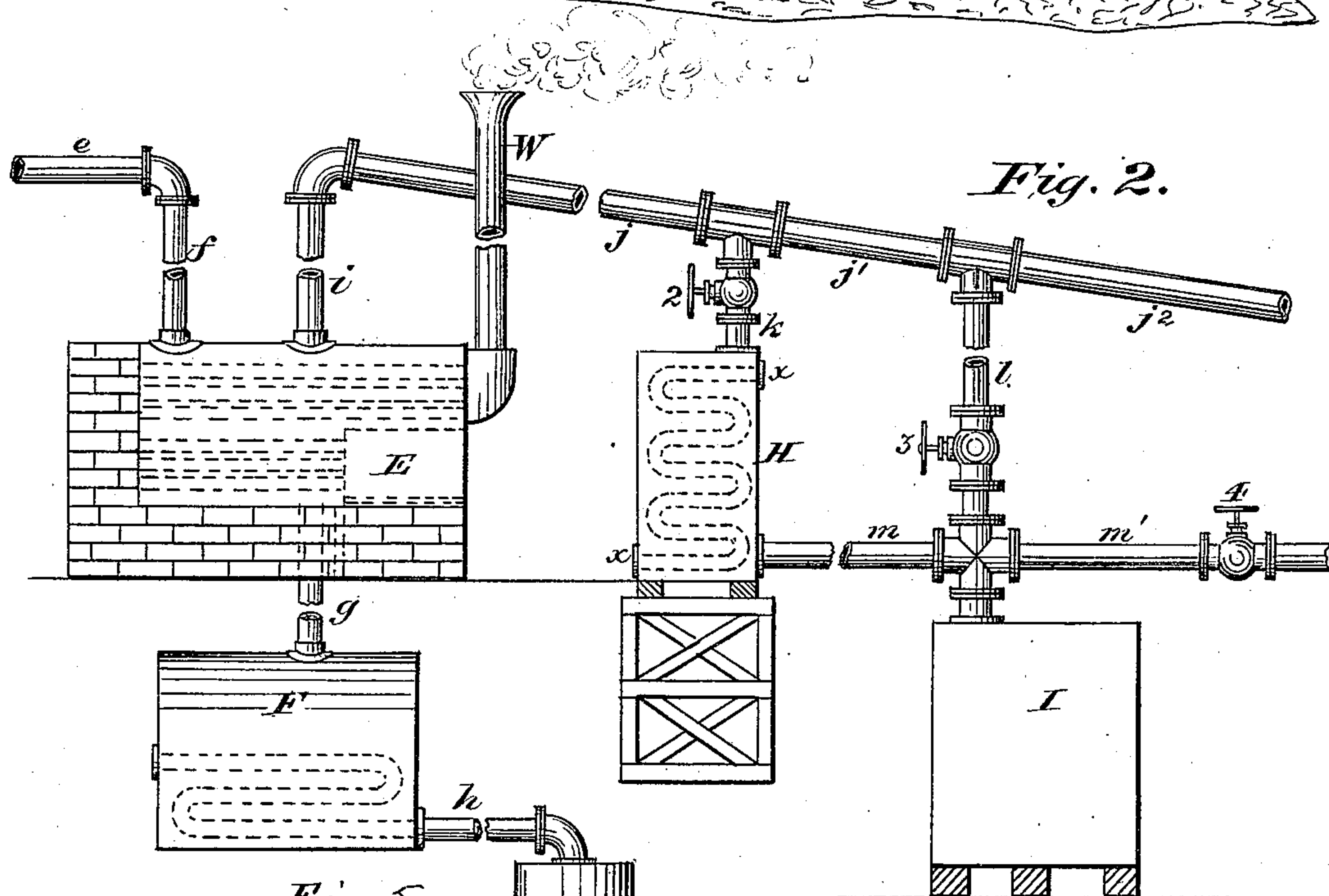
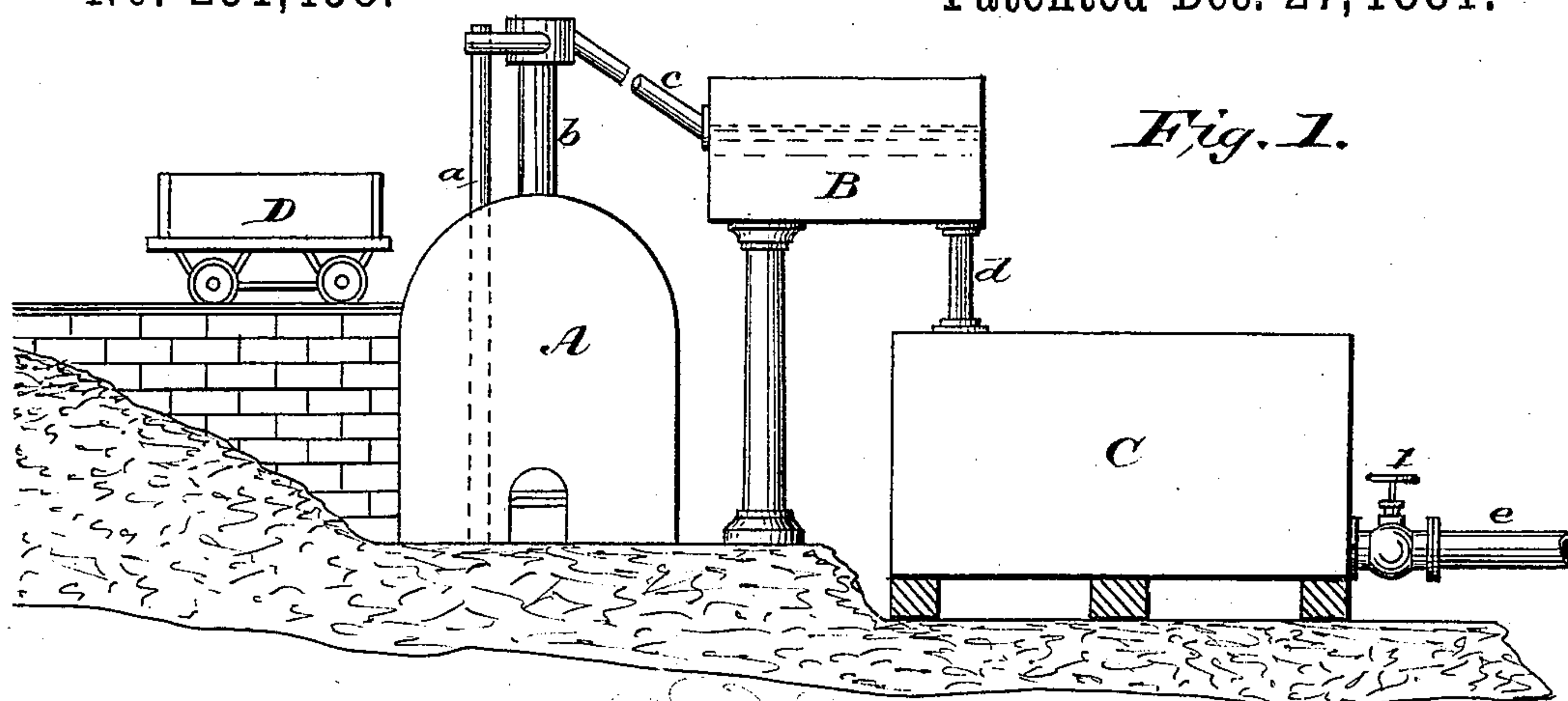


2 Sheets—Sheet 1.

Patented Dec. 27, 1881.



Witnesses:

Jonah Jowitt
Chas E. Booth

Inventor:

George Shepard Page.

(No Model.)

2 Sheets—Sheet 2.

G. S. PAGE.

FUEL, AND PROCESS OF MANUFACTURING THE SAME.

No. 251 458.

Patented Dec. 27, 1881.

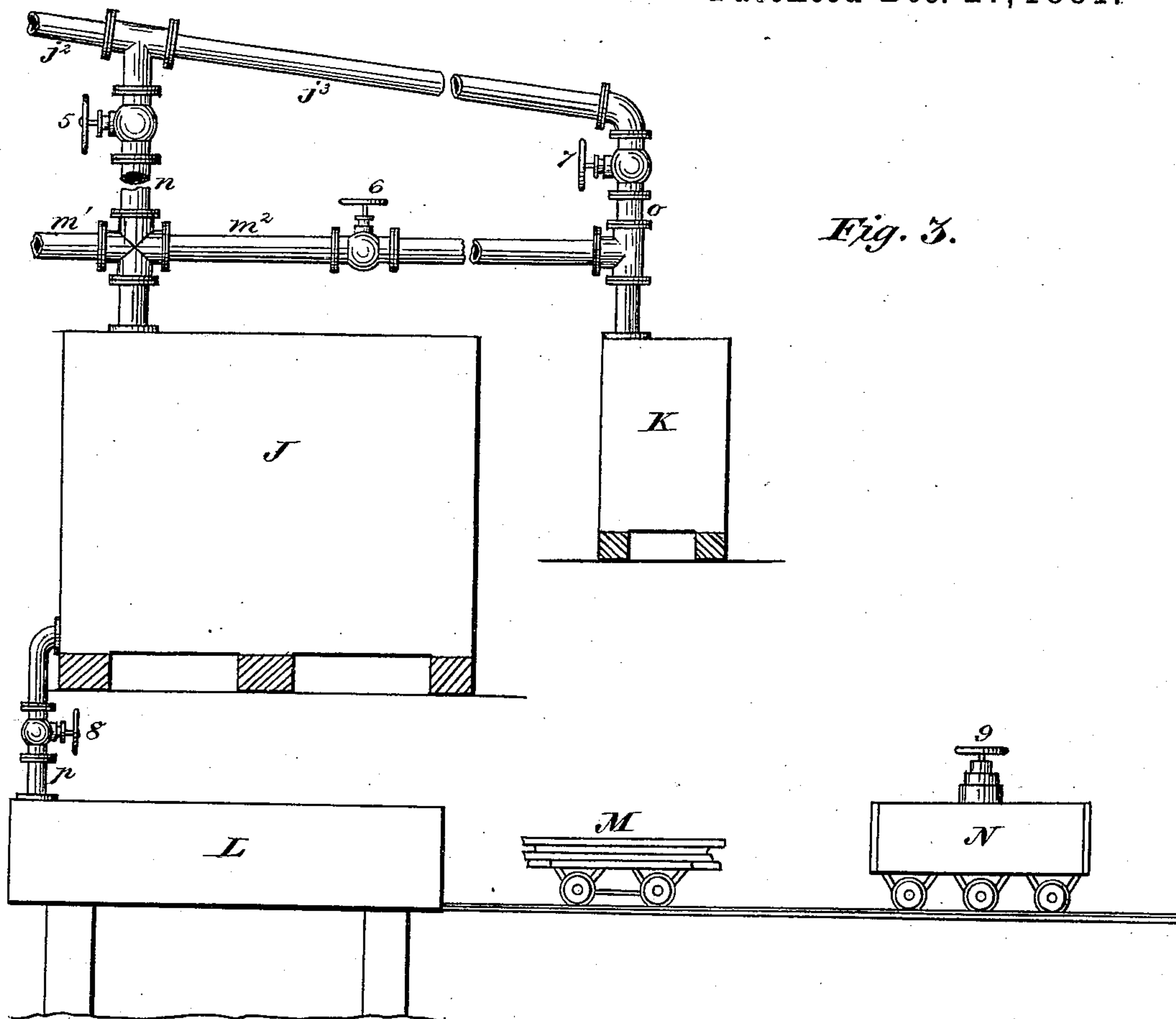


Fig. 3.

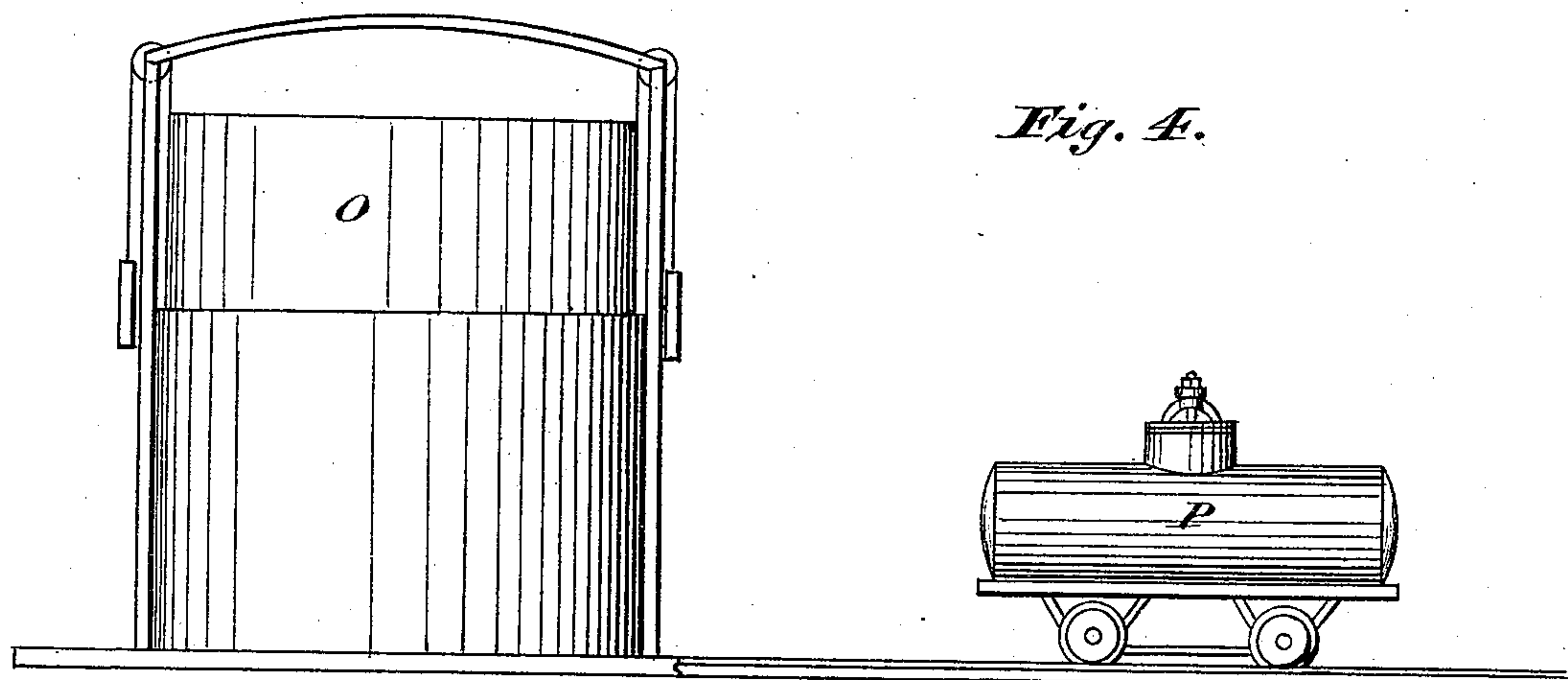


Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE SHEPARD PAGE, OF STANLEY, NEW JERSEY, ASSIGNOR OF ONE-SIXTH TO CHARLES E. BOOTH, OF NEW YORK, N. Y.

FUEL AND PROCESS OF MANUFACTURING THE SAME.

SPECIFICATION forming part of Letters Patent No. 251,458, dated December 27, 1881.

Application filed June 17, 1881. (No model.)

To all whom it may concern:

Be it known that I, GEORGE SHEPARD PAGE, a citizen of the United States, residing at Stanley, in the county of Morris and State of New Jersey, have invented a new and useful improvement in fuel and in the process of manufacturing the same from the waste slack or culm of bituminous or semi-bituminous coal, and also in the utilization of the products derived therefrom in the process of preparation; and I do hereby declare that the following is a full, clear, and exact description of the same, which will enable others skilled in the art to which it appertains to make and use the same.

Heretofore waste bituminous coal dust or culm has been utilized as fuel by mixing it with other substances by agglomerating the same with bituminous and resinous substances and pressing the same into blocks. It has also been utilized to a limited extent as a coke; but in the production of said coke no provision has heretofore been made for the saving of ammoniacal products, gases, and hydrocarbons.

The object of my invention is to receive the dust, culm, or slack as it is daily produced at the mines, or to use the present vast refuse accumulations, and, by the aid of appliances and mechanism hereinafter more fully set forth, utilize every product contained in the coal-waste in the most economical and effective manner, not only in the preparation of the fuel, but in the production of the various products for use in the various arts.

To this end my invention consists in the manufacture of fuel from the waste slack or culm of bituminous or semi-bituminous or other coking coal by coking the same at the mines, as above stated, then crushing or grinding and mixing it with about equal proportions of raw coal dust or culm of any kind of coal, with the addition of enough pitch to cause the mass to adhere and be formed into convenient-sized bricks or blocks.

It consists, further, of the arrangement of the coke-ovens, gas-receivers, tar-receptacles, tar-stills, and receivers for the different products arising from the distillation of the coal-tar, as will hereinafter more fully appear, together with the system of connecting-pipes for

the ready manipulation and transfer of said products.

In order to manufacture the fuel from waste coal, slack, or culm, and at the same time save all the products arising from the manufacture of the coke, I have shown in the drawings hereto annexed the most convenient arrangement of stills, receivers, and connecting-pipes which I have found best adapted for the purpose.

Referring to the drawings, Figure 1 is a perspective view of the coke-producing oven, water-tank, and receiving-tank, with connecting-pipes broken away, and a continuation of which is shown in Fig. 2. Fig. 2 is a continuation of Fig. 1, showing in perspective the tar-still, condensing-tank, light-oil tank, with connecting-pipes and valves, a combination of which is shown in Fig. 3. Fig. 3 is a continuation of Fig. 2, showing in perspective the creosote-oil tank and anthracene-tank, with pipes and cocks connecting with Fig. 2, together with the creosoting-cylinder and car. Fig. 4 is a view in perspective of the gas-holder or gasometer and storage-car. Fig. 5 is a view in perspective of the pitch-receiver, with pipes connecting it with the tar-still, and another pipe connecting it with the fuel mixer or machine.

Ordinarily coal is found deposited in hills and mountains, and the mines are opened and worked in the sides of the same, and when such is the case, either in a working mine or where the accumulations of slack or culm of exhausted mines are formed on the hill or mountain side, I propose to arrange my ovens, stills, condensers, &c., in such a manner as to take advantage of the laws of gravitation in the transfer of the various products from one vessel to another.

A designates one or more coking-ovens, which are located conveniently near the mouth of the mine or deposit of refuse dust, slack, or culm, and receive their charges of slack or culm through openings in the top, (not shown,) which are closed and sealed after receiving a suitable quantity of slack or culm from the car D. The gases eliminated from the slack or culm during the coking process ascend through the stand-pipe *b* and pipe *c* into the tank B, which is partially filled with

water, and in which the coal-tar and ammonia are separated from the illuminating-gas, the tar and ammonia being conveyed to the receiving-tank G, while the gas is conveyed by the pipe *a* to the gasometer O. The gases thus produced in the coking of the slack or culm I utilize as a fuel for carrying on the coking process, and also for fuel in the distilling processes of the coal-tar, to be immediately described. The coal-tar is run from the tank C into the tar-still E through the pipes *e* and *s* by opening the valve 1. The tar-still is of novel construction, so far as I am aware, and for which I here reserve the right of filing a separate application for a patent at some future time. Suffice it to say, in connection with this specification, that the still contains flues similar to the flue-boilers now in use for generating steam, and is provided with an opening in the bottom, through which the pitch or residuum is discharged.

The coal-tar still is adapted to be heated by the gas from the gasometer, derived from the coking of the slack or culm, as heretofore stated. In the distillation of the coal-tar the vapors rise and pass through the pipes *i* and *j*, valve 2, and pipe *k* into the condensing-tank H, said tank being provided with a coil or series of coils of pipes, *x*, through which cold water is passed, and by which the vapors are condensed and flow through the pipes *m*, *m'*, and *m''* into the respective tanks which receive the light, creosote, and anthracene oils. The light oil, or oil lighter than water, comes over at a temperature under 250° Fahrenheit. While this is running the valve 4 is closed and the oil passes into the light-oil tank I. As the temperature rises above 250° the valve 4 is opened to allow the heavy creosote-oil to pass into tank J. When the thermometer indicates 450° the valve 6 is opened, and the oil coming over between 450° and 600°, called "anthracene-oil," is deposited in the tank K. I can, however, accomplish the same results of condensation of the light, creosote, and anthracene oils by lengthening the pipes *j*, *j'*, and *j''* and pass the liquids or oils generated at the temperature heretofore indicated through the respective pipes *l*, *n*, and *o* and valves 2, 5, and 7 into the tanks I, J, and K without the use of the condensing-tank H. After the oils referred to have been driven off and deposited in the various tanks assigned them, a liquid pitch yet remains in the still. This pitch is drawn off from the still through the pipe *g* into the tank F, which is kept in a heated condition by a steam-coil located therein, in order to retain the pitch in a fluid condition until ready for use. The pitch thus produced I use as the binding material for the crushed coke and slack or culm, to form the same into bricks.

I have shown in the drawings a pipe, *h*, leading from the tank F to the mixer, through which the pitch is carried, where it is mixed with the crushed coke and slack or culm, and is then pressed into blocks by any suitable machinery.

I may find it expedient and desirable to use that class of machines used in the manufacture of bricks in which the clay is forced out in a continuous stream and the bricks cut therefrom. By using a machine of this kind the crushed coke, slack, or culm and pitch are placed in the machine and thoroughly mixed, and exude from the mill or machine in a continuous stream, and can be cut into blocks of suitable and desirable size, as above stated.

In order to utilize the creosote-oil at the place of its manufacture, I open the valve 8 and pass the oil through the pipe *p* into the creosoting-cylinder L, said cylinder having been previously charged with timber to be preserved on the truck M.

The process of creosoting the timber which I prefer to use is that known as the "Bethell process," first used in England in 1838.

It may be advantageous at times to dispose of the surplus tar not needed at the works to distillers and to chemical works in various parts of the country, and in such cases the coal-tar is drawn from the tank C into a tank-car for shipment, which is similar to the manner in which crude petroleum and petroleum oils are now transported.

In case it is desirable to sell the creosote-oil for use at other points for wood-preserving or for other purposes, it is drawn from the tank J into the tank-car N for transportation. The light oil and anthracene-oil can also be transported to market by drawing the same into a tank-car N, unless it is found advantageous to manufacture benzole, nitro-benzole, naphtha, and carbolic acid from the light oils, and anthracene from the anthracene-oil at the place of production.

I have not deemed it necessary to exhibit a diagram for the utilization of the ammonia generated in the carbonization of the dust, slack, or culm; but it is obvious that it can be readily saved and converted into sulphate of ammonia. The sulphur can be saved in a well-known manner by passing the gas through oxide of iron, which will gradually absorb the sulphur, and when it has gained from one hundred to one hundred and fifty per cent. in weight of sulphur the oxide can be burned in a furnace, the sulphur-fumes passed into an acid-chamber, making sulphuric acid, which can be used for making sulphate of ammonia.

It will be apparent that by the method and means herein set forth every ingredient of the heretofore valueless refuse of bituminous and semi-bituminous coal dust, slack, or culm is made of value and put into practical form to be utilized in the industrial arts.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The fuel herein described, the same consisting of pulverized coke, coal dust, slack, or culm, and coal-tar pitch, when combined in about the proportions herein set forth.

2. The process herein described of manufac-

turing fuel, the same consisting of coking bituminous or semi-bituminous coal dust, slack, or culm and utilizing the pitch or tar derived from the coking process as a binding material, as set forth.

3. The process herein described of manufacturing fuel from bituminous or semi-bituminous coal dust, slack, or culm and utilizing all the products derived therefrom, the same consisting in coking the dust, slack, or culm in tight chambers, saving the gas, ammonia, and tar derived from the coking process by the devices substantially as specified, distilling the tar and saving the products derived from said distillation, and utilizing the pitch or residue in the still for agglomerating or cementing the crushed or pulverized coke, coal dust, slack, or culm into a mass, as set forth.

4. A plant for the treatment of coal-slack and the production of an article of fuel, as set forth, the same consisting of a series of devices enumerated in the above specification, by which

the coal slack, dust, or culm is coked and the gas, oil, acid, sulphur, ammonia, and hydrocarbons driven off in the process of coking are saved and utilized in substantially the manner set forth.

5. As an improvement in the art of manufacturing an article of fuel from coal slack, dust, or culm, the plant or arrangement of devices herein set forth, the same consisting of the coking-ovens, gas-receivers, tar-receptacles, tar-stills, and receivers for the different products arising from the distillation of the coal-tar, and the system of pipes connecting the same, whereby a continuous process of coking and refining is carried on, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE SHEPARD PAGE.

Witnesses:

CHARLES E. BOOTH,
EDWD. M. ATKINSON.