(No Model.)

A. O. GRANGER & J. H. COLLINS, Jr.

PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

No. 287,277. Patented Oct. 23, 1883.

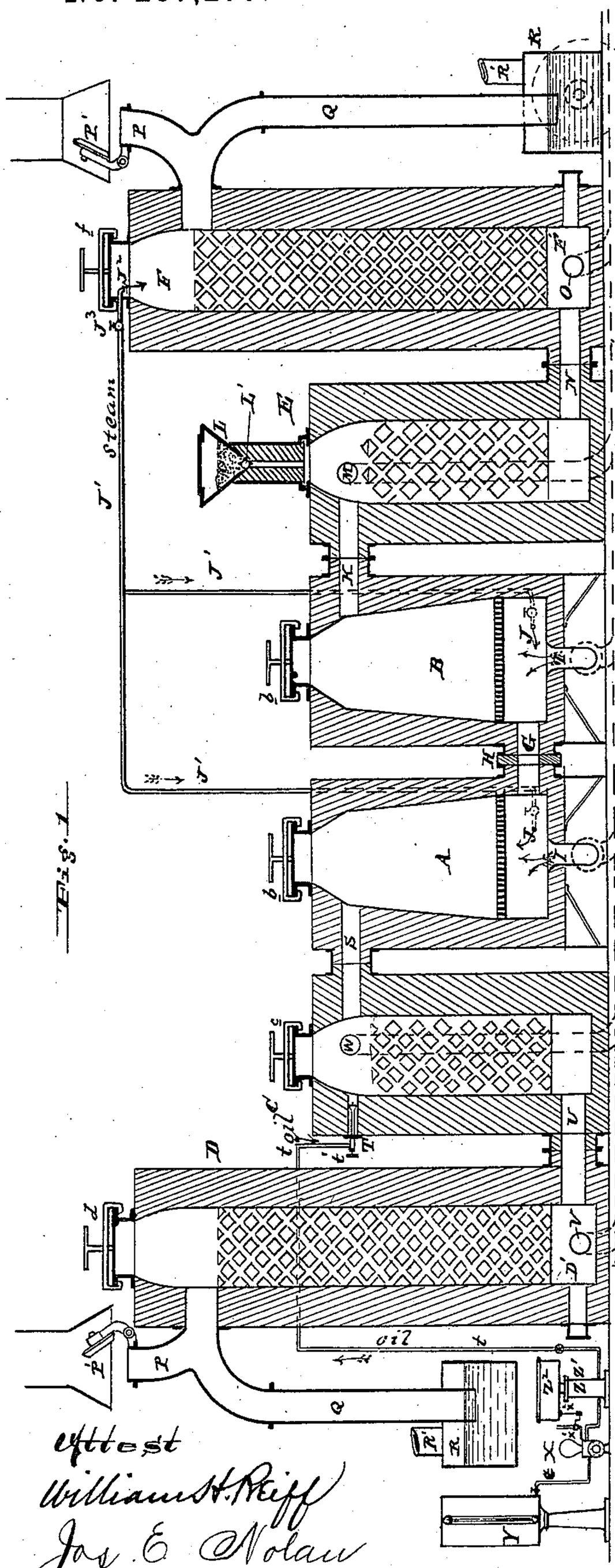

Fig. 1.

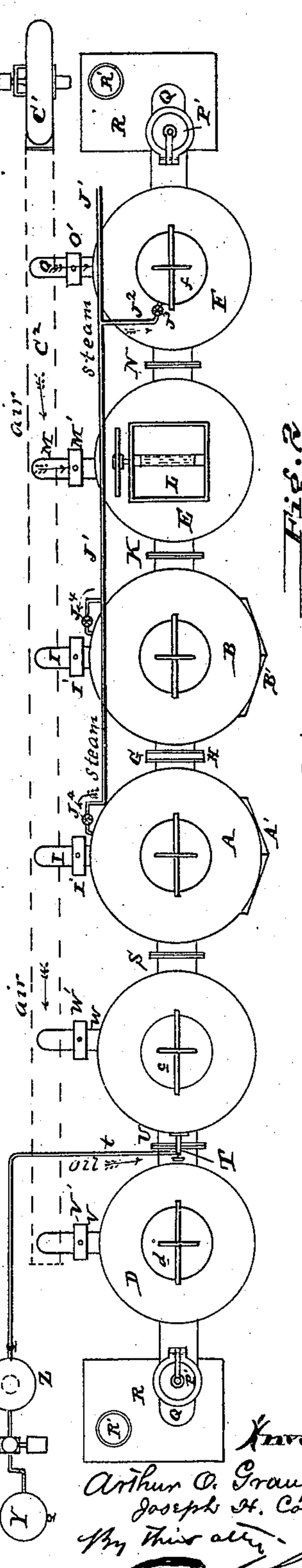

Fig. 2.

Fig. 3.

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PROCESS OF AND APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 287,277, dated October 23, 1883.

Application filed March 10, 1883. (No model.)

To all whom it may concern:

Be it known that we, ARTHUR O. GRANGER and JOSEPH H. COLLINS, Jr., both of the city and county of Philadelphia, and State of Pennsylvania, have invented an Improvement in Processes of and Apparatus for Manufacturing Gas, of which the following is a specification.

Our invention has reference to processes and apparatus for generating a heating or illuminating gas from coal, coal-dust, and hydrocarbon oil; and it consists in the combined processes as carried on in what is known as the "Strong Gas Apparatus" and apparatus for which a pending application of ours is now before the Patent Office, the said processes being carried on in a continuous manner and intimately connected; further, in the construction of apparatus in which to carry on said process, all of which is fully set forth in the following specification, and shown in the accompanying drawings, which form part thereof.

The object of our invention is to provide a suitable process and apparatus whereby either heating or illuminating gas may be produced on a large and economical scale, and utilize coal-dust as well as coal.

In the drawings, Figure 1 is a sectional elevation of a gas works or apparatus embodying our invention. Fig. 2 is a plan view of same, and Fig. 3 is a sectional elevation of the cap or disk to be used to separate the apparatus into two parts when either part alone is desired to be used.

A and B are two water-gas generators, and are connected at their bottoms, below the grate-bars, by a flue, G, which may be left free and open by an annular ring, H, being made a part thereof, or closed by a solid disk, H′, being substituted for ring H, and thereby entirely separate the generators A B from each other, so far as their internal chambers are concerned. These generators are supplied with air or blast pipes I and steam-pipes J, both of which are located below the grate-bars, the former of which is provided with valves I′ and the latter with valves J^4, which admit steam from the main J′ to pipes or nozzles J. The tops of these generators are provided with the usual charging-doors, *b*, and their bottoms with the cleaning-doors A′ B′.

Generator B connects by flue K at the top with the decomposing retort or chamber E, filled with open brick-work, preferably leaving oblique passages, as shown. The top of chamber E is provided with a hopper, L, and feed-roller L′, to feed coal-dust into the chamber in substantially the manner carried on in the Strong process. An air-pipe, M, provided with a valve, M′, admits air into the top of this chamber E. The bottom of chamber E opens into combustion-chamber F′ of the superheater F by pipe or flue N. This superheater is provided at the bottom with an air or blast pipe, O, provided with a valve, O′, has its body filled with open brick-work and its top furnished with a door, *f*, a steam-pipe, J^2, provided with a valve, J^3, and connecting with steam-main J′, and an exit for the products of combustion and gas. The products of combustion pass out by a passage, P, provided with a valve, P′, and the gas, whether illuminating or heating, passes down a pipe, Q, to washer or water-seal R, and by pipe R′ to holder.

The apparatus just described, it will be seen, is very similar to what is known as the Strong apparatus.

The generator A connects at the top by a flue, S, with the top of a vaporizing-chamber, C, into which the hydrocarbon oil is sprayed under pressure from a nozzle, T. This vaporizing or carbureting chamber is provided at the top with a door, *c*, and air or blast pipe W, provided with a valve, W′, has its body preferably filled with open brick-work, and has its bottom connected with the bottom or combustion chamber, D′, of the superheating or fixing chamber D by a flue, U. The bottom of this fixing-chamber D is provided with an air or blast pipe, V, having a valve, V′. Its body is filled with open brick-work, and its top is closed with a door, *d*, and furnished with an outlet for products of combustion and heating or illuminating gas. The smoke passes off by a passage, P, furnished with a valve, P′, as before, and the gas is conveyed to the holder by pipe Q, through washer

or water-seal R and pipe R′. Two washers are shown; but it is evident that only one would be necessary in practice.

Y is the hydrocarbon-oil receptacle, from which oil is drawn by pump X and forced by pipe to the spraying-nozzle. To regulate the flow and cause it to be continuous, it is caused to flow through a regulator, Z, which consists of the cylinder Z′, into which a weighted plunger, Z^2, works. To make the pump work automatically, the steam-valve X′ may be controlled by a rod, X^2, connecting with the plunger Z^2, so as to shut off the steam the moment the spraying operation is stopped by the valve t' on nozzle T.

If desired, the chamber C may be dispensed with and the gas from generator A passed into the bottom of chamber D, the oil being admitted either in the top of generator A or bottom of chamber D.

C′ is the air-blast fan, and C^2 the air or blast main, which supplies air to the various blast-pipes, previously referred to.

The operation is as follows: The valves P′ P′ and all of the air-valves are opened and all of the others closed. Combustion now takes place in generators A and B, and the products of combustion from each of said generators takes its respective course to chambers C and D or chambers E and F. The carbonic oxide produced in chamber B is burned in chamber E, either in part or whole, and is then passed up through chamber F, where any gas remaining is completely burned, and the resulting products escape by valve P′ into the atmosphere. This operation soon brings the carbon in generator B to incandescence, and heats the open brick-work and walls in chambers E and F to a high degree. In precisely a similar manner the coal in chamber or generator A is raised to incandescence, and the carbureting-chamber C and fixing-chamber D heated to a high degree. The valves to the blast-pipes are then all closed, and the smoke-flues P closed by their valves P′. The steam-valves J^3 and J^4 are then opened. Coal-dust is allowed to drop from hopper L into chamber E, and oil is sprayed into chamber C by nozzle T. The steam is first highly superheated by passing through chamber F, and in passing up chamber E it is met by the finely-divided coal-dust in the highly-heated chamber, thereby causing a decomposition of the steam to take place, producing water-gas, which consists of a mixture of hydrogen, carbonic oxide, and carbonic acid. This gas, with any free steam, passes into the top of chamber or generator A, and passes down through the highly-heated carbon contained therein, converting all of the steam into hydrogen, carbonic oxide, and carbonic acid, and reducing part of the acid to oxide. This water-gas is then caused to pass up through the red-hot mass of carbon in generator A, in company with steam admitted by pipe J. The latter, being decomposed, greatly increases the quantity of heating-gas, and the resulting gas thus produced passes into the chamber C, where it meets with the sprayed oil, and is thereby carbureted or converted into an illuminating-gas, which is fixed by passing up through retort or fixing-chamber D, and then passes to the gas-holder. By this process it is possible to utilize coal-dust without using external apparatus in which to carburet the resulting gas produced by the decomposition of steam by passing the latter into the coal-dust in the heated chamber, as hereinbefore set forth.

A heating-gas may be produced by omitting the carbureting operation, and in this case it is unnecessary to heat the chambers C and D. When the demand for gas is small, the flue G may be closed by plate H′, and the left-hand part of the apparatus alone may be used; or, if desired, the right-hand part may be used with an external or independent carbureting apparatus, as in the case of Strong's apparatus. For instance, the left-hand part of the apparatus would in many instances be sufficient to generate the required quantity of gas during summer, while both the left and right hand parts or the entire apparatus would be required during the winter.

It is evident that the flue K may connect directly with flue G, cutting out generator B, if desired; but we prefer them as shown.

In English Patent No. 5,310 of 1879 is described a process in which steam, after being superheated, is passed through a shower of finely-divided carbon, and the resulting gases passed down through a bed of incandescent carbon; but this is only part of our process, for in that patent no provision is made for an excessive production of gas in a short space of time, and the conversion of carbonic acid into carbonic oxide, by which the composition of the resulting gas is greatly improved, be it for heating or illuminating purpose. It is upon these features that the novelty of our process depends.

In addition to the foregoing, there is no admission of fresh steam to the gases between their place of generation by the carbon-dust and incandescent bed of carbon in the Bonneville patent, and it is upon this important difference, as well as the two beds of incandescent carbon, that the novelty of our process lies over and above that set forth and shown in the Bonneville patent.

We are also aware of the patent to Strong, November 13, 1877, No. 197,062, and claim nothing therein set forth or shown. Strong decomposes steam by a shower of carbon-dust, and passes the resulting gases mixed with any undecomposed steam down through a bed of incandescent coal. Now, by his process he fails to utilize to the fullest extent the decomposing-power of said bed of incandescent coal, while, on the other hand, if he were to mix fresh steam with the gases produced by the first decomposition, as applicants do, and then pass the mixture down through the bed of carbon, he would greatly increase the yield of gas.

Having now described our invention, what

we claim as new, and desire to secure by Letters Patent, is—

1. The herein-described process of generating water-gas, which consists in first raising to incandescence two beds of carbon by forcing air into and through the said carbon, and then burning the resulting gases in a series of chambers, thereby heating them internally, then in superheating steam by passing it through one of said heated chambers, then decomposing said superheated steam by bringing it into contact with finely-divided carbon in a heated condition, producing a mixture of hydrogen, carbonic oxide, and carbonic acid, then passing said hydrogen, carbonic oxide, and carbonic acid, with any undecomposed steam mixed therewith, down through one of said beds of carbon, and then mixing the resulting gases with more steam and passing them through the second of said beds of highly-heated carbon, then carbureting resulting gases produced thereby, and finally fixing said gases by passing them through a highly-heated chamber, substantially as and for the purpose specified.

2. The herein-described process of generating water-gas, which consists in first raising to incandescence one or more beds of carbon by forcing air into and through the same, and then burning the resulting gases in one or more chambers, thereby heating them internally, then in passing steam through said highly-heated chamber and bringing it into contact with finely-divided carbon in a highly-heated condition, producing hydrogen, carbonic oxide, and carbonic acid, and then passing said gases through the incandescent bed of carbon in company with more steam, admitted between the place of decomposition by the carbon-dust and bed of heated carbon, thereby producing a resulting gas rich in carbonic oxide, substantially as and for the purpose specified.

3. The herein-described process of generating water-gas, which consists in first raising to incandescence two beds of carbon by forcing air into and through the same, and then burning the resulting gases in one or more chambers, thereby heating the same internally, then in passing steam through said chambers and decomposing it by bringing it into contact with a shower of finely-divided carbon in a heated condition, producing a mixture of hydrogen, carbonic oxide, and carbonic acid, then passing said hydrogen, carbonic oxide, and carbonic acid, with any undecomposed steam mixed therewith, down through one of said beds of carbon, and then mixing the resulting gases with more steam and passing them through the second of said beds of carbon, producing a gas rich in carbonic oxide, substantially as and for the purpose specified.

4. The combination of generators A B, decomposing-chamber E, provided with means to discharge coal-dust therein, superheater F, chimney-flue P, having valve P′, opening from said superheater, steam-pipe J, opening into said generators below the grate-bars, steam-pipe J^2, opening into the top of the superheater, blast-pipes I, opening into the generators below the grate-bars, blast-pipe M, opening into said decomposing-chamber E, blast-pipe O, opening into the bottom of said superheater, and connecting-flues between said generators, decomposing-chamber E, and superheater F, substantially as and for the purpose specified.

5. The combination of generators A B, chamber E, having means to discharge coal-dust therein, chamber C, fixing retort or chamber D, blast-pipes I, M, W, and V, steam-pipes to admit steam to chambers E, A, and B, oil-nozzle T or its equivalent, and connecting-flues, substantially as and for the purpose specified.

6. The combination, with generators A B, of chamber E, provided with means to discharge coal-dust therein, chamber F, carbureting-chamber C, fixing retort or chamber D, smoke-flue P, having valve P′, blast-pipes O, M, I, W, and V, steam-pipes J and J^2, hydrocarbon-nozzle T, and connecting-flues, substantially as set forth.

7. The combination, with generators A B, of chamber E, having means to discharge coal-dust therein, chamber F, carbureting-chamber C, fixing-chamber D, smoke-flue P, valve P′, blast-pipes O, M, I, W, and V, steam-pipes J and J^2, hydrocarbon-spraying nozzle, means to force said hydrocarbon into the chamber C under pressure, and connecting-flues, substantially as set forth.

8. The combination of generator A, provided with steam and blast pipes, a superheater, a hydrocarbon-spraying nozzle, T, means to force oil or hydrocarbon fluid into said nozzle under great pressure, and means to automatically control the flow of said hydrocarbon and keep it of uniform pressure.

9. The combination, with two generators, A and B, having their bottoms connected by a trunk, of air-blast and steam pipes entering said trunk, a chamber, E, provided with means to discharge coal-dust therein, and blast and steam pipes to alternately admit air and steam to said chamber, substantially as set forth.

In testimony of which invention we hereunto set our hands.

ARTHUR O. GRANGER.
JOSEPH H. COLLINS, Jr.

Witnesses:
R. M. Hunter,
R. S. Child, Jr.