

(No Model.)

2 Sheets—Sheet 1.

R. MACFARLANE.  
TUBULAR WATER GRATE.

No. 488,170.

Patented Dec. 13, 1892.

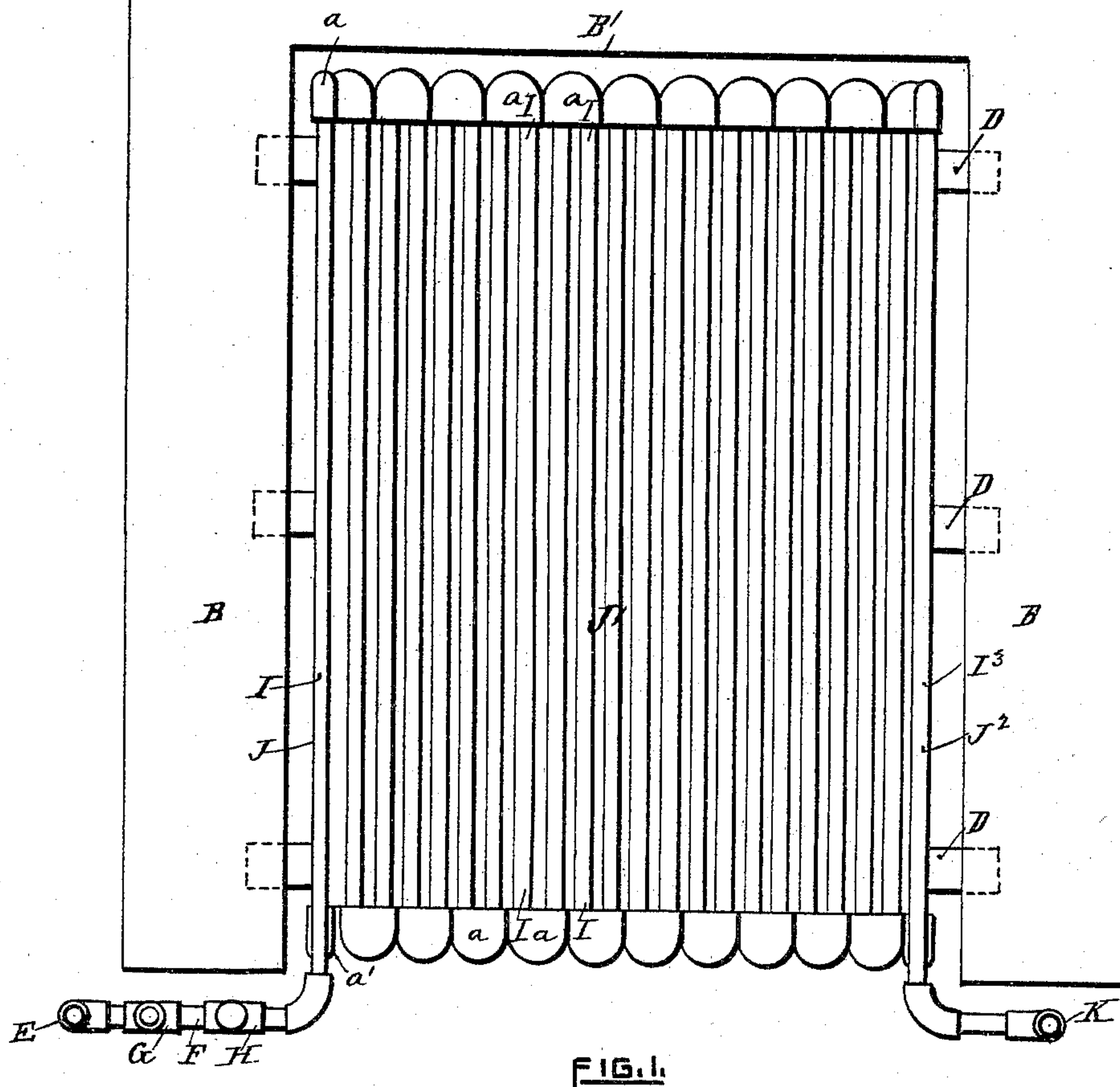


FIG. 1.

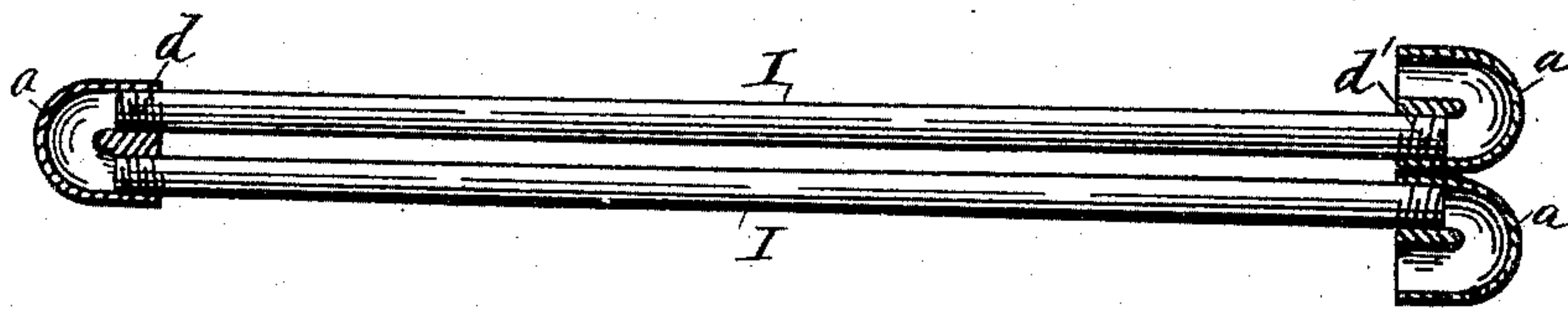


FIG. 2.

WITNESSES.

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James W. Burnham

INVENTOR.

Robert MacFarlane  
per S. Scholfield  
Attorney

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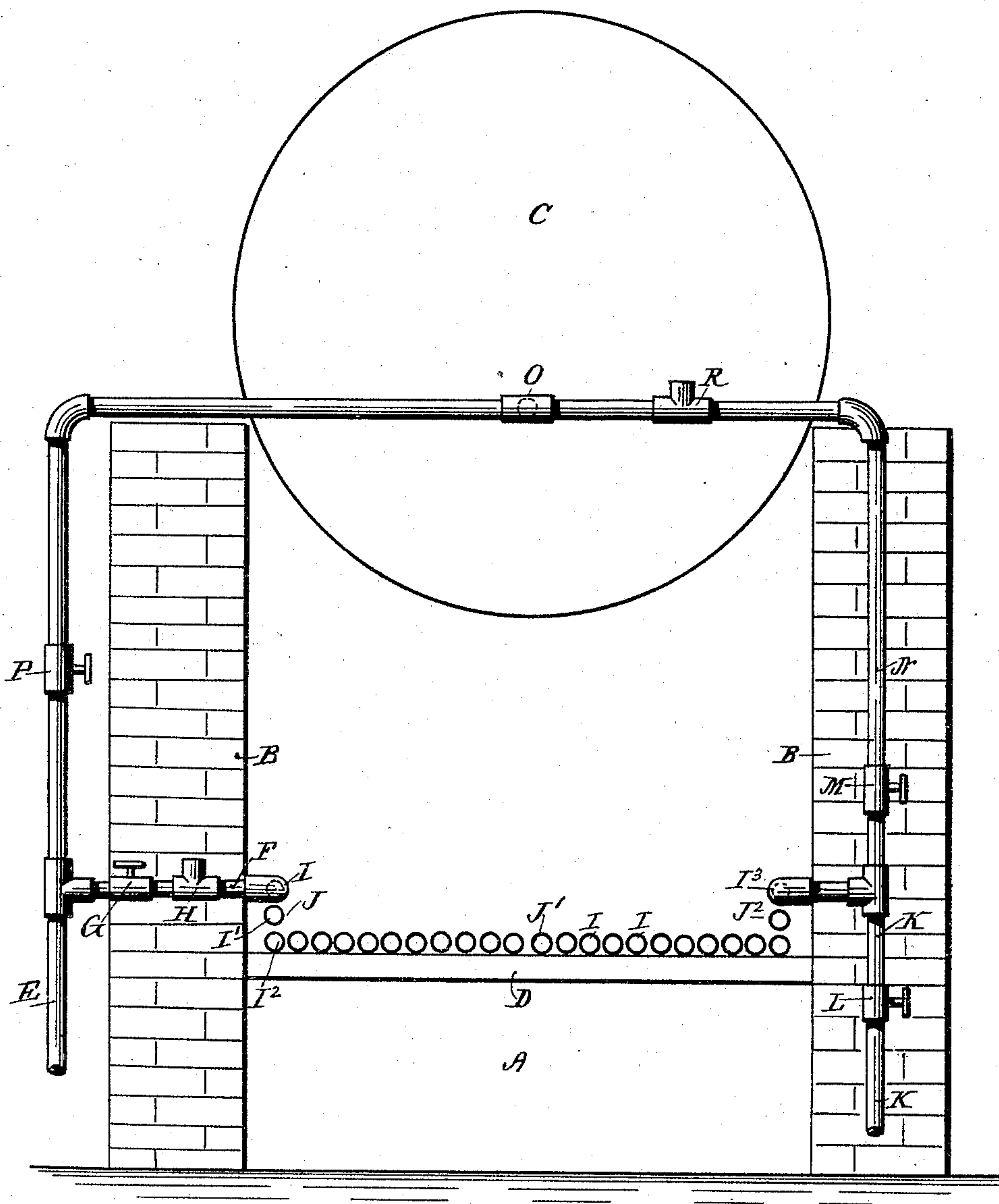


FIG. 3.

WITNESSES.

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# UNITED STATES PATENT OFFICE.

ROBERT MACFARLANE, OF MAGOG, CANADA.

## TUBULAR WATER-GRATE.

SPECIFICATION forming part of Letters Patent No. 488,170, dated December 13, 1892.

Application filed September 12, 1891. Serial No. 405,549. (No model.) Patented in Canada July 24, 1891, No. 37,059.

*To all whom it may concern:*

Be it known that I, ROBERT MACFARLANE, a subject of the Queen of Great Britain, and a resident of the town of Magog, Province of Quebec, Dominion of Canada, have invented a new and useful Improvement in Tubular Water-Grates, (patented in Canada, No. 37,059, dated July 24, 1891,) of which the following is a specification.

10 In using the finely-granulated cheaper grades of coal in the furnace of a steam-boiler an ordinary furnace-grate will soon become so clogged with clinkers as to render it useless until the clinkers are with great difficulty  
15 removed therefrom; and it is the object of my invention to prevent the formation of clinkers upon the grate-bars when using coal of inferior quality, thus securing greater economy in the cost of steam-power; and my  
20 invention consists in the employment of tubular grate-bars of such proper dimension and nearness to each other as to obtain the economical combustion of the said coal, and having the grate-tubes connected at their ends  
25 by return-bends, so as to provide a continuous passage for a stream of water which, entering at one side and passing rapidly through all the tubes and bends, will flow out at the opposite side either to other use or to waste after thus serving to reduce the temperature of  
30 the grate-bars, so that the clinker will not attach itself thereto or to be conducted to the boiler to feed the same with hot water, as desired.

35 Figure 1 represents a plan view of my improved non-clinckering tubular grate. Fig. 2 represents an enlarged detail section showing two adjacent grate-bars and the return-bends for connecting the same. Fig. 3 represents an elevation of the front of the boiler-furnace and a section of the grate.

In the accompanying drawings, A represents the ash-pit; B B, the walls of an ordinary furnace; C, the boiler, and D the truss-bar supporting the tubes of the grate. The feed-pipe E is connected with the boiler C at the pipe O, and is provided with a stop-cock P, and to the pipe E, below the stop-cock P, is attached the branch pipe F, which is provided  
45 with the stop-cock G and the check-valve H, and is connected with the upper tube I of the side grate J, as shown in Fig. 2, the check-

valve H serving to prevent back-pressure from the said grate. After entering the tube I the water is forced through the said tube 55 to the rear end where a return-bend  $\alpha$  carries it to the underlying tube I' of the side grate, thence returning through the said tube to the return-bend  $\alpha'$ , by means of which it is carried into the first tube I<sup>2</sup> of the bottom grate 60 J', and in a like manner through each succeeding horizontal tube of the grate J', flowing backward in one tube and forward in the next, until finally passing out of the upper tube I<sup>3</sup> of the side grate J<sup>2</sup> at the opposite side of the 65 furnace and into the waste-pipe K. The waste-pipe K is provided with a stop-cock L, by the closing of which and the opening of the stop-cock M in the pipe N, the water which has become heated in its passage through the 70 grate, may be conveyed upward through the pipe N and enter the boiler through the pipe O, the pipe N being also provided with a check-valve R.

The cold feed-water for the grate which is 75 first brought in at the top of the side grate J will become somewhat warmed before reaching the tubes of the bottom grate J', so that the low temperature of the grate J' will not be sufficient to retard the proper combustion 80 of the fuel.

In their normal positions the stop-cock P will be closed, and the stop-cocks G and M open, so that the heated water from the grate will flow into the boiler, and the stop-cock L 85 in the waste-pipe K may be either closed for turning all the water into the boiler, or partially open in order to allow a stronger flow of water through the tubes of the grate to keep them from becoming overheated, there- 90 by preventing the formation of clinker thereon, and the proportion of the water passing through the grate-tubes that is from time to time required in the boiler is directed thereto by the proper adjustment of the stop-cocks 95 L and M. By closing the stop-cock G and opening the stop-cock P the feed-water will be diverted from the grate and carried to the boiler in the ordinary way whenever desired for any purpose. The tubes I, forming the 100 grate, are connected to return-bends  $\alpha$  by means of right and left hand screw-threads  $d d'$ , cut on the opposite ends of the tubes, so that by turning them in one direction both



ends of the tube will screw into the respective return-bends, and by turning in the opposite direction will screw out and become free therefrom, thus providing for the removal and replacement of a defective tube; and sufficient space is to be left between the back wall B' of the furnace and the return-bends to allow for the backward movement of one portion of the grate to facilitate the taking out or putting in of any tube required; and by the employment of the return-bends having right and left hand screw-threads, so that the tubes can be arranged close to each other, I am enabled to form a complete practical grate capable of burning the cheaper and lower grades of fine coal, and at the same time avoid the obstructive formation of clinkers, which would occur in the attempt to burn this class of fuel upon an ordinary grate.

It will be understood that it is important that the supply-pipe for furnishing the water for the grate should be of sufficient size and be worked under such pressure as to provide an abundant supply of water to reduce and regulate the temperature of the grate so that the clinker will not form thereon.

Although the arrangement of tubes composing the grate and connecting pipes, herein shown, is thought to be the best application of my invention, yet I do not confine myself to the particular mode of construction.

In some cases I force the feed-water simultaneously through the pipe E and through the grate J' and pipe N, both currents meeting at the common pipe O to enter the boiler, and by this means any desired proportion of the feed-water may be passed through the grate by the proper adjustment of the respective stop-cocks, a desired proportion of the

water passing to the boiler through the grate J' and pipe N, and the remaining portion through the pipe E, both streams passing into the boiler through the pipe O.

I claim as my invention—

1. The combination, with the inlet-pipe F, provided with the stop-cock G and check-valve H, and the tubular grates J J' J<sup>2</sup>, connected with the pipe F, of the waste-pipe K, provided with the stop-cock L, the pipe N, provided with the stop-cock M and check-valve R, and the connected boiler C, substantially as described.

2. The combination, with the boiler C, of the feed-pipe E, provided with the stop-cock P and communicating with the boiler through the pipe O, the branch pipe F, provided with the stop-cock G and check-valve H, the tubular grate J', the waste-pipe K, provided with the stop-cock L, the pipe N, provided with the stop-cock M and check-valve R, and also connecting with the boiler through the pipe O, substantially as described.

3. The combination, with the boiler C, of the pipe O, connected therewith, the feed-pipe E, connected with the pipe O and provided with the stop-cock P, the tubular-grate J', connected with the pipe E, and the pipe N, connected with the tubular grate J' and with the pipe O, and provided with the stop-cock M to form a circuit with the pipe E, substantially as described.

ROBERT <sup>his</sup> X MACFARLANE.  
mark

Witnesses:

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