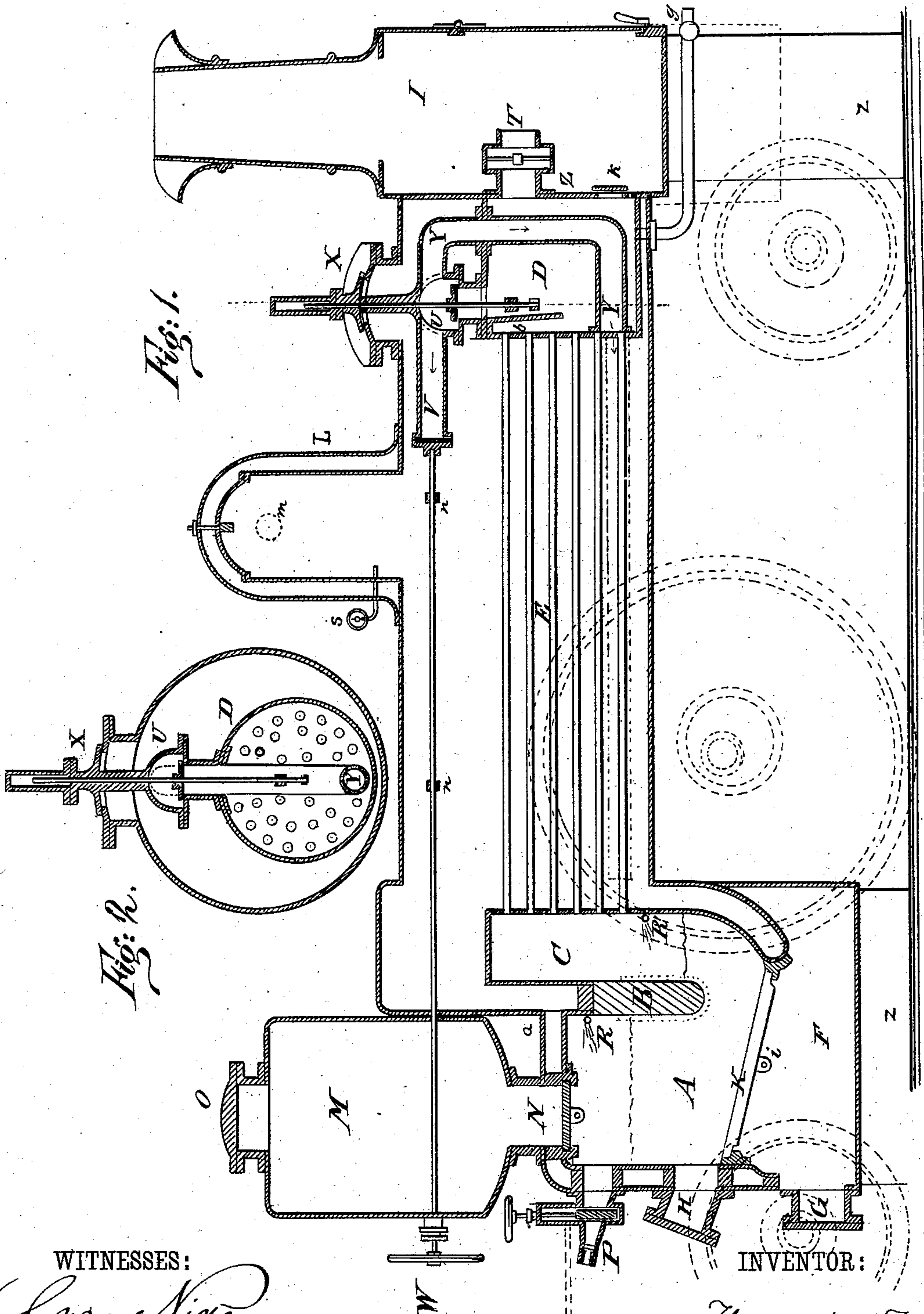


T. M. FELL.
Production of Motive Power.

No. 224,669.

Patented Feb. 17, 1880.



WITNESSES:

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Enas. Nida
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INVENTOR:

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UNITED STATES PATENT OFFICE.

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PRODUCTION OF MOTIVE POWER.

SPECIFICATION forming part of Letters Patent No. 224,669, dated February 17, 1880.

Application filed July 15, 1879.

To all whom it may concern:

Be it known that I, THOMAS MARA FELL, civil engineer, of the city of Brooklyn, county of Kings, State of New York, have invented
5 new and useful Improvements in the Production of Motive Power, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to the use of the waste
10 heat and gases of fire-combustion, which is added to the ordinary steam for purposes of motive force for engines.

In order that such gases may be successfully used, it is necessary that the fuel be burnt in
15 such manner as to prevent any reaction of the incombustible gases upon the fire, also in such manner as to secure complete combustion of the carbon, so as to avoid waste or smoke and the production of heat-gases alone. The
20 mechanism requisite is a reliable and adjustable feed of air and fuel, and in such manner as to be under perfect control, a system of chambers for equalizing the temperatures of the air and gases before entering the steam
25 or water spaces, a proper distribution of the same, and means of removing and preventing cinder or fine ash from passing into the water.

My devices or mechanism is a practical realization of the foregoing requisites, and which
30 I now describe as Figure 1 being a longitudinal vertical section, and Fig. 2 a vertical cross-section through the chamber D, the whole representing a boiler of the type locomotive,
35 which can be used for stationary purposes by resting on supports Z Z. The dotted lines show the position of the cylinders and wheels when for road use.

The back part or crown-sheet of the usual
40 fire-box is brought down to the point *a*, at which place I insert a solid cross-plate or partition, B, made of refractory or other material capable of resisting the effect of a high heat, which is made to dip down to within a short
45 distance of the fire-bars, and is supported by angle-iron bolted to the side sheets shown by the dotted lines.

C is a combustion-chamber; D, a heat and distributing chamber; E, flue-tubes; F, ash-pit; G and H, air-tight man-holes; I, the ordi-

nary smoke-box; K, grate-bars in the fire-place A; L, the main shell and steam-dome; M, a circular receptacle or vessel for holding a supply of coal or fuel, fitted with a tight man-hole plate, O, and a feeder, N; P, a spy-hole or
55 contrivance for ascertaining the condition of the fire at all times, and consists of a conical pipe bolted to the front sheet, with a flat slide-valve, handle, and a stuffing-box for holding a disk of annealed glass or mica, made tight
60 by the use of packing, (asbestos preferred;) R and R', perforated air-pipes across the width of the chamber C and fire-box A, connected with an air-pump to be driven by the engine; S, a pyrometer; T, an outlet into the smoke-
65 box and chimney I from the chamber D, operated by a rod and handle on the outside. (Not shown.) This is a wedge flat slide-valve, and is similar to the one used at P. U is the main hot-air gas-valve, connected with the top
70 part of the combustion-chamber D, and fitted with a circular cap and flange and a pipe, V, on the end of which is placed a flat valve operated by a long rod, with guides *n n*, extending through the length of the boiler and
75 through the coal or fuel vessel, with a stuffing-box and handle, W. The passage of this stem through the vessel M is made by using a pipe screwed at both ends, as shown.

The stem of the valve U is run up into a
80 cap which is fastened to the man-hole plate X, which acts as a guide, and can be removed at any time for inspection. From this valve also proceeds the distribution gas and air pipe Y, which descends down into and through the
85 chamber D, back to and near the end of the flues, and whose end is perforated with small holes after entering the water. (Shown by the dotted lines.)

The chamber D is a circular vessel, and is
90 flanged to the smoke-box by angle-iron, and shut off from the same by the movable plate Z. It is furnished with a deflecting-plate, *b*, and a pipe and valve, *g*.

The flue-tubes E are in number about one-
95 half the usual quantity put in boilers of this size, and are used more especially for getting up a starting pressure from steam. These tubes are also shorter for the length of boiler, and are swelled into the back sheet of the
100

chamber D, instead of into the usual smoke-sheet.

To operate this motor: The man-holes G and H and outlet-valve T being open, which permits a fire being lighted on the grate-bars K of the fire-place A, the motor operates with an open fire in the usual manner, the gases passing out to the chimney I, through the chamber C, flues E, chamber D, and valve T. But to operate with the gases under pressure, the manholes G and H and valve T are closed, compressed air enters by the pipes R and R', which renews combustion. The hot and expanded gases pass through the valve U down the pipe Y, into the water of the boiler, where it is distributed by the perforations, evaporating the water into steam, and is used therewith for driving the engine. Fuel is fed from the large supply-vessel M, which is calculated to hold enough for a given time or for a trip, by the feeder N, as required, the quantity of which and condition of combustion being plainly seen through spy-hole P.

To avoid smoke, and to bring about a proper condition of the various gases and air, it is necessary to have a depth of fuel in a highly-ignited condition. This I obtain by the use and construction of the partition or cross-plate B, which not only heats said gases, &c., but compels them to pass down and up before entering the chamber C, at which point they arrive in a condition ready for the effect of the second blast of air by the pipe R', which completes the full oxidation of the carbon particles into a flame of heat without smoke. It is necessary that this plate B, against which the gases impinge, should be as hot, or nearly so, as the fuel, in which case the carbon is fully consumed or converted. I therefore prefer to construct it of material that will hold or retain a high temperature, and of suitable thickness.

In order to regulate the heat of the mixed steam, air, and gases so as to produce the most economical effect by the engine, a certain quantity of the latter is occasionally allowed to enter or escape by the pipe V into the steam-space, thereby raising the whole to any degree of temperature required, which is regulated by the use of a pyrometer, S, placed on the dome or elsewhere along the top of the boiler.

Leakage of water, if any, by the valve U will not interrupt the working of the apparatus or interfere with the fire, as the gases delivered at this point are deflected downward by the plate b, and will evaporate and put back the same through the valve U. The pipe and valve g are used as a seat for the presence of any water.

The general arrangement of parts is such that all points are readily got at for repairs or adjustment—the flue-tubes E by removing the plate Z, the ashes by the man-hole plate G, and light dust, if any, by the small plate k in the smoke-arch.

In case of breakage of the glass or mica at the spy-hole, the valve attached can be immediately closed and another plate or disk put in. The ashes of the fire-box are brought down into the ash-pit by moving or shaking the grate-bars by means of a rod attached at the lug i, which passes through a stuffing-box to a handle on the outside. (Not shown.)

The supply-pipe to the engine can be taken from the dome at the point m, as at present.

The usual appliances necessary for boilers using either air or steam—such as safety-valves, gages, &c.—are omitted, as the use and application of the same are now well understood.

What I claim as my invention is embraced in the following claims:

1. In an apparatus for the production of motive power from the combined use of steam, air, and gases of combustion, the combination, in a fire-place, of the heating partition-plate B, with air-pipes R and R', and a combustion-chamber, C, leading to a flue or flues, E, arranged as shown, and for the purposes as set forth.

2. The method herein described for delivering the heated gases into an air-tight back chamber, D, provided with the deflecting-plate b, substantially as set forth, and for the purposes described.

3. In an apparatus as herein described, the combination of a spy-hole fitted in the fire-box of air-tight boilers provided with a valve and disk of glass, mica, or other transparent material, for the purposes and substantially in the manner described.

4. In an apparatus as herein described for the production of motive power, a heating-plate, B, in combination with a combustion-chamber, C, and a flue or flues, E, for the purposes as set forth.

5. The distributing-valve U, having a perforated delivery-pipe extending into the water of the boiler, in combination with another pipe and valve, V, delivering heated gases into the steam-space, for the purposes of regulating and controlling the temperature of the combined vapor, gases, and air, substantially in the manner and for the purposes set forth.

THOMAS MARA FELL.

Witnesses:

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