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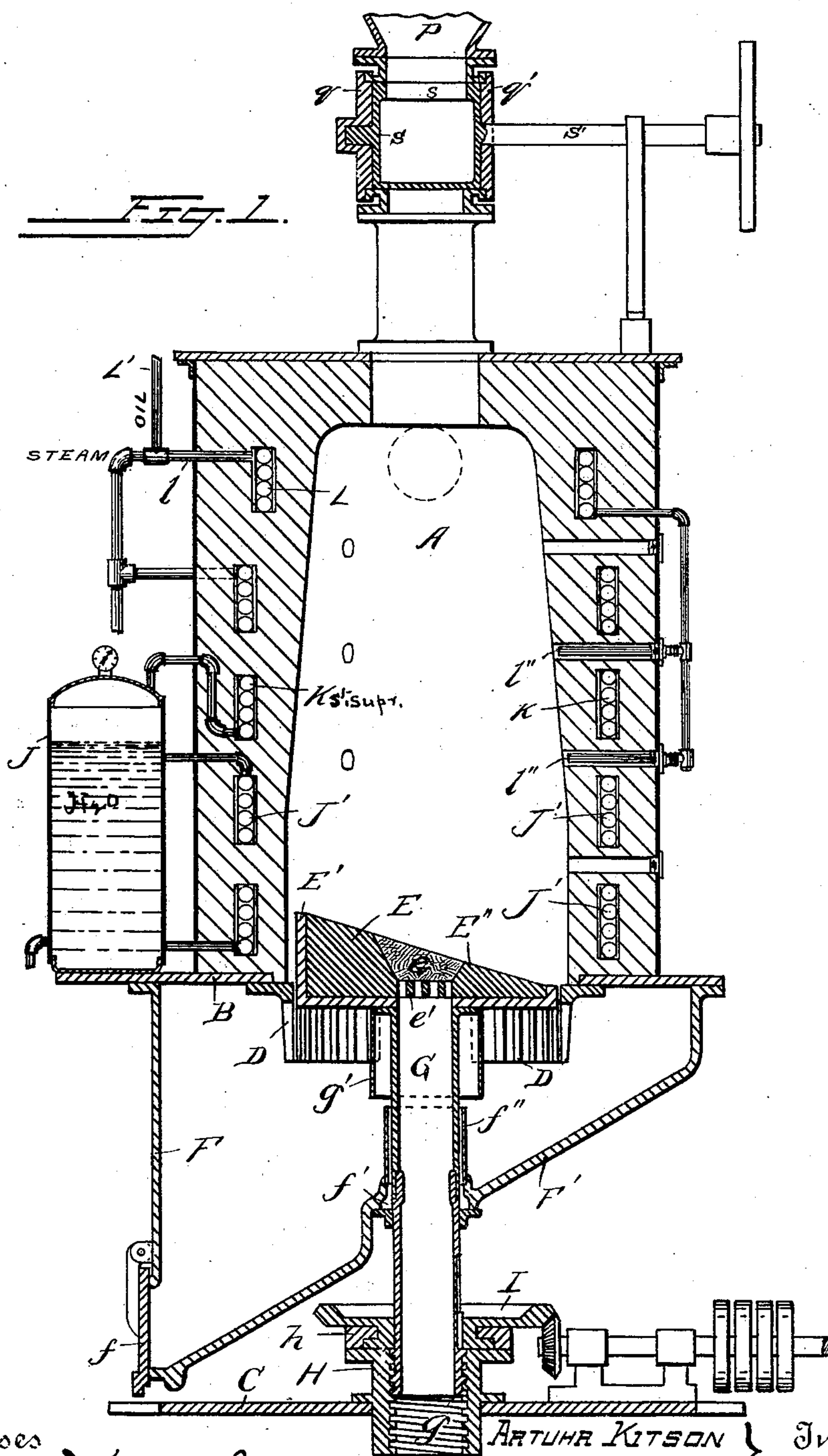
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A. KITSON & T. WALKER.

APPARATUS FOR AND METHOD OF PRODUCING GAS.

No. 507,073.

Patented Oct. 17, 1893.



Witnesses

Edw. Kelly
David Levan

ARTHUR KITSON
THOMAS WALKER.

Inventors

By *their* Attorney

J. H. H. H.

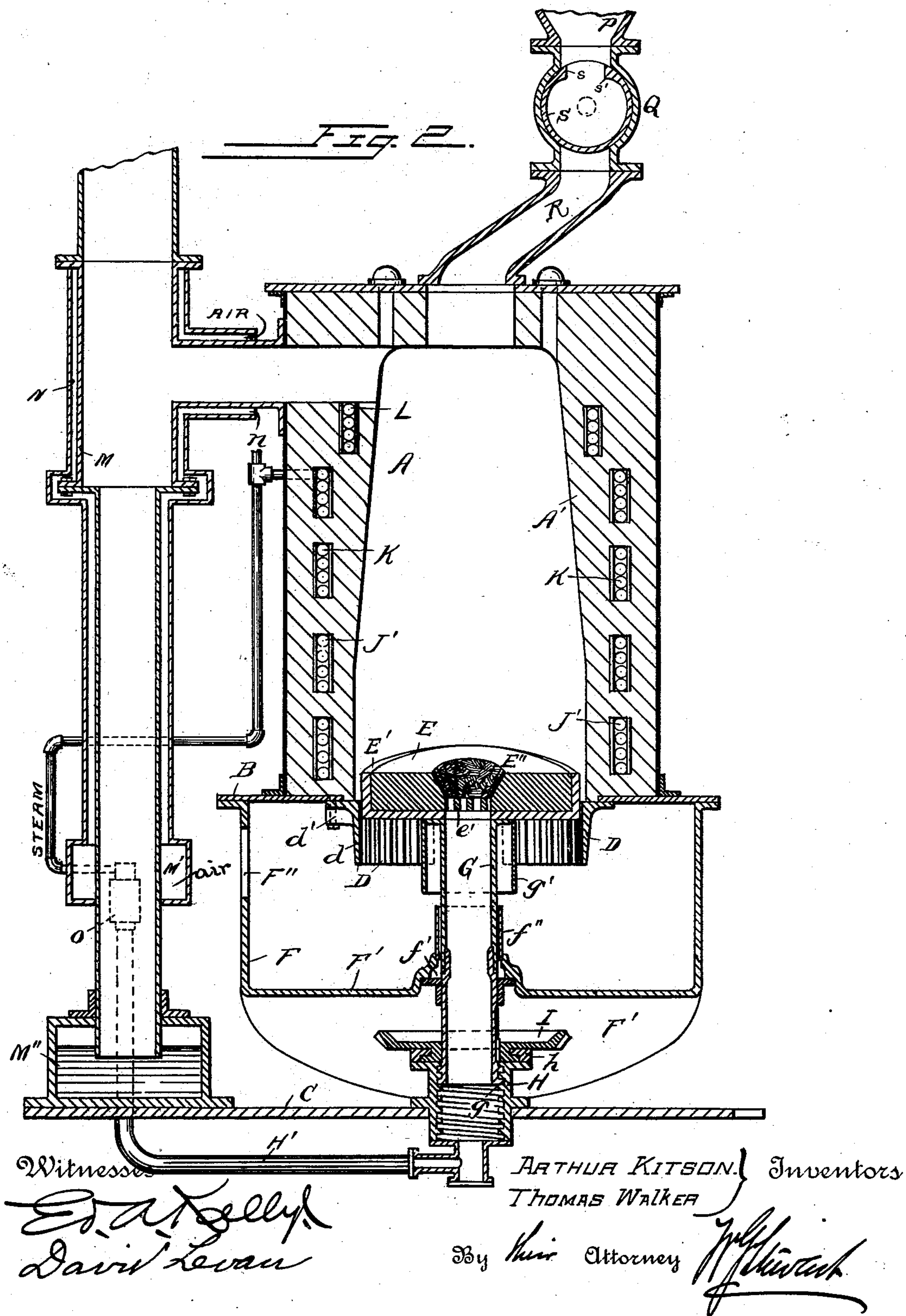
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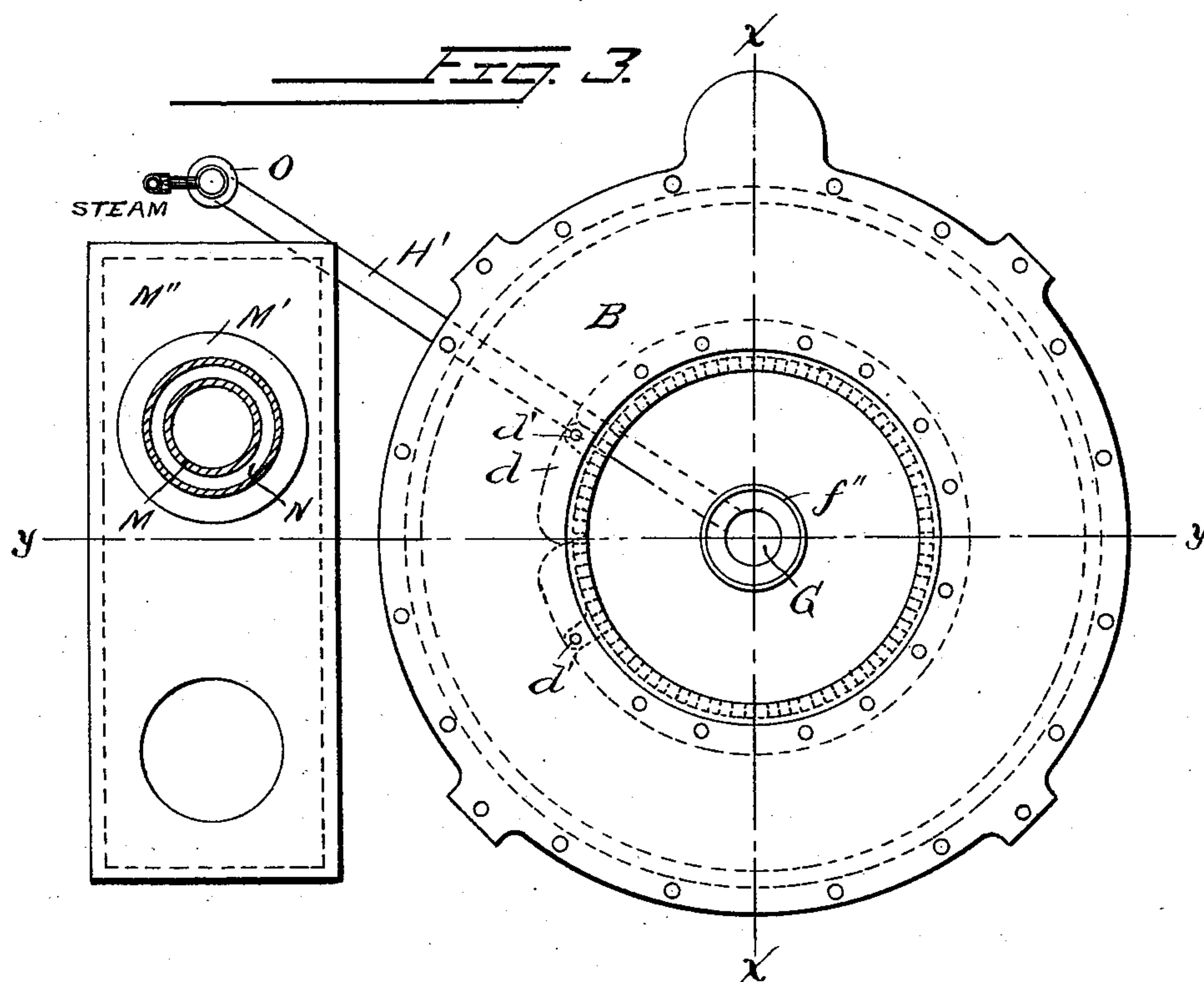
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UNITED STATES PATENT OFFICE.

ARTHUR KITSON AND THOMAS WALKER, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR AND METHOD OF PRODUCING GAS.

SPECIFICATION forming part of Letters Patent No. 507,073, dated October 17, 1893.

Application filed August 26, 1892. Serial No. 444,153. (No model.)

all whom it may concern:

Be it known that we, ARTHUR KITSON, a subject of the Queen of Great Britain, and THOMAS WALKER, a citizen of the United States of America, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for and Methods of Producing Gas, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates particularly to improvements in furnaces for generating gas from fuel subjected therein to suitable treatment. Among the greatest of the practical difficulties encountered in thus producing gas, are, first, the tendency of the fuel to clinker so as to prevent the free passage through it of the jets of steam, &c., to which it is subjected; and second the tendency to form holes instead of lying in a compact mass, thus preventing that uniform action upon the whole body of fuel and upon the jets themselves, which is necessary to the complete and economical generation of a uniform quality of gas. To remedy this difficulty furnaces have heretofore been provided with hearths capable of both a rotary and up and down movement as is shown in Patent No. 462,561, issued November 3, 1891, to Arthur Kitson, one of your petitioners; but the result has not been entirely satisfactory, the rotation of the hearth frequently failing to sufficiently effect the main body of the fuel and the proper operation of the hearth mechanism being interfered with by exposure of the operative mechanism to ashes and heat. An important object of our present invention is to obviate these difficulties.

Other principal objects of our invention are to improve the process of enriching the fuel gas by the addition thereto of hydrocarbon; to provide improved mechanism for the injecting of heated air and vaporized oil into the furnaces by the action of steam jets, and for the satisfactory feeding of fuel into the furnace during its continual operation.

The invention is fully described in connection with the accompanying drawings

which illustrate a preferred form of apparatus embodying the same, and the novel features are specifically pointed out in the claims.

Figure 1 is a sectional elevation of the apparatus taken on line X X of Fig. 3. Fig. 2 is a similar view taken on line Y Y Fig. 3. Fig. 3 is a plan view of the furnace plate, grate bars and ash pit, with the hearth removed.

The fuel chamber A of the furnace is inclosed by fire-brick walls A' with an iron jacket as usual, resting upon a furnace plate B which is in turn supported by means of suitable legs from a base plate C. To the under side of the furnace plate are secured vertical grate bars D arranged in a circle within which the hearth E of the furnace is adapted to move freely as is shown in a pending application of one of your petitioners, Serial No. 408,670. The iron ash pit F is freely supported from the furnace plate and is formed with an inclined bottom F' the lowest portion of which extends nearly to the base plate C near which a cleaning door f is provided.

The grate or hearth E consists of a circular plate of iron having a circular flange E' of gradually increasing height, which incloses and supports the fire brick portion of the hearth. The upper surface E'' upon which the fuel rests, thus forms an oblique plane considerably inclined from the horizontal. The hearth is supported upon a central hollow shaft G communicating with the central opening e in the hearth through a grating or bars e' by means of which a chamber is formed for the reception of suitable materials, such as asbestos wool and ashes, or pieces of fire brick through which the blast is admitted to the fuel as will be described later. The hollow shaft G which is preferably formed in two parts as shown, passes through an opening in the inclined bottom F' of the ash pit a stuffing box f' being provided to maintain a tight ash pit while permitting free movement of the shaft. The lower end of the shaft is provided with a screw thread g which engages the internally screw threaded hub or nut H fastened to the bed plate below and

outside of the ash pit, and a gear wheel I, which is feathered on the shaft, serves to convey rotating power to the latter through any suitable hand or power mechanism. The rotation of the shaft in one direction turns the hearth and at the same time raises it by means of the screw threaded end and hub, the gear wheel being held upon the hub by means of a collar *h*; while rotating in the opposite direction in like manner lowers the hearth. A sleeve *f''* fastened to the inclined bottom of the ash pit extends upward within it inclosing the shaft and a corresponding sleeve *g'* of somewhat larger diameter, secured to the under side of the hearth, is moved up and down with the latter, overlapping the fixed sleeve *f''* in telescope fashion, and serving to protect the shaft and stuffing box from the ashes dropping into the pit from the fuel chamber; thus insuring perfectly satisfactory operation of the movable hearth.

The water circulating coils *J'* extending around the fuel chamber are connected as heretofore to the boiler or reservoir *J*, as is also the super-heating coil *K*. We provide in addition an oil vaporizing coil *L*, one end of which is connected with an oil supply pipe *L'* and also with an intercepting steam pipe *L''* supplied from the superheating coil *K*; by means of this steam jet the oil is driven through the coil *L*, in which it is simultaneously subjected to the furnace heat, and through suitably located openings *l''* or *l'''* at the other end of the coil into the fuel chamber. These openings are arranged at different points circumferentially and at different heights above the grate and are provided with regulating valves as indicated for regulating or entirely closing them so as to permit the vaporized oil and steam to be admitted at proper points into the incandescent fuel as will be described later.

To provide for thoroughly heating the air blast which is conveyed to the furnace through the hollow central shaft *G* of the hearth and through the blast pipe *H'* connecting with the fixed hub *H*, we surround the gas take off pipe *M'* from the furnace with a casing *N*, thus forming an annular air passage having a supply opening *n* at one end and terminating in a chamber *M'* from which the air thus heated by contact with the surface of the take-off pipe is drawn into the blast pipe *H'* and driven through the same in the usual manner into the furnace by means of the injector *O*, which is also supplied with steam from the superheating coil *K*; the lower end of the take-off pipe *M* is seated in the water box *M''*.

To provide for more conveniently removing clinkers from the hearth one or more sections *d* of the pendent grate bars are formed with lugs *d'* by means of which they are hinged to the furnace plate adjacent to a side door *F''* in the ash pit, so as to permit of their being swung entirely out of the way during

the cleaning operation and readily returned to normal position thereafter, any suitable means being provided to lock them.

Our mechanism for conveniently feeding fuel to the furnace as it is required, without allowing any escape of gas therefrom, consists of an ordinary hopper *P* which is mounted upon a cylindrical valve casing *Q* arranged horizontally and having opposite openings communicating respectively with the hopper and with the goose neck passage way *R* to a central opening in the furnace. This casing is provided with end heads *q* and *q'* through one of which the stem *s'* of a hollow valve *s* is fitted to the casing, projects, whereby through suitable mechanism, the valve is rotated during the operation of the furnace. The valve itself is a hollow cylinder having a single opening *s* which registers alternately, during rotation, with the hopper and furnace openings of the casing, the valve chamber being filled with fuel from the hopper when in communication therewith and the contents discharged into the furnace as the opening *s* reaches its lowest position in the casing, while escape of gas is at all times prevented.

In practice we have found that the proper action of the rotary valve is apt to be interfered with by the passage of the opening *s* across the hopper opening, during which passage the column of fuel from the hopper is cut off from the portion in the valve; the crowding of the fuel during this movement ordinarily forces it between the valve and casing thus cutting grooves which allow the escape of gas. This difficulty we have overcome by constructing the valve with an overhanging flange *s'* which enables the column of coal above the valve to be more easily cut off, the fuel being crowded into the unfilled space below said flange instead of between the valve and casing as described.

Both the valve controlling the supply of fuel to the furnace, and the hearth mechanism are preferably operated continuously; the alternate up and down movement of the hearth being effected by means of two sets of pulleys arranged to be run in opposite directions, with an automatic belt shifting mechanism, such as is commonly used in similar cases. During the operation of the furnace the fuel is kept constantly agitated not only by the up and down movement of the hearth but by the positive turning or rotation of practically the whole mass of fuel with the rotating hearth. This positive rotation of the fuel which we have found to be essential to the satisfactory breaking up of any bridges or arches forming above the hearth, is effected by the peculiar form of the latter which is considerably higher at one side than at the other so that it is impossible for it to rotate independently of the body of fuel supported upon it as is the case with rotating grates heretofore used. The top portion of the fuel may not be rotated as rapidly as the lower

portion which is directly supported upon and positively rotated by the hearth but it is so effectually agitated throughout that neither holes or clinkers can be formed nor caking of coal (when soft coal is used) occur to any appreciable extent. The blast of heated air and steam enters the furnace through the hearth passing through the asbestos wool or equivalent material in the chamber *e*, the presence of which prevents any clogging of the passage as effectually as the form of the rotating grate prevents any unequal resistance to the passage of the blast through the mass of fuel, thus insuring thorough distribution and decomposition of the steam. The vaporized oil is blown into the incandescent fuel sufficiently below the surface to insure a proper decomposition of the same in passing upward through it but not sufficient to cause the breaking up of the heavy hydrocarbons into lighter gases with the result of impairing its illuminating properties, one or other of the different series of inlets *l'* being used depending upon the height of the fuel in the chamber. The ashes, which are sifted through the pendent grate bars into the ash pit practically as fast as formed, can have no effect whatever on the hearth operating gear which is effectually protected by our improved construction; and they are removed with the greatest ease owing to the inclined form of the pit.

In our complete operation of manufacturing gas a constant stream of blended air and steam is projected into and passes upward through the entire mass of incandescent fuel while at the same time continuous streams of blended steam and oil are projected into it at a properly adjusted distance below the surface to insure sufficient but not too prolonged action of the heat upon the vaporized oil; these streams of steam and air, and steam and oil are maintained by the constant generation of steam and the constant vaporization of the oil by means of the same combustion which serves to generate the gas. The fuel, which is fed in regularly and automatically, instead of being intermittently or periodically agitated or stirred, as is ordinarily done with the result of producing gas of varying quality, is continuously automatically and uniformly agitated so as to maintain the fuel in a uniformly loose yet compact mass which insures uniform action upon the oil and the consequent production of a uniform quality and maximum quantity of gas, at the same time avoiding all necessity for interfering with the continuous operation of the furnace.

Having thus clearly described our invention we do not limit ourselves to the exact construction shown; but

What we claim is—

1. In a gas generating furnace the combination with the fuel chamber of the movable circular grate or hearth, having its upper face

upon which the body of fuel rests a plane surface inclined from the horizontal, and mechanism for imparting a rotary motion to the said hearth for the purpose described. 70

2. In a gas generator the combination with the fuel chamber and the ash pit below the same, of the movable grate or hearth having a central opening and a hollow shaft extending downward through the bottom of the ash-pit, the fixed hub or nut below said ash-pit internally screw threaded to receive the threaded end of the hollow shaft, the blast pipe connected to said fixed hub and a rotating mechanism for operating said shaft, all substantially as set forth. 75 80

3. In a gas generator the combination with the fuel chamber, of a circular grate or hearth, having a central opening a hollow supporting shaft extending downward therefrom, a pipe connected with the hollow shaft, the said central opening in the grate being arranged to form an open chamber and having loosely packed therein porous or broken refractory material through which the blast passes, substantially as and for the purpose set forth. 85 90

4. In a gas generator the combination with the fuel chamber of a coil of pipe surrounding the same and having one end connected with an oil supply pipe and with a steam jet for projecting the oil through said coil, and the opposite end provided with two or more series of inlets into the fuel chamber arranged at different heights from the hearth and provided with independent regulating valves, substantially as set forth. 95 100

5. In a gas generator the combination with the fuel chamber and the grate, of the steam generating and oil vaporizing coils surrounding said fuel chamber, a blast conduit entering said chamber through the grate and suitable connections between said steam coil and the vaporizing coil, between the steam coil and the blast conduit, and between the vaporizing coil and the generator, whereby blended steam-and-oil and steam-and-air are separately and simultaneously projected into the fuel chamber, substantially as set forth. 105 110

6. The combination with the generating chamber and the vertically movable rotary hearth, of the vertical grate bars inclosing the movable hearth and mainly fixed to the furnace plate but having one or more sections hinged to said plate and arranged to swing outward from the hearth to allow free access thereto for cleaning, substantially as set forth. 115 120

7. The improvement in the art of manufacturing gas which consists in mechanically maintaining the body of incandescent fuel in a state of uniform and continuous agitation, thereby preventing incipient clinker and caking formations, and simultaneously projecting into it a continuous stream of vapor, substantially as set forth. 125 130

8. The improvement in the art of manufac-

turing gas which consists in mechanically
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and simultaneously projecting into it sepa-
5 rate and continuous streams of blended
steam and air and steam and oil respectively,
substantially as set forth.

In testimony whereof we affix our signatures
in presence of two witnesses.

ARTHUR KITSON.
THOMAS WALKER.

Witnesses:

E. CLINTON RHOADS,
JNO. C. BELL.

It is hereby certified that Letters Patent No. 507,073, granted October 17, 1893, upon the application of Arthur Kitson and Thomas Walker, of Philadelphia, Pennsylvania, for an improvement in "Apparatus for and Method of Reducing Gas," were erroneously issued to said Kitson and Walker, as owners of the invention; whereas said Letters Patent should have been issued to *said Arthur Kitson*, he being sole owner of the entire interest, as shown by the record of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 30th day of June, A. D. 1896.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

S. T. FISHER,
Acting Commissioner of Patents.