

(No Model.)

2 Sheets—Sheet 1.

E. M. ROBERTS, J. F. BLACKWOOD & J. P. CAHILL.
LOCOMOTIVE DIAPHRAGM.

No. 514,337.

Patented Feb. 6, 1894

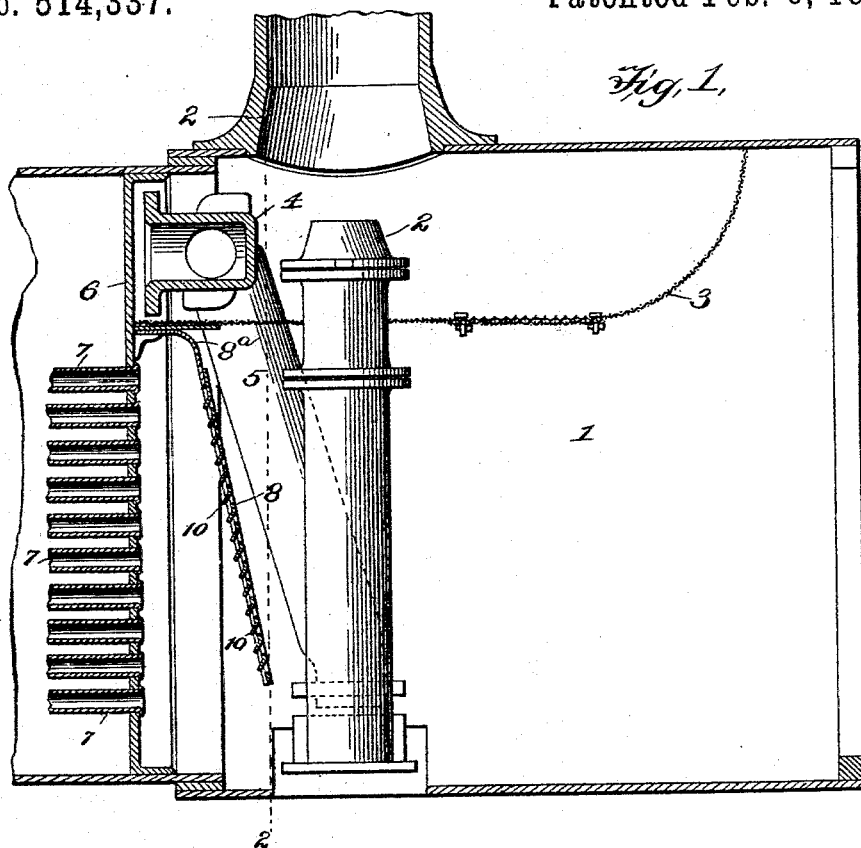
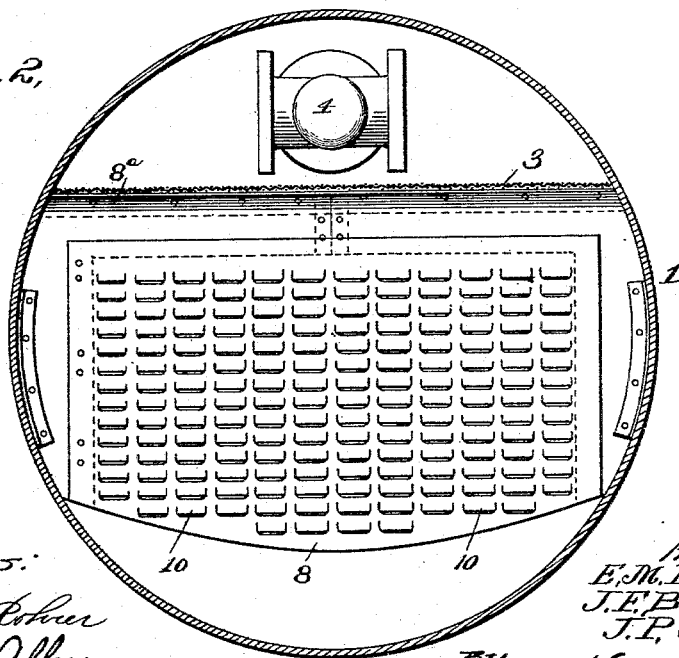


Fig. 2,



Witnesses:

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By

Harold B. Smith

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Fig. 3.

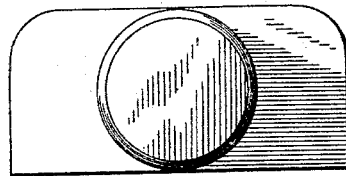
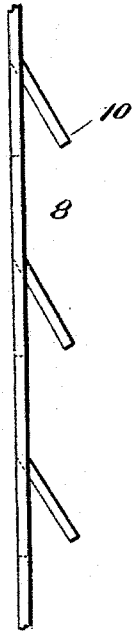


Fig. 4.

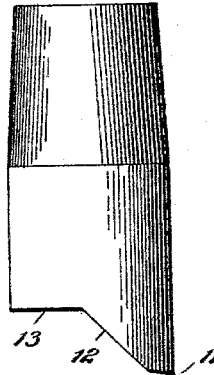
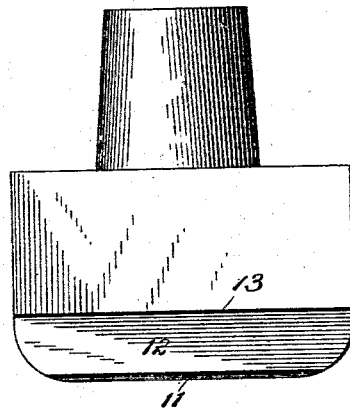
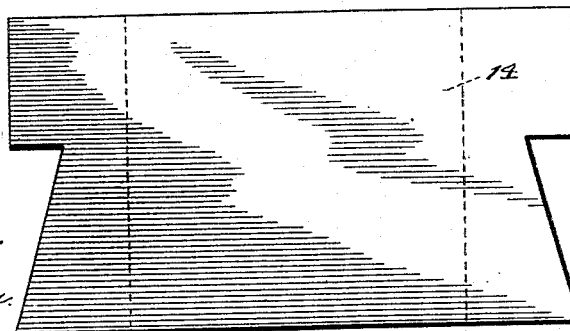
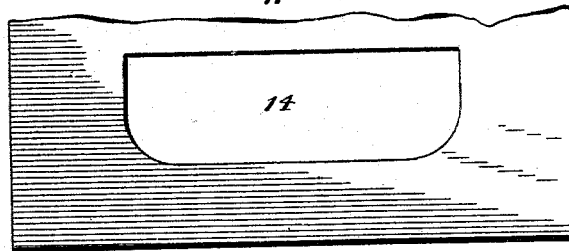


Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWARD M. ROBERTS, JAMES F. BLACKWOOD, AND JAMES P. CAHILL, OF
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LOCOMOTIVE-DIAPHRAGM.

SPECIFICATION forming part of Letters Patent No. 514,337, dated February 6, 1894.

Application filed August 8, 1893. Serial No. 482,672. (No model.)

To all whom it may concern:

Be it known that we, EDWARD M. ROBERTS, JAMES F. BLACKWOOD, and JAMES P. CAHILL, citizens of the United States, residing at Charleston, in the county of Charleston, State of South Carolina, have invented certain new and useful Improvements in Diaphragm Draft-Plates for Steam-Locomotives, of which the following is a specification.

Our invention relates to a perforated deflecting or draft plate to be used in the smoke-box of multi-tubular boilers of steam locomotives, whereby the forced draft, produced by the exhaust, has more direct and efficient action upon the tubes and the fire in the fire-box, at the same time maintaining a uniform suction or draft upon each tube opening, and upon the surface of the fire than when such draft is controlled by the angle and vertical adjustment of the ordinary deflecting or diaphragm plate in the usual manner.

Our invention consists in a peculiar manner of perforating the deflecting or diaphragm plate which permits an increase of suction on the tubes, distributes the suction evenly among the respective tubes and all parts of the fire grate, and creates a more uniform and perfect combustion of fuel, resulting in an increase of heat and decrease of unconsumed carbon and fuel passing through the tubes to be thrown against the spark arrester, or deposited in front of the smoke-box, or receptacle for holding the sparks. Our improved construction of plate also so distributes the accumulations in the smoke-box, as to prevent the fragments from being picked up by the draft, thus preserving the functions of a blank deflecting plate by which sparks are deflected to the front of the smoke-box and prevented from lodging back of the steam pipes where they would be liable to obstruct the openings of the lower boiler tubes. These results of the perforated deflecting plate or diaphragm are equally effective at any position or angle at which the deflecting plate may be used.

The invention will be fully understood upon reference to the accompanying drawings in which—

Figure "1" is a vertical longitudinal section of the front extension of a locomotive

boiler. Fig. "2" is a section on the line 2—2 Fig. "1." Fig. "3" represents in face and edge view, a portion of the sheet metal diaphragm. Fig. "4" represents, in plan and side and end elevation, the upper one of the dies employed for making the perforations in the diaphragm. Fig. "5" represents in plan and side elevation the other of said dies.

1 represents the smoke-box, in which is mounted the usual exhaust nozzle 2, spark-arresting screen 3, T-head 4, and steam pipes 5, which communicate with the cylinders and are connected by the T-head with the dry-pipe (not shown). 6 represents the boiler head in which are fixed at various points, fire-tubes 7. Ordinarily the suction produced through the tubes upon the fire by the exhaust nozzles is regulated by a diaphragm consisting of a blank sheet of iron or steel, No. 14 to No. 8 gage, placed in front of the tubes, fitting closely to the sides of smoke-box, from two to six inches from tube sheet at top, and extending forward at an angle of from eight to thirty degrees, and extending downward to within eight to fourteen inches of the bottom of the smoke-box. The action of the draft, or suction, is through the space between the lower edge of the diaphragm-plate and the bottom of smoke-box, and through this space all the smoke, gases and sparks from the tubes are drawn in a circuitous route by the vacuum produced in the smoke stack and these products of incomplete combustion either pass through the spark arrester or are deposited in the forward part of the boiler extension. To create a vacuum in the stack sufficient to make the necessary blast on the fire around the intervening obstructions, the exhaust nozzles are contracted, and this gives such a high speed to the draft that it robs the fire of unconsumed fuel. This fuel is in the form of gases and small particles below the igniting temperature and it passes through the tubes and goes away unconsumed, thus resulting in great waste.

Diaphragm plates have been used with unobstructed round or rectangular perforations, but this expedient proves undesirable, for the reason that it interferes with the function or purpose of a deflecting plate, causes a draft

only upon a portion of the tubes and concentrates the draft upon a portion only of the fire which results in drawing off pieces of fuel and increasing the sparking.

5 We have successfully obviated the objections and accomplished the desirable results named above, by a peculiar form of protected perforations, in the sheet. In forming this perforation, the sheet is slit horizontally a
10 distance equal to the required opening, and vertically at the ends of the horizontal cut, so as to form tongues which are then pushed outward from the sheet at a suitable angle to serve as projecting lips or hoods over the
15 openings thus formed in the sheets. The form of cut prevents the warping or buckling of the sheet which results when a single transverse slit is made without the side slits, and the lip is upset, pressed, or stamped outward beyond the surface of the sheet.

20 At the proper distance in front of the fire tubes 7 is hung a draft-plate or diaphragm 8, upon a curved bracket 8^a, and being formed as above described, with lips 10, projecting
25 downwardly and rearwardly to offer some resistance to the air and gases by causing them to take a circuitous passage through the diaphragm, and at the same time preventing the escape of sparks otherwise than by the pas-
30 sage at the bottom of the plate.

It will be observed that the projecting lips or hoods permit a large area of opening in the plate and are at such an angle as to allow the passage of gases more freely to the stack
35 while the sparks are deflected to the front of the smoke box, while the circuitous course of the current produces a nicely balanced effect upon the tubes and all parts of the fire, and admits of using a much lighter and milder
40 exhaust to force the fire, while the gases are allowed to flow through the tubes more slowly, so that the sparks and carbon may be consumed in the furnace and tubes, and the heating value of the fuel is increased by al-
45 lowing more time for the heat to be imparted to the water surrounding the tubes. By the difference in location the deflecting lips are

made to bear varying relations to the direction of the draft from different tubes, that is to say from the lower and more distant tubes, 50 the direction of the draft is such that it passes upward beneath the lips and thus suffers less opposition than the draft from the nearer tubes.

In Fig. 3 the construction of the diaphragm 55 will be seen.

The formation of the plate is simple and economical, there being no waste.

Having thus described our invention, the following is what we claim as new therein 60 and desire to secure by Letters Patent:

1. In a locomotive, the combination of the fire-tubes or flues, the exhaust-nozzle for creating a draft through said tubes, and an interposed deflecting plate or diaphragm formed 65 of a sheet, and punctured substantially as described, placed forward of the tubes at a suitable angle, and provided with protecting lips over the perforations, which project inward toward the fire-tubes substantially as 70 and for the purpose explained.

2. In a locomotive the combination of the fire-tubes or flues, the exhaust-nozzle for creating a draft through said tubes or flues and the draft-controlling plate or diaphragm pro- 75 jecting downward before the tubes and having perforations with the downwardly and rearwardly inclined protecting lips, substantially as and for the purpose set forth.

3. In combination with a forced draft boiler, the herein-described draft-plate consisting of a sheet 8 punctured substantially as shown to form the lips 10, severed on three sides 80 from the sheet; said lips being forced outwardly to leave openings in the plate, and 85 guarding said openings to control the draft through them, as explained.

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