

J. Montgomery,
Steam-Boiler Furnace,
No 27,922, Patented Apr. 17, 1860.

Fig: 1.

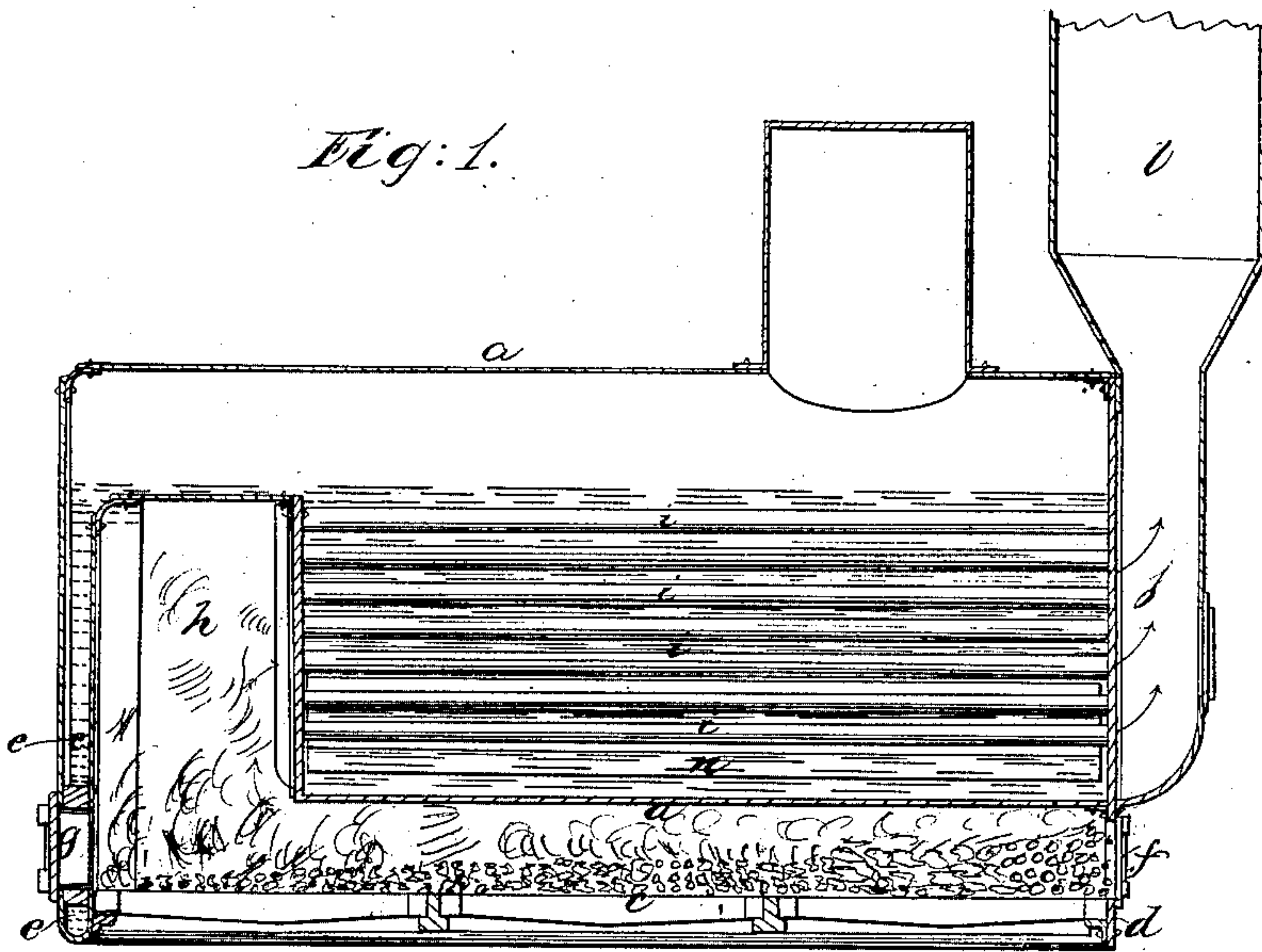
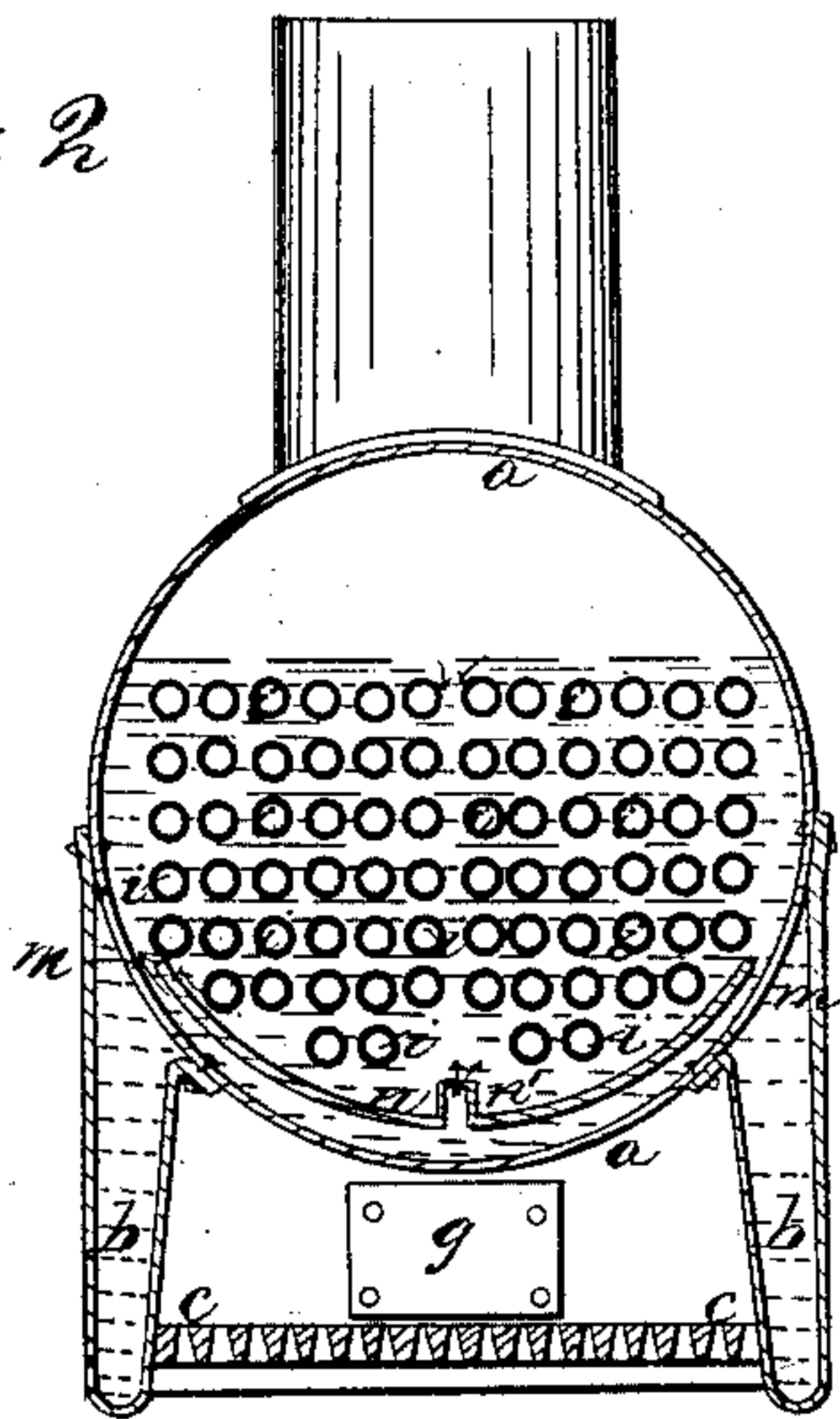


Fig: 2



UNITED STATES PATENT OFFICE.

JAMES MONTGOMERY, OF BALTIMORE, MARYLAND.

STEAM-BOILER.

Specification of Letters Patent No. 27,922, dated April 17, 1860.

To all whom it may concern:

Be it known that I, JAMES MONTGOMERY, of the city and county of Baltimore and State of Maryland, have invented certain new and useful Improvements in Locomotive and other Steam Boilers for Burning Bituminous and other Coal; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1, is a central longitudinal vertical section of a coal burning locomotive boiler. Fig. 2, is a transverse vertical section of the same in the line *x, x*, of Fig. 1.

Similar letters of reference indicate corresponding parts in both figures.

This invention has for its object to obtain in locomotive boilers or other steam boilers constructed otherwise than with vertical water tubes and a flue space among said tubes, a sufficient area of manageable grate surface in proportion to their tubular or other heating surface which is not directly exposed to the radiated heat of the fuel. On the 7th day of July 1858 I obtained Letters Patent of the U. S., No. 21013, for a certain arrangement of a grate and fire doors combined with a boiler constructed with vertical water tubes and a flue space among said tubes communicating with the fire chamber at one end only, whereby a very large area of manageable grate surface is obtained; but I have discovered that the same arrangement of the grate and fire doors is applicable with great advantage to the burning of coal (more especially of the bituminous kind) in locomotives, by combining the said arrangement with a boiler having horizontal fire tubes, and also with tubular boilers of any other construction whose flue spaces communicate with the fire chamber at one end only, and my present invention consists in the employment of such arrangement of the grate and fire doors in combination with all boilers other than of the construction specified in my Letters Patent aforesaid, in which the flue spaces communicate with the fire chamber at one end only. The true theory of the combustion of coal on grates as laid down in the specification of my Letters Patent aforesaid need not be repeated here, but I will at once proceed to describe the application of my invention to a locomotive boiler with horizontal fire tubes and the operation thereof, which with some

additional explanation will serve to render intelligible to the engineer the manner of applying the invention to other boilers.

a, is the body or shell of the boiler of horizontal cylindrical form.

b, b, are water legs extending downward from the sides and below the bottom of the shell *a*, and the whole length of the boiler, said legs communicating with the shell of the boiler through slots *m, m*, at numerous intervals, and their inner sides constituting the sides of the furnace of which the bottom of the shell *a*, constitutes the crown sheet. The grate *c, c*, which extends all across the space between the water legs extends from the front plate *d*, to the water back *e*.

f and *g*, are the doors one at the front and the other at the rear end of the boiler, one to give access to the front portion and the other to the rear portion of the grate.

h, is a vertical flue space extending from the rear of the furnace or fire chamber the whole width thereof upward into the shell *a*, of the boiler, and *i, i*, are tubes extending from this flue space directly through the shell *a*, of the boiler into what is commonly called a smoke box *j*, at the front end of the boiler. At the top of this smoke box is the chimney *l*.

n, is a shield plate of similar character to that which constitutes part of the subject matter of Letters Patent of the United States No. 20,167, granted to me on the 4th day of May, 1858, said plate being interposed between the crown sheet *o*, of the furnace or fire chamber and the tubes *i, i*, and inclining upward on each side from the center for the purpose of causing all the steam which is generated on the crown sheet to be deflected laterally on each side and to pass upward between the sides of the shell and the tubes *i, i*, without passing among the tubes where it would in its ascent tend to break up the water into foam. Along the middle of the said shield there is a narrow slot *n'*, or a series of openings at intervals to provide for a downward circulation of water to supply the place of the steam generated upon the crown sheet. The circulation of water produced by the shield plate is indicated in Fig. 2, by arrows. This shield plate also serves as a collector of sediment, and properly arranged man-holes must be provided in the shell *a*, for cleaning it.

The arrangement of the furnace should be

as follows:—The coal to be charged through the door *f*, on to the front portion of the grate which is the portion farthest from the flue space *h*, or means of communication between the furnace and the tubes, and when the whole charge has reached the incandescent state a portion of it should be pushed back as far as possible by a stoker operating through the door *f*, and afterward drawn farther back over the rear portion of the grate by a stoker operating through the door *g*, taking care however always to leave a sufficient quantity on the front portion of the grate to ignite a fresh charge of coal which when incandescent will be transferred to the back portion of the grate in the same manner, and in this manner the firing proceeds, alternately charging and transferring. The combustible gases evolved from the fresh coal on the front portion of the grate are by such management caused to pass over the incandescent coal on the rear portion, and as the large area of the grate provides for a greater supply of air through it by the blast or draft than can be consumed in passing through the fresh charge the excess of air is heated by the incandescent coal and serves to inflame the highly heated gases in the rear portion of the furnace, thus producing a most perfect combustion of all the inflammable matter of the coal.

It is obvious that the same system of firing and managing the fire may be performed through doors arranged at the sides of the boiler near the ends of the grate. I do not consider such position of the doors, generally speaking, so good as the ends of the boiler but mention it as a mere modification of my invention.

By my arrangement of the grate and fire doors in combination with a locomotive boiler I obtain very important results mainly owing to the enormous increase of furnace, fire and grate surface obtained, which enables combustion to be effected with a much less draft; and I will proceed to explain the reasons why the lowest possible draft should be used. First, the fuel will be economized. Second, the furnace as well as the tubes will be less liable to burn out from excessive heat. Third, the water will remain on the furnace plates in a more solid state thus preventing the furnace burning out even though made of iron; while at the same time the steam will be generated more rapidly owing to the greater solidity of the water for it must be evident that when water is broken up by the effervescence caused by an excessive temperature, but a comparatively small amount of water is in actual contact with the furnace plates. Fourth, a much less blast of exhaust steam will be required to increase the draft, and I will here remark that it is

very desirable to avoid the use of exhaust steam altogether if possible, and to use only a natural draft, as then an enormous amount of steam (equal in many locomotives to one entire half) would be saved and utilized that is now wasted in producing the draft. Fifth, the reduction of draft prevents in a great degree the production of clinker, and causes less sparks and ashes to be drawn into the flues and so obviates much annoyance to passengers and much danger to property. The above however are not the only requisite in a coal burning locomotive boiler that are secured by my improvement, as it insures the entire combustion of the fine particles of carbon which form the coloring matter in the smoke of bituminous coal and which when escaping unconsumed are so annoying to passengers and productive of obstruction in the flues in the form of soot. It also obviates the tendency to foam so common to locomotive boilers and so productive of evil not only on account of the danger arising from the engineer being deceived as to the actual amount of water in the boiler, and of the priming incident to foaming, but because the generator will not make nearly as much steam for reasons before detailed, and also because much of the water will be worked off through the engine in the form of spray, which is another source of waste of fuel and also of water. The same important results will be obtained in a greater or less degree by the application of the said arrangement of the grate and fire doors in combination with boilers for other than locomotive purposes.

To explain the application of my invention to boilers of other construction than the horizontal tubular kind represented in the drawings it is necessary to observe that the flue passage or space through which the products of combustion leave the fire chamber must be at or near one end of the grate that by charging the coal at the other end the combustible gases evolved therefrom may pass over the whole or nearly the whole length of the grate. This being the case the boiler may be made of almost any imaginable construction in other respects, either of plain cylindrical form with return flues, either inside or outside, or of any of the various multitubular constructions.

I do not here intend to claim the employment of the within described arrangement of the grate and fire doors and flue space or passage by which the products of combustion leave the fire chamber, in combination with a boiler formed with vertical water tubes and a flue space among the said tubes, as that is covered by my before mentioned Letters Patent No. 21,013, but

What I claim as my invention and desire to secure by Letters Patent, is—

Combining with a boiler which has a series of horizontal flues or tubes or a boiler
5 of any form other than that specified in my above mentioned Letters Patent but which has the flue space or passage leading from the fire chamber to the tubes or flues at one end of the said chamber, a grate of

the whole or nearly the whole length of the 10 boiler with one or more fire doors at each end substantially as and for the purpose set forth.

JAMES MONTGOMERY.

Witnesses:

HENRY T. BROWN,
W. HAUFF.