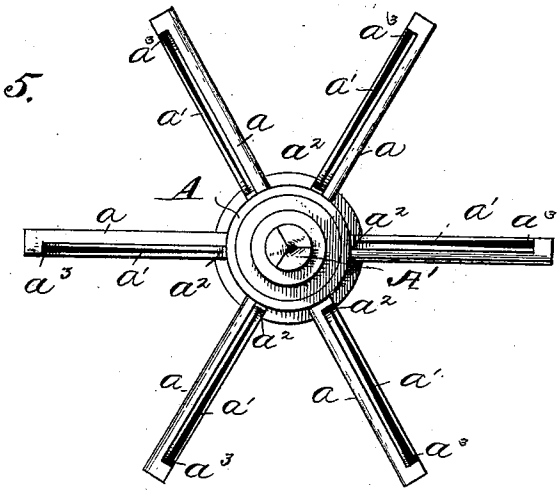
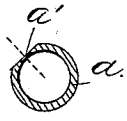


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

Q. J. HOKE.

SPARK EXTINGUISHER AND ARRESTER.

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Fig. 7.

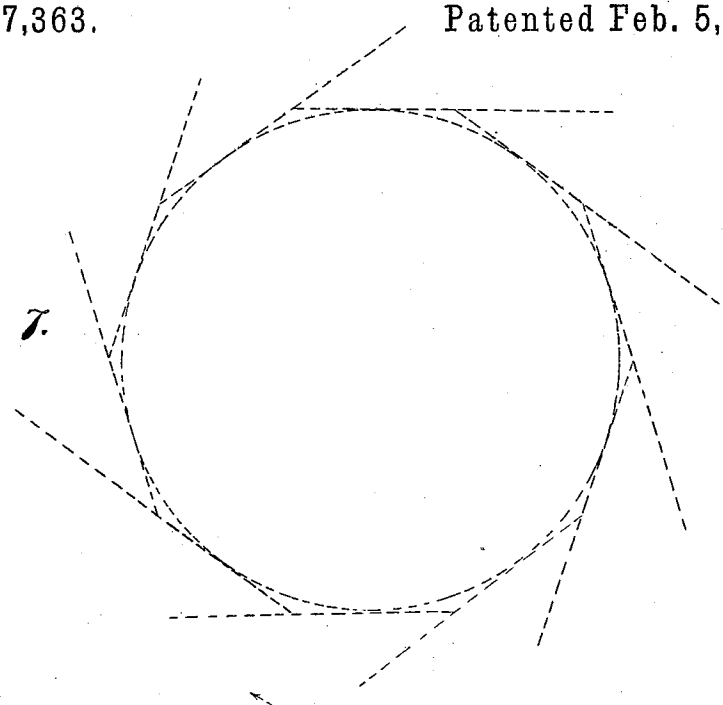
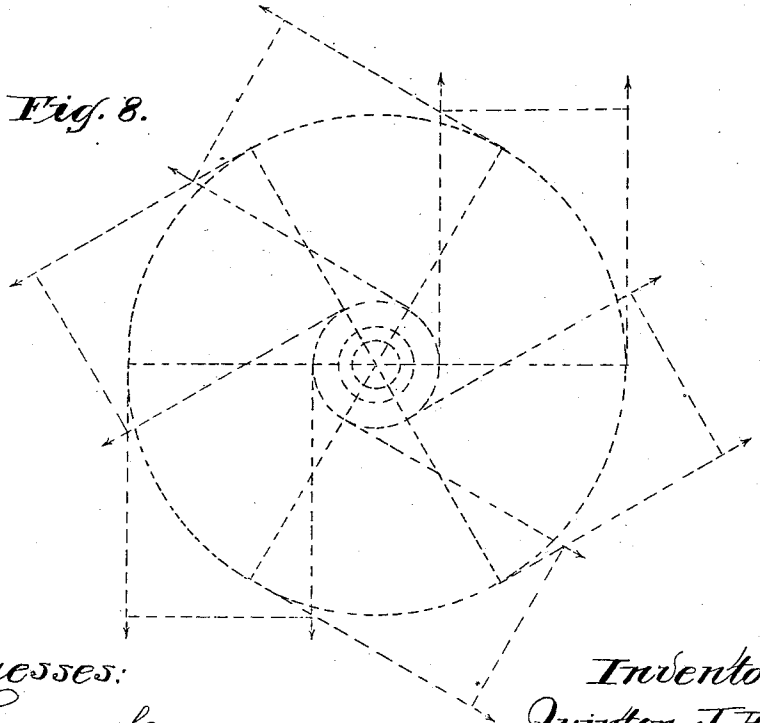


Fig. 8.



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UNITED STATES PATENT OFFICE.

QUINTON J. HOKE, OF YORKVILLE, ASSIGNOR TO HIMSELF, WILLIAM J. HERRON, OF WINNSBOROUGH, AND J. ROBERT LINDSAY AND SAMUEL L. MILLER, BOTH OF YORKVILLE, SOUTH CAROLINA.

SPARK EXTINGUISHER AND ARRESTER.

SPECIFICATION forming part of Letters Patent No. 397,363, dated February 5, 1889.

Application filed August 13, 1888. Serial No. 282,608. (No model.)

To all whom it may concern:

Be it known that I, QUINTON J. HOKE, a citizen of the United States, residing at Yorkville, in the county of York and State of South Carolina, have invented certain new and useful Improvements in Spark Extinguishers and Arresters; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

In the drawings, Figure 1 is a sectional elevation of so much of a steam-boiler as is necessary to illustrate my invention. Figs. 2, 3, and 4 are vertical sections of a portion of the upper end of the exhaust-pipe carrying my improved spark arrester and extinguisher. Fig. 5 is a top plan view of the form of injector shown in Figs. 3 and 4. Fig. 6 is a cross-section of one of the tubular radial arms shown in Figs. 3, 4, and 5. Figs. 7 and 8 are diagrams illustrating the action of the spark-extinguisher.

This invention relates more especially to that class of devices known as "spark-extinguishers" in contradistinction to those known as "spark-arresters." In the former class the sparks passing through the stack of a steam-boiler are extinguished before they reach the atmosphere, or they are extinguished by impact with the stack and precipitated into the smoke-box. In the latter class the sparks are arrested on their way to the upper end of the stack or prior to their escape therefrom, this class of devices being chiefly applied to, on, or within the upper end of the smoke-stack.

The devices for carrying out the method that forms the subject-matter of this invention pertain in a manner to both of the classes of devices referred to in that they not only operate to extinguish the sparks before they issue from the stack, but in that they also operate in a measure to arrest the sparks, and more especially the heavier incandescent particles carried along with the products of combustion, which, when brought in contact with the stack, are arrested in their upward flight and precipitated into the smoke-box.

This invention is an improvement on the method of and devices for which I obtained Letters Patent of the United States under date of April 6, 1886, No. 339,553; and it has for its object to increase the efficiency of the spark extinguisher and arrester.

This invention consists, essentially, in the method of arresting and extinguishing sparks, the means for carrying out the same being applied at or near the base of the smoke-stack of a steam-boiler for projecting the exhaust-steam into the stack in such a manner as to produce a spiral rotary or whirling motion in the draft, the greatest velocity of movement being on the "periphery," if I may so call it, of a column of steam, as in the case of a whirlwind or cyclonic column, said periphery being limited by the stack itself, and for gradually increasing the volume or density of the column of steam from its axis to its periphery, whereby the effect of the column of steam upon the incandescent matter, as well as upon the draft, is very materially enhanced.

The invention further consists in the method of imparting to the column of steam a gyrating motion on its own axis to still further enhance its effect or action upon the incandescent matter and upon the draft.

By the devices described in the patent hereinbefore referred to the exhaust-steam is projected on lines tangential to a circle, thereby producing by impact with the smoke-stack a whirling column of steam, ascending the stack on spiral lines. It is obvious, however, that when a gyrating motion is imparted to the jets themselves the point of impact with the stack is a continuously changing one for each jet, thereby producing what I may call a "grinding" or "rubbing" action, since there is not only impact by projection, but friction due to the gyrating motion of the jets, which here produce a hollow gyrating column of steam, which acts more powerfully than the ordinary exhaust-steam nozzle to produce a vacuum, and at the same time arrests and projects the incandescent particles against the stack, where they are subjected to a grind-

ing action by the steam. It is further obvious that where the column of steam is a substantially solid column, whether said column has a gyratory motion imparted to it or not, as when the steam is admitted in the form of a sheet, increasing in thickness from the axis toward the periphery of the smoke-stack and projected thereinto on lines tangential to a circle, it will be impossible for any incandescent matter to pass beyond the lines of projection, since the projected sheets of steam overlap one another. If, now, a gyratory motion be imparted to said projected sheets of steam, the effect will be still greater, both upon the incandescent matter and the draft.

In practice, and with a view to economize steam, I apply the devices to the steam-exhaust pipe, but do not desire to limit myself to this arrangement, as live steam from the boiler may be used, if desired, or the latter and exhaust-steam, in which case the exhaust-pipe is connected with the steam-space of the boiler by a suitably-valved pipe, so that live steam may be admitted to the exhaust-pipe whenever desired. Under ordinary circumstances it will, however, be found that the exhaust-steam alone will suffice to produce the desired result.

Another advantage derived from the described mode of preventing incandescent particles carried along with the products of combustion from being carried out of the stack is in an increased and more steady draft.

The invention is more especially designed for use in portable or stationary engines employed in proximity to inflammable materials—as, for instance, in engines for driving cotton-gins, thrashing-machines, and other like machines, or in locomotives in general with engine-boilers operated or located in proximity to inflammable materials liable to be set on fire by incandescent particles carried along with the products of combustion and escaping from the smoke-stack.

For the purpose of carrying out my invention I have shown in the accompanying drawings convenient and efficient means, and in said drawings—

B is the boiler; *s*, the smoke-box; S, the smoke-stack, and P the exhaust-pipe from the cylinder or cylinders. The arrangement of these devices is so well known as not to need any particular detailed description, more especially as they form no part of this invention and as they vary to some extent, according to the description of the boiler or engine to which my improvements are or can be applied. The exhaust-pipe terminates in or approximately in the axis of the stack at its base, and in Fig. 2 I have shown the device described in my patent hereinbefore referred to (the head A, with its bent tubes *a*, hereinafter termed the "spark-extinguisher") as pivotally connected with the exhaust-pipe, so that the impact of the steam upon the curved ends of the tubes *a* will impart a gyrating motion to the extinguisher in a manner similar to that of water upon the bent tubes of a lawn-sprinkler.

The connection between the extinguisher and the exhaust-pipe, so as to cause the former to revolve on the latter, may be of any usual, well-known, or of any preferred construction, which forms no part of this invention, as any construction that will allow the spark-extinguisher to revolve on the exhaust-pipe will answer the purposes. In this form of spark-extinguisher the jets of steam are projected from points on a circle common to all the jets and on lines tangential to such circle, said jets intersecting one another, as shown in the diagram Fig. 7, a hollow gyrating column of steam being produced that has a spiral vertical movement due to the inclination of the jets relatively to the vertical or inclined walls of the stack, said column of steam exerting a grinding action upon such walls that will more effectually extinguish the incandescent matter carried into the stack with the products of combustion by the draft, and that will also materially increase said draft.

In respect of a stationary spark-extinguisher, as shown in my former patent, its effect may be materially increased by converting the annular jet into a sheet of steam projected from the tubes *a* on lines tangential to a circle and at an inclination to the vertical axis of the stack, as shown in Fig. 3, and I have found that by varying the thickness of the "sheet of steam," if such term may be used in this connection, the effect will be better than when such sheet is of uniform thickness. To this end I form a single port, *a'*, longitudinally of the tube, which port is preferably of gradually-increasing width from a point near the head to a point near the outer end of the tube.

The initials a^2 of the ports *a'* of the tubes are on a common circle and equidistant from one another, the terminals or outer ends, a^3, of said ports being arranged likewise on a common circle, both circles having as center the axis of the head A. In this manner the steam is projected in sheets that overlap one another, thus forming a solid wall of steam at the base of the stack, as shown in the diagram Fig. 8, which wall increases in thickness from the initial a^2 to the terminal a^3 of the extinguisher-ports or from the axis to the inner periphery of the stack.

The inclination of the sheets of steam to the vertical imparts to the column a spiral upward motion that materially increases the draft and more effectually arresting incandescent matter, as there is no possibility of such matter passing through the column of steam. If now a gyratory motion is imparted to the head A by pivoting the same to the exhaust-pipe P, which gyratory motion may be increased by forming turbine blades B in said head, as shown in Fig. 4, a spirally-gyrating column of steam increasing gradually in den-

sity from its axis to its periphery, which is the stack, is obtained. The effect of this last arrangement of spark-extinguisher will be readily understood.

The extinguisher, whether stationary or revoluble on the exhaust-pipe P, is provided with a screw-plug, A′, on removing which, and substituting a nozzle therefor, the devices may be used as an ordinary exhaust-pipe.

Having described my invention, I claim—

1. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam into the base of the stack from points on a circle concentric with the axis of said stack and on lines tangential to the said circle and imparting a gyratory motion to said jets, substantially as and for the purposes specified.

2. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam at an inclination to a vertical into the base of the stack from points on a circle concentric with the axis of said stack and on lines tangential to the said circle and imparting a gyratory motion to said jets, substantially as and for the purposes specified.

3. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam in the form of sheets into the base of the stack from points on a circle concentric with the axis of the stack and on lines tangential to the said circle, substantially as and for the purposes specified.

4. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam in the form of sheets increasing in volume or density in a radial direction into the base of the stack from points on a circle concentric with the axis of said stack and on lines tangential to the said circle, substantially as and for the purposes specified.

5. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam in the form of sheets into the base of the stack from points on a circle concentric with the axis of said stack and on lines tangential to the said circle and imparting a gyratory motion to the jets, substantially as and for the purposes specified.

6. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam in the form of a sheet and at an inclination to the vertical into the base of the stack from points on a circle concentric with the axis of said stack and on lines tangential to the said circle, substantially as and for the purposes specified.

7. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam at an inclination to a vertical and in the form of a sheet increasing in volume or density in a radial direction into the base of the stack from points on a circle concentric with the axis of the stack and on lines tangential to the said circle, substantially as and for the purposes specified.

8. The herein-described method of extinguishing and arresting incandescent particles carried along with the products of combustion through the smoke-stack of a steam-engine, which consists in injecting jets of steam at an inclination to a vertical and in the form of a sheet increasing in volume or density in a radial direction into the base of the stack from points on a circle concentric with the axis of said stack and on lines tangential to the said circle and imparting a gyratory motion to the jets, substantially as and for the purposes specified.

In testimony whereof I affix my signature in presence of two witnesses.

QUINTON J. HOKE.

Witnesses:

J. D. ANDREW,

his

D. B. × BROWN.

mark.