(No Model.) 2 Sheets—Sheet 1.

J. P. MALONEY.

COMBINED SMOKE CONSUMER AND SPARK ARRESTER.

No. 491,576. Patented Feb. 14, 1893.

Fig. 1.

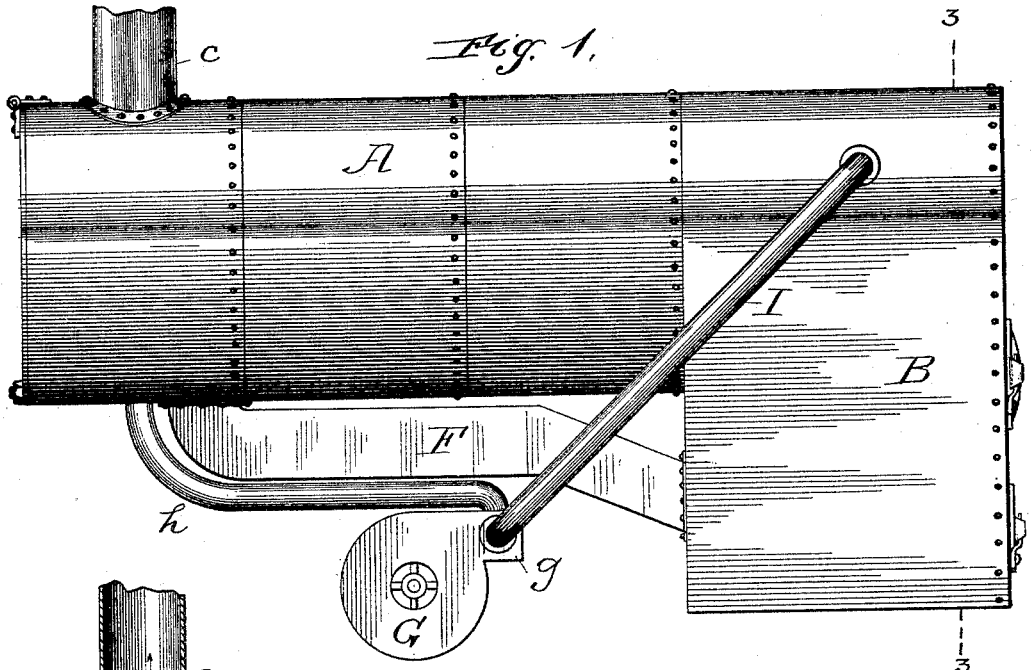
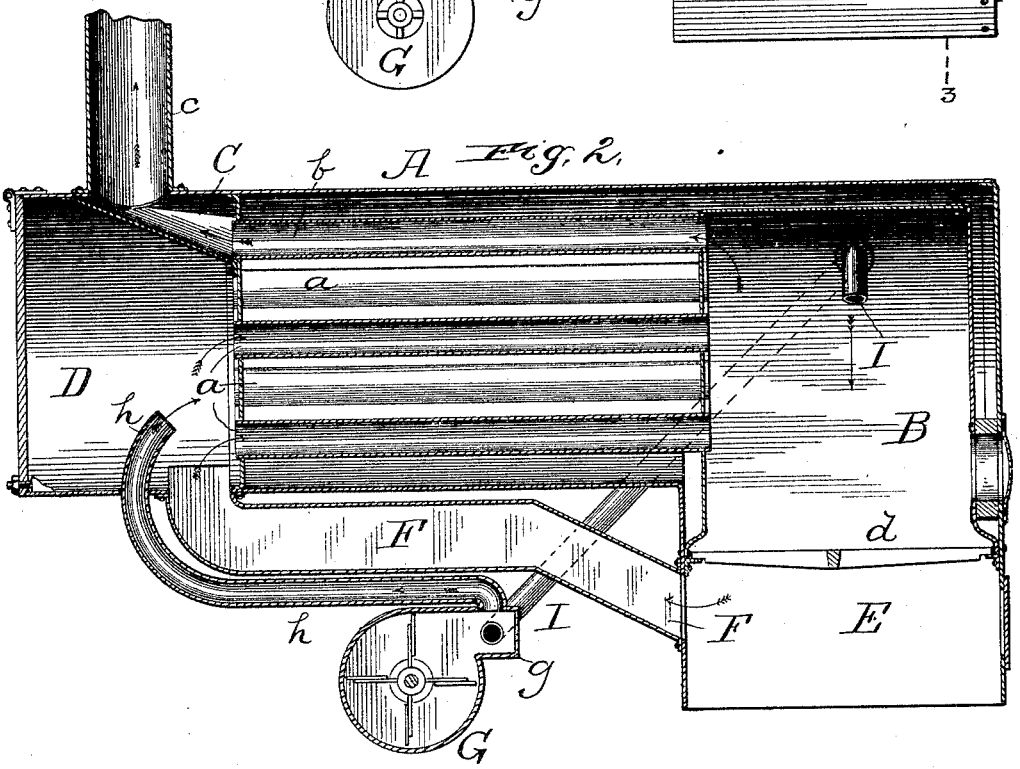


Fig. 2.



Witnesses:
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Edward Seidenstricker.

Inventor:
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(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

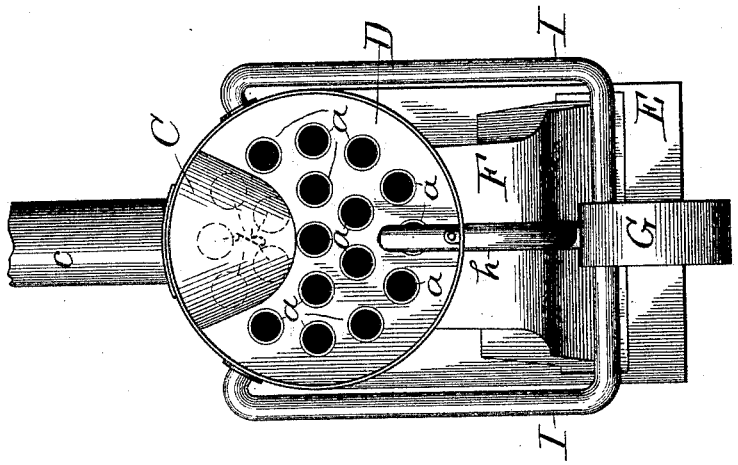
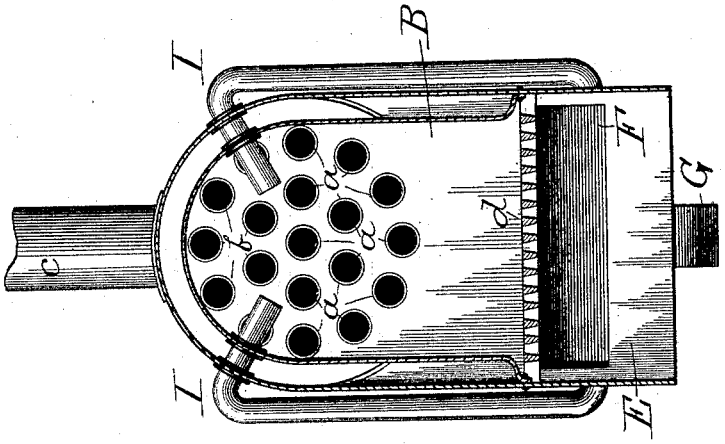


Fig. 3.



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John Pierce Maloney
By Frank D. Thomason Atty.

UNITED STATES PATENT OFFICE.

JOHN PIERCE MALONEY, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO HARRY CAMPBELL BUNN, OF SAME PLACE.

COMBINED SMOKE-CONSUMER AND SPARK-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 491,576, dated February 14, 1893.

Application filed April 25, 1892. Serial No. 430,530. (No model.)

To all whom it may concern:

Be it known that I, JOHN PIERCE MALONEY, of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Combined Smoke-Consumers and Spark-Arresters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Heretofore all attempts to obtain perfect combustion in boiler furnaces, have been directed to confining and holding the unconsumed and volatile gases of combustion in the fire-chamber above the fire long enough to insure their consumption, or have been directed to the adding to them, in the proximity of the fire, sufficient quantities of oxygen gas in one form or another to cause their ignition before they have had time to escape into the outer free atmosphere. This is well enough as far as it goes, or is capable of going, but it stands to reason there must be a limit so far as the consumption of the unconsumed gases thrown off by the fire is concerned, which falls short of "perfect combustion," because the fire itself—the source of heat—must be hotter than either the vaporized water in the boiler—which is sometimes injected into the fire-chamber—or the fresh air sometimes supplied thereto. This being the case the gases generated in and thrown off by the fire, of which they originally constitute a part, are so hot that they rise quicker and outstrip the oxygen, no matter how supplied, in the race for the open atmosphere and escape to a greater or less extent in an unconsumed condition.

The object of my invention is to capture and force the unconsumed gases of combustion down into and through the fire-bed, and by reversing and artificially creating a continuous circuitous down draft which produces a perfect combustion of the unconsumed carbonic gases thrown off by the burning fuel, and prevent the possibility of such a thing as sparks arising and being ejected as a constant menace to the surrounding country; substantially as hereinafter fully described, and as illustrated in the drawings, in which:—

Figure 1, is a side elevation of a locomotive boiler and fire box having my improvements applied thereto. Fig. 2, is a longitudinal vertical central section through the same. Fig. 3, is a transverse vertical section through the same, taken on dotted line 3, 3, Fig. 1, and, Fig. 4, is a front elevation thereof with the head of the smoke box removed.

The drawings show a locomotive boiler A, which is traversed longitudinally by numerous flues *a* and *b*, that lead from the fire box B located at the rear of the boiler, and constructed with reference thereto in the usual manner. The flues *a*, which constitute all the flues located below the uppermost segment of the boiler, about as shown, are open at their forward ends to the smoke box D, whereas the flues *b* which come within the limits of said segment are open at their forward ends to, and discharge into the chamber C, which is separated entirely from the smoke box D by a suitable metallic partition, and from which the smoke-stack *c* arises.

As is customary the grates *d* in the fire box B are located some distance below the plane of the bottom of the boiler. In the front wall of the ash-pit E just below these grates, is the rear opening of the smoke-passage F, which leads to and discharges into the smoke box D, at the base of the forward head of the boiler proper. This passage F is, preferably, made gradually narrower from its rear opening in the ash-pit to its forward end, so as to accommodate the possible contraction of the heated products of combustion passing therethrough (as will hereinafter be more fully explained), and so as to compress the same said gases as they are discharged into the fire box.

Located, preferably, centrally below the boiler and passage F is a suitable blast fan G, which may be operated in any suitable manner, and by any desired means, whether derived from the locomotive or not. This fan blows into a short chamber *g*, leading directly therefrom, and from this chamber the blast is distributed, partly through the pipe *h* leading forward to under the smoke box, then bent upward so as to enter said box, and then backward so as to discharge toward and rearwardly into the flues, *a* at a point over the discharge opening of passage F. The remainder of the air current generated by said fan passes into and through the twin pipes I, I, which are bent so as to avoid the surrounding structure

and lead from said chamber *g* to the dome of the fire box into which they enter at points opposite each other, as shown in Fig. 3, having their mouths bent downward and terminating at such a point that the air currents issuing therefrom will meet at a point intersected by an imaginary line drawn through the center of the boiler, or below the same, and then be projected down into the fire bed. The volume of air currents created by the fan is, preferably, four times as great as could be accommodated by any one of said pipes *h* or I, I. In view of this fact, therefore, the pressure of the current of air and gases traveling back through flues *a*, and down from the pipes I, is such as to create a down draft through the grates, thus artificially reversing the draft. The products of combustion naturally seeking the highest outlet in the ash-pit, enter the passage F, and being assisted by the injection of air from pipe *h*, which draws the products of combustion issuing from passage F, after it, back into the fire box. Here, the heavier unconsumed carboniferous gases, being the heavier drop to such a plane that they are caught by the current issuing from the pipes I and forced down through the fire again where coming in contact with the greatest heat they are consumed. This circuit of the unconsumed gases of combustion is kept up until they are entirely consumed. When the gases of combustion are thoroughly consumed, they have become both heated to the greatest extent and consequently rarefied by reason of their expansion under such condition; when, therefore, they enter the fire box they rise to and occupy the space in the fire box above the plane of the mouths of the pipes I and, thus, being beyond the reach of the air currents issuing therefrom pass out of the flues *b*, and the smoke stack into open atmosphere.

It will, of course be borne in mind, that, my invention as described and illustrated will, when put in practical use, be subject to many modifications of detail, especially as regards dimensions and arrangements, not necessary to enumerate here. The principle of my improvements, however, contemplate a circuitous draft, which, passing down through the grates, then to the front of the boiler and then back through the flues thereof into the fire box, and then again through the same course until both the fuel and gases generated thereby, are thoroughly consumed.

It is possible, (although, I prefer it as it has been described) to dispense with pipe *h* altogether, or to substitute therefor, or to combine therewith the steam exhaust. It is also possible to adopt separate blast creating mechanism for pipes I, and pipe *h*, as also to substitute for the former suitable steam jets.

What I claim as new is:

1. The combination with a boiler furnace having an inclosed passage way leading from the ash-pit below the plane of the grate to the smoke arch, and provided with flues through the boiler, some of which connect only the smoke arch and furnace proper, and others of which connect the furnace with the smoke stack or chimney; of suitable devices for directing an artificially created down draft in the fire chamber, which causes the products of combustion to issue below the grate; from thence to the smoke arch and then back again to the furnace and into the fire.

2. The combination with a boiler furnace having a passage way leading from the ash-pit below the grate to the smoke arch, and having flues some of which connect only the smoke arch and furnace proper and others of which lead from said furnace to the smoke stack or chimney, of suitable devices for directing a down draft in the fire chamber which causes the products of combustion to issue below the grates and into and through said passage way to the smoke arch, and a rearwardly directed draft in front of the said boiler causing the return of the products of combustion to the furnace proper, substantially as set forth.

3. The combination with a fire-chamber B, boiler A, having a smoke box D and provided with a lower series of longitudinally disposed flues *a* connecting the smoke box and fire-chamber, and an upper series of flues connecting said fire-chamber and the smoke stack, and a passage F connecting the ash pit, and smoke arch, of the pipes I for injecting into and creating a down draft in said fire-chamber, as set forth.

4. The combination with a fire-chamber B, boiler A provided with a lower series of flues connecting the smoke box and fire-chamber, and an upper series connecting the fire-chamber and smoke stack, said smoke box, and a passage connecting the ash pit and smoke box, of pipes I for creating a down draft in the fire-chamber, and pipe *h* for creating a rearwardly moving current through the lower series of flues in the boiler, as set forth.

5. The combination with a fire-chamber B boiler A provided with a lower series of flues *a* connecting the smoke box and fire-chamber, and an upper series of flues connecting said fire-chamber and the smoke stack, said smoke box and smoke stack, the ash pit, and a passage F connecting the ash pit and smoke box, of a blast fan G, pipes I, I, leading therefrom downward into the fire-chamber, and pipe *h* leading therefrom to the smoke box where it is bent so as to create a rearward blast through the lower flue of the boiler, as set forth.

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