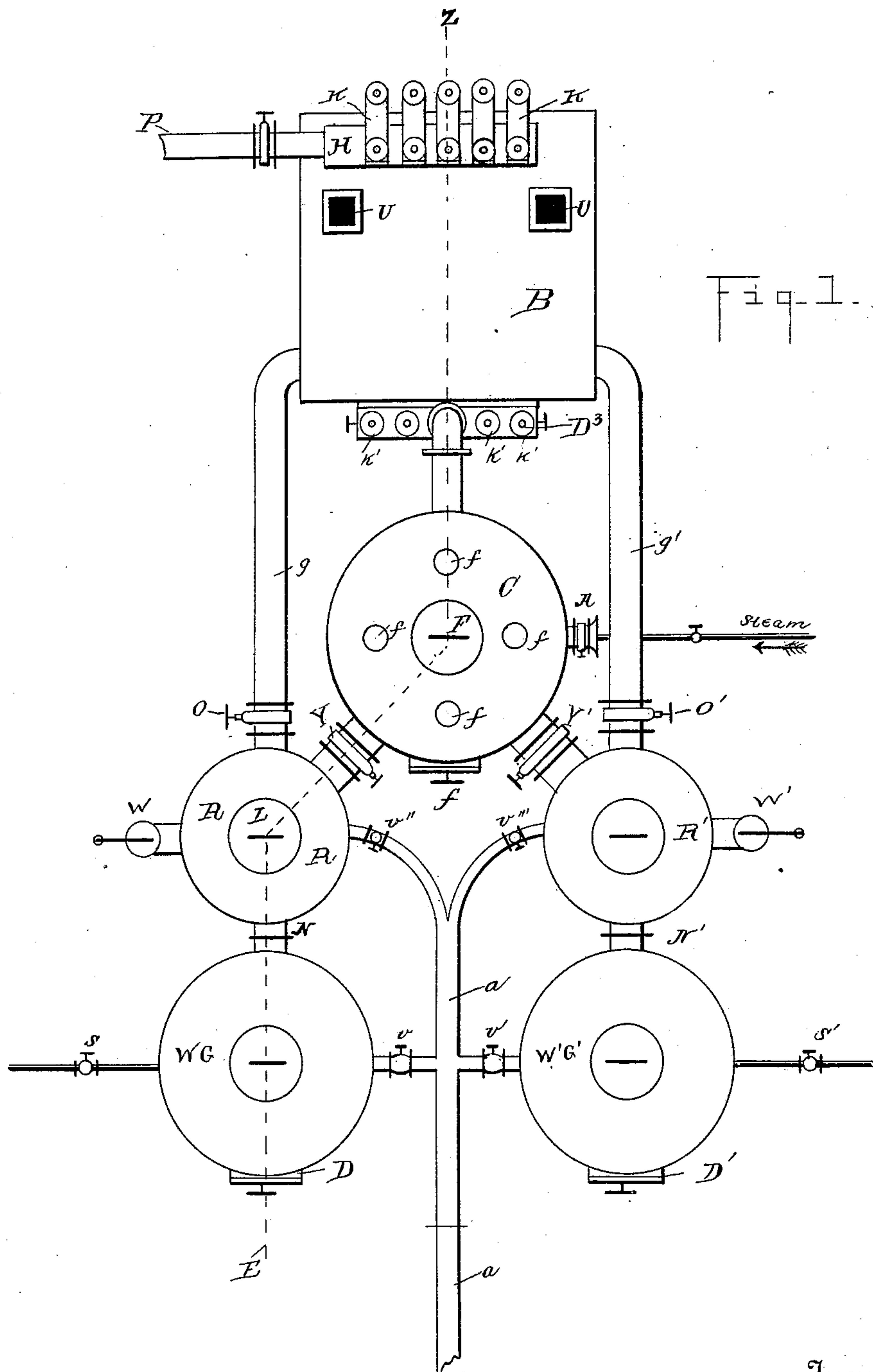


(No Model.)

2 Sheets—Sheet 1.

J. W. HARRISON & F. EGNER.
APPARATUS FOR THE MANUFACTURE OF FUEL AND ILLUMINATING GAS.
No. 404,404. Patented June 4, 1889.



Witnesses:

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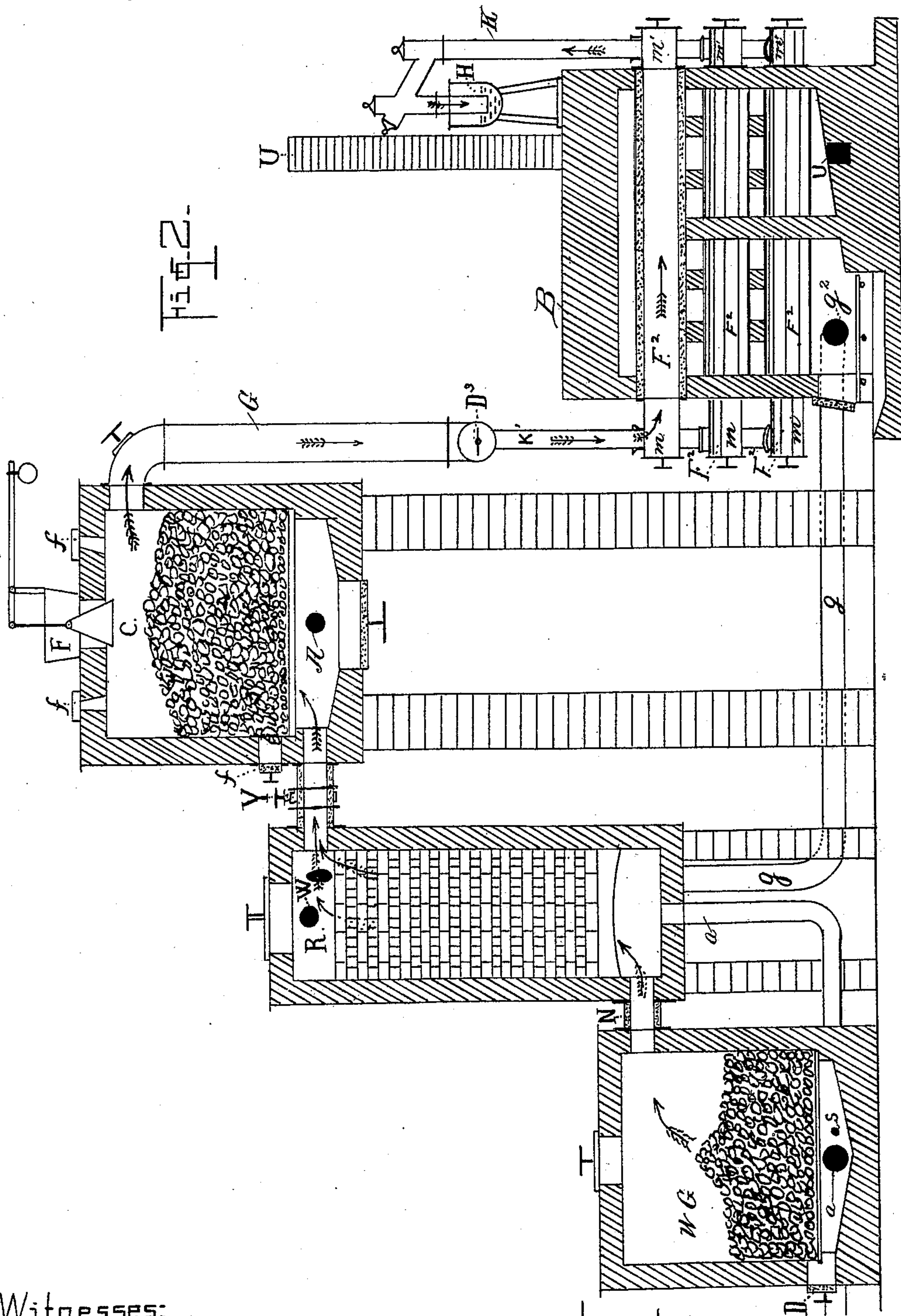
John W. Harrison
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By their Attorney

Mandus Bailey

2 Sheets—Sheet 2.

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John Harrison
Frederic Egner
by Marcellus Bailey their attorney

UNITED STATES PATENT OFFICE.

JOHN W. HARRISON AND FREDERIC EGNER, OF ST. LOUIS, MISSOURI.

APPARATUS FOR THE MANUFACTURE OF FUEL AND ILLUMINATING GAS.

SPECIFICATION forming part of Letters Patent No. 404,404, dated June 4, 1889.

Application filed January 16, 1889. Serial No. 296,562. (No model.)

To all whom it may concern:

Be it known that we, JOHN W. HARRISON and FREDERIC EGNER, citizens of the United States, residing at St. Louis, in the State of Missouri, have invented an Improved Apparatus for the Manufacture of Fuel and Illuminating Gas, of which the following is a specification.

Our invention relates to that class of apparatus for manufacturing gas wherein steam is decomposed by the action of incandescent carbon, the resulting gases being afterward carbureted or not, according as the gas may be desired, merely as a fuel or for illuminating purposes.

The object of the invention is to obtain an apparatus wherein bituminous coal may be used for the production of what may be called "water-gas," a thing not heretofore successfully accomplished, and an apparatus by means of which all the carbon contained in the coal may be converted into a fixed gas, which may be used for fuel or illuminating purposes, these results being accomplished in a thorough and safe manner with a minimum of labor. We attain these objects by the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of the entire apparatus. Fig. 2 is a view of a vertical section of the apparatus through lines E L F Z, Fig. 1.

Similar letters refer to similar parts in both views.

W G W' G' are water-gas producers or generators of well-known pattern, having an air-blast pipe *a* from a fan or power-blower *b*, driven by an engine or suitable motor, said air-pipe having branches to the superheating-chambers R R', and being provided at proper points with suitable quick-moving valves V V' V'' V'''. The said water-gas generators have doors D D' and steam-pipes S S', fitted with suitable valves, the steam being supplied from any convenient steam-boiler. N N' are passages from the top of the generators to the superheating chambers or vessels R R'. These vessels are also generally of the well-known shape—viz., cylindrical iron shells lined with fire-brick and fitted with brick or other refractory material. But we have the following additions in our superheating-chambers, viz: We have not only the usual

vent W or W', fitted with a weighted valve, which in the apparatus as ordinarily used serves to discharge the products of combustion into the atmosphere, but we also have the pipes *g g'*, by means of which said products of combustion are carried on and made still further use of by heating the bench B, hereinafter described; and, furthermore, we have passages Y Y', fitted with suitable valves, which connect the superheating-vessels R R' with another vessel C. This vessel C is also constructed of a casing of light boiler-iron, lined with fire-brick. It has preferably a fire-brick grate, (although a metal dumping-grate may be used,) a fuel-hopper F, and stoke-holes and plates *f f f f* at side and top; and it is further provided with a suitable valved vent or inspirator A, for admitting air and steam, if desired, and a passage G, communicating with bench B through dry main D³.

Bench B is constructed very much the same as an ordinary coal-gas bench with through-retorts F². The drawings, Fig. 2, represent such a bench of five retorts in section. The retorts are supplied with mouth-pieces *m m'*, &c., and with ascension or stand pipes K K', which connect the retorts with the dry main D³ at one end and the hydraulic main H at the opposite end. Letter *g²* shows the opening of the pipe *g* into the furnace of the bench.

U U is the chimney and flue through which the products of combustion make their escape from the bench.

The method of operating this apparatus is as follows: Having filled vessel C about three-fourths full of coke, and kindling a fire in the same, the air and steam with which this was done, through means of inspirators or vents A, are shut off. While C was heating the generators and other bench have been treated in the same manner. Now, having all the parts of the apparatus in a good hot condition, we put an air-blast into one of the generators W G. The air passing up through the usual depth of fuel not only brings the latter to any desired state of incandescence, but produces a combustible gas, which is passed through passage N into the chamber R, where an additional air-supply through *a* causes the gas to be burned, producing intense heat, which is stored in the brick fit-

things to the desired degree. During this operation the valve of pipe Y is shut and the valve O of pipe g is open. Consequently from superheater R these gases, still very
 5 hot, are (instead of wasting the same through vent W, as is the usual custom) sent into the bench-furnace B to assist in heating or to wholly heat the same. It may be advisable to put an additional air-blast to the bench-
 0 furnace also; but if the combustion in superheater R has been well managed this will not be necessary. Having in due time heated W G, R, and B, we shut off the air-blast from these and turn the blast on W' G' and R' and
 5 repeat the previous operation on that (the other) side of the apparatus. While the latter is heating up we close the valve O and open pipe Y and turn the steam on under the grate W G at s, producing what is now called
 10 "water-gas," a mixture of hydrogen, carbonic oxide, and carbonic acid, not much of the latter in proportion. The gas thus produced must now pass into the superheating-chamber R, where it is brought to a very high
 25 heat. From there, valve O having been closed and valve Y opened, this hot gas passes through the vessel C, into which, before this is done, a charge of bituminous coal (commonly called "gas-coal") has been deposited
 30 through the hopper F. The hot water-gas will now distill the gas-coal, causing gas and tar vapors to leave it and pass on with the water-gas through the hot retorts F² in bench B to become a fixed gas and then pass off up
 35 through pipe K to hydraulic main H, and out through P to the purifiers. The coke produced in C will from time to time be removed through the bottom door and conveyed while still hot into the generators. To do this, C
 40 should be placed nearly over the generators; but for the sake of better illustration we have in the drawings shown the same to one side of the generators, in which position the apparatus will work very well, and it may be
 45 more desirable in some locations to so locate the vessel C. When generator W G and superheater R are no longer in proper condition to effectively make gas, it will be found that generator W' G' and superheater R' are
 50 now hot enough. We then reverse the operation previously described, and thus produce continuously a gas which can be used for fuel and illuminating purposes without an undue addition of nitrogen. The object of air-valve
 55 and steam-jet A in vessel C is not only to aid the heating of C in the beginning of the operation, but to assist the proper carbonization of the coal in C from time to time, when found necessary.
 60 When it becomes necessary to clean either of the generators, the valves O O' must be closed and vents W W' opened. This is to prevent a possibly dangerous explosion. Vents W W' are only used when clinkering
 65 becomes necessary. Should the coal and the vapors from vessel C not efficiently enrich the gas produced, supposing the same should

be wanted for illuminating purposes, then a small amount of oil may be admitted in each of the retorts in the bench B in any well- 70 known manner.

Having now fully described our apparatus and the manner in which the same is to be operated, we wish to state that we are well aware that the generators W G W' G' are 75 not in themselves new. The same also is true in a general way of the superheating-chambers R R', except as to the addition to be presently mentioned. Such vessels have been used (or such use has been described) in con- 80 nection with the water-gas generators for many years. They usually, however, have had but two outlets—the one corresponding to W or W' to discharge the products of combustion into the atmosphere and the other to discharge 85 the subsequently-manufactured gases into coolers or purifiers. Under our arrangement we have the vent W. We also have a second passage or outlet Y or Y', not, however, to connect the superheater with a purifying 90 or cooling chamber, but to connect it with a coal-chamber C; and in addition to these two we have a third outlet or passage to conduct the products of combustion, when desired, to the bench B. The form and construction 95 of the coal-chamber C also are not new *per se*. It has been shown in that form as a water-gas and fuel-gas producer; but we are not aware that such chamber has ever before been used in the manner and for the purpose 100 proposed by us. Likewise the bench B is of ordinary construction, and, indeed, coal-gas could be made in it in the ordinary way if it were shut off from the rest of the appa- 105 ratus; but in the connection in which we use it it serves a different purpose. Furthermore, we are aware that heretofore it has been proposed at various times to distill coal by means of ordinary and superheated steam, and in one recent instance of which we have knowl- 110 edge the tar-oil vapors thus produced are deposited afterward in red-hot coke as solid carbon and in the coolers as tar; but we pass these vapors and gas direct to the extremely- 115 heated retorts in bench B, and thus convert all the convertible vapors into rich fixed gas, in which, so far as we are informed, we differ from all other prior inventions or apparatus for distilling gas from coal by the passage therethrough of other gases. 120

What we claim as new and of our own invention is as follows:

1. The combination of a water-gas generator or producer, a superheater which receives the gases from the generator, a coal-distilling 125 chamber which receives the gases from the superheater, and a bench of retorts to which the gases and vapors from the coal-distilling chamber directly pass, the whole connected and adapted to operate substantially in the 130 manner hereinbefore set forth.

2. The combination, with the water-gas generators or sets of generators W G W' G', the superheaters R R', one for each water-gas gen-

erator or set of generators, and the coal-distilling chamber C, common to said superheaters, these elements being constructed, connected together, and adapted to jointly operate substantially in the manner and for the purposes hereinbefore set forth.

3. In combination with the retort-bench and the coal-distilling chamber, the regulator or superheater provided with three valve-controlled outlets, the one leading to the atmosphere, the next to the coal-distilling chamber, and the third to the combustion chamber or furnace of the retort-bench, substantially as and for the purposes hereinbefore set forth.

4. In combination with the superheaters 15 and retort-bench, the intermediate coal-distilling chamber, connected on the one hand with the superheaters and on the other hand with the retorts, and provided with the air and steam inspirator A, substantially as and 20 for the purposes hereinbefore set forth.

In testimony whereof we have hereunto set our hands this 10th day of January, 1889.

JOHN W. HARRISON.

FREDERIC EGNER.

Witnesses:

EWELL A. DICK,

WILL E. AUGHINBAUGH.