

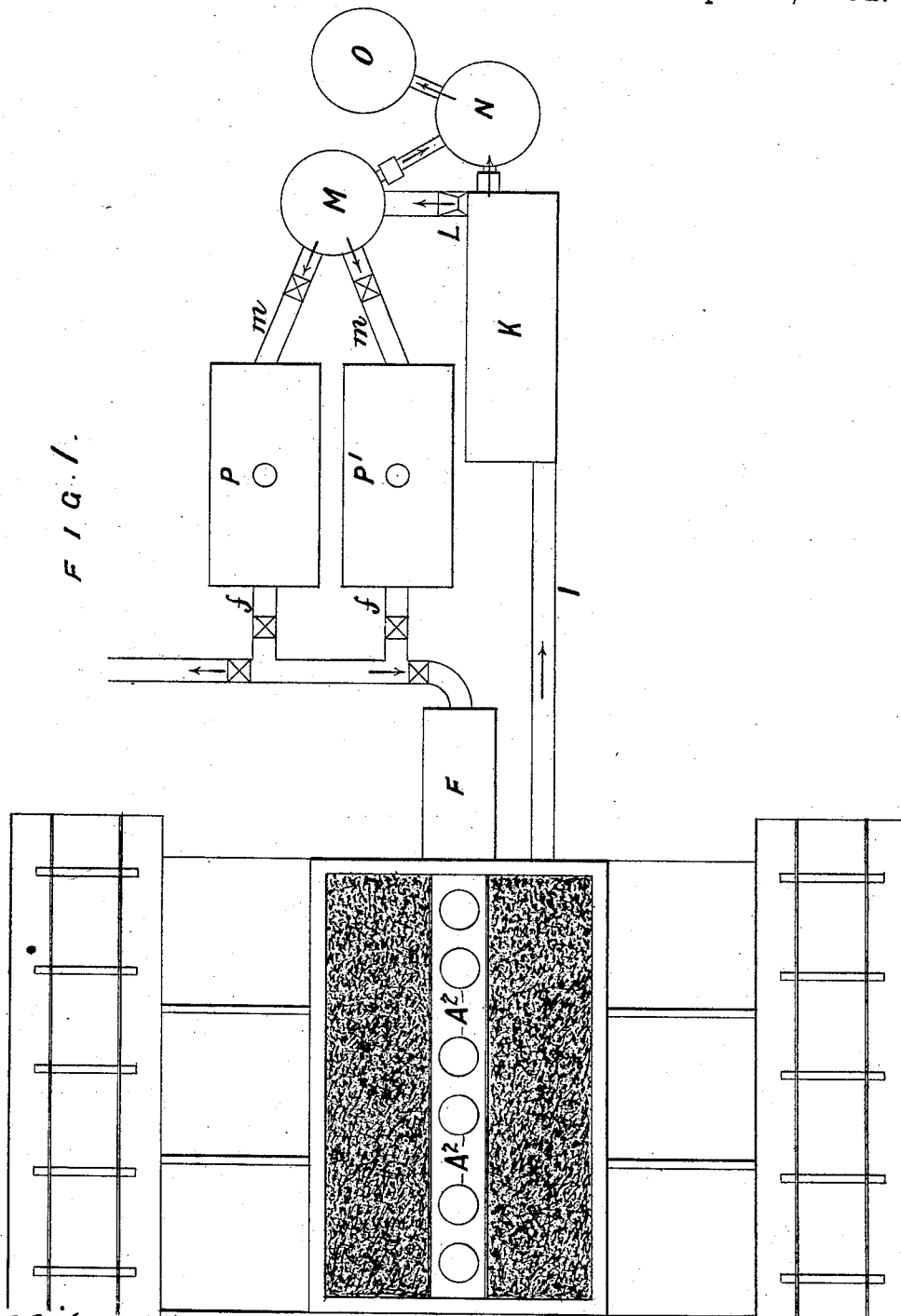
(No Model.)

5 Sheets—Sheet 1.

F. J. JONES.
PROCESS OF MAKING COKE.

No. 472,621.

Patented Apr. 12, 1892.



Witness.
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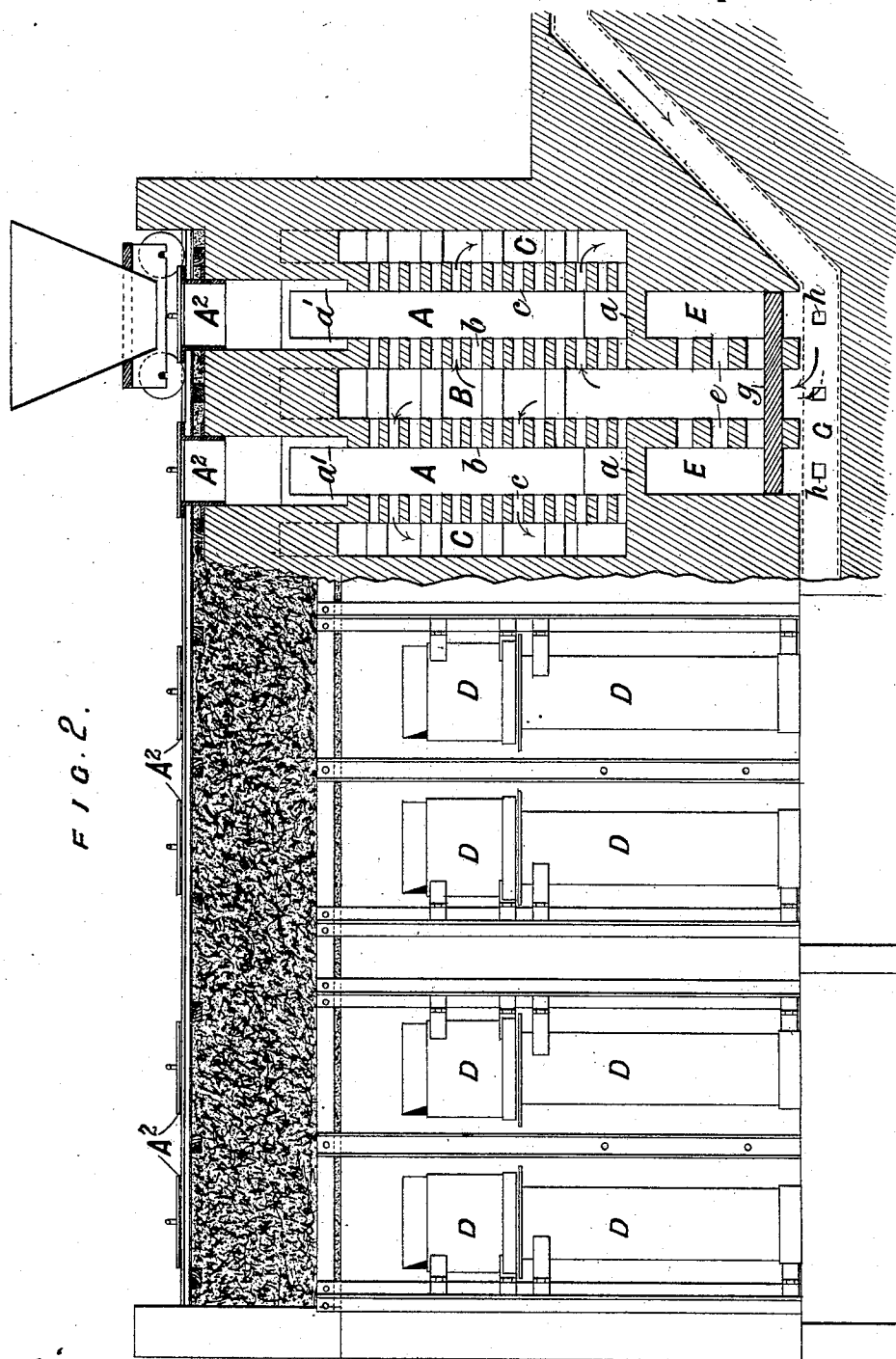
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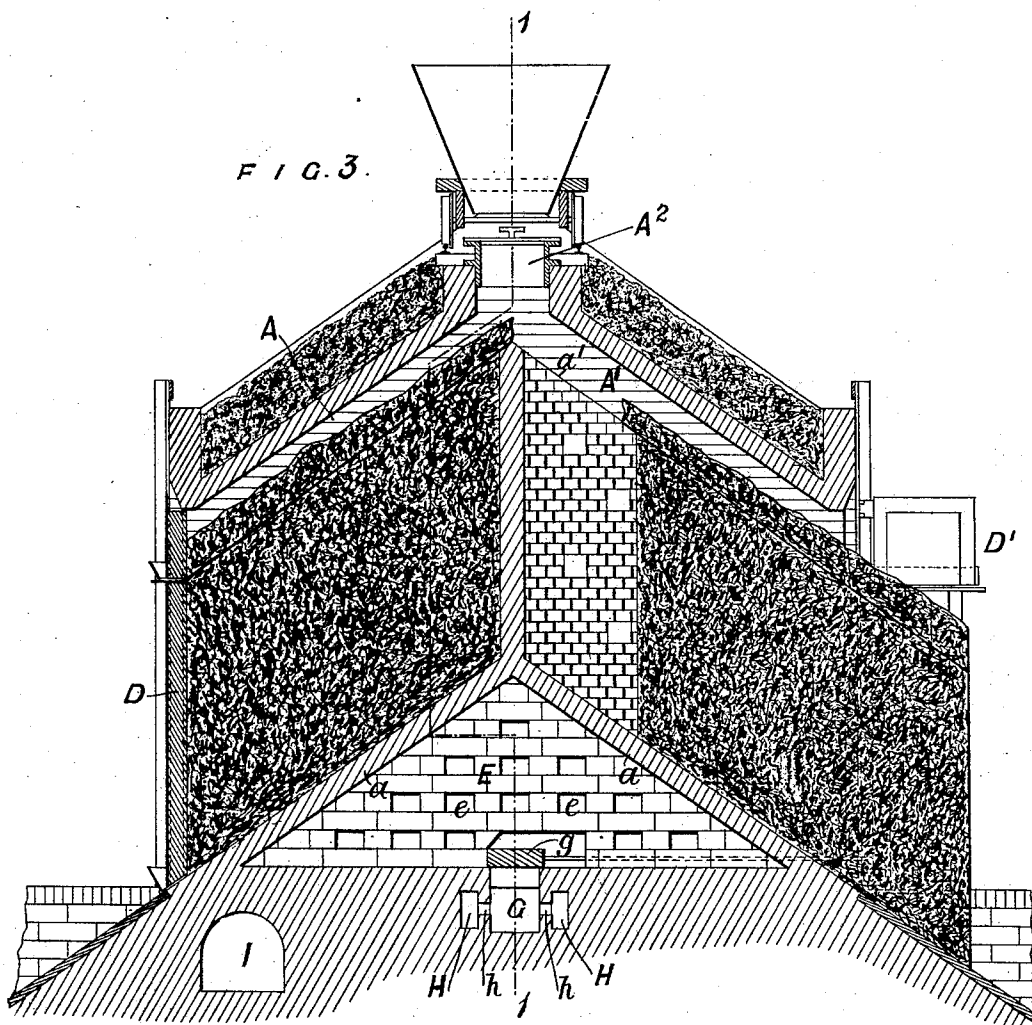
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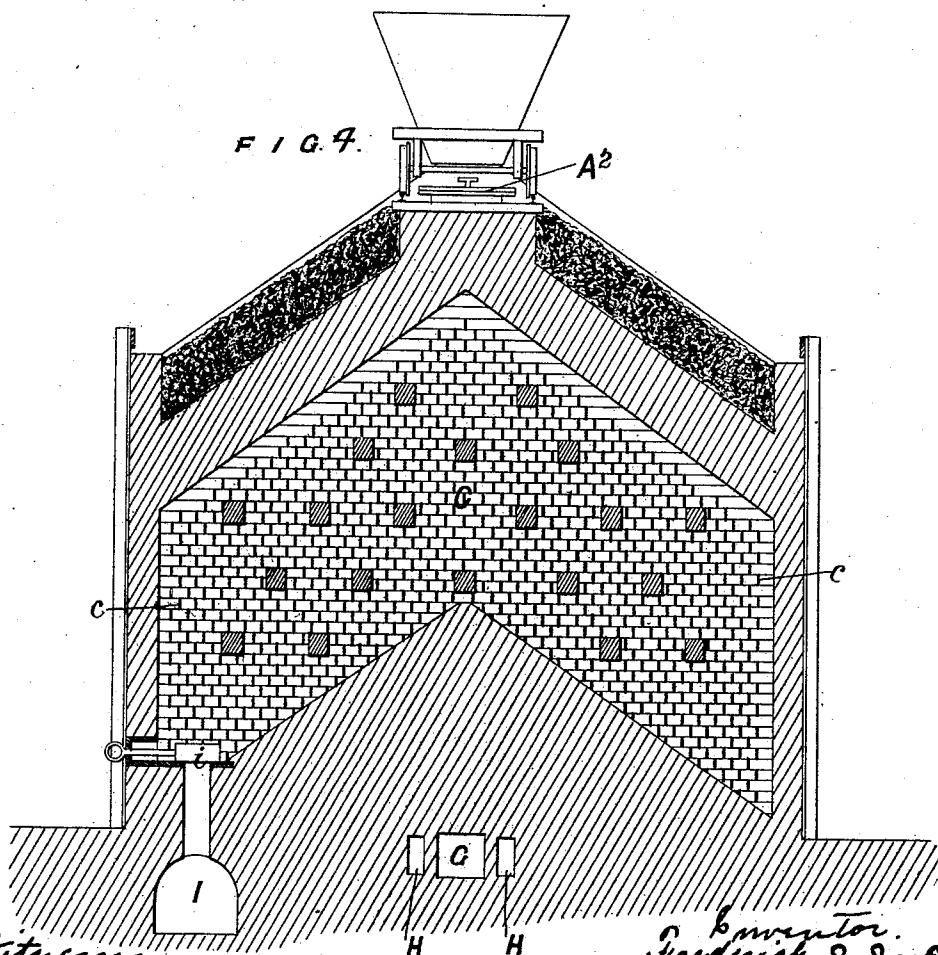
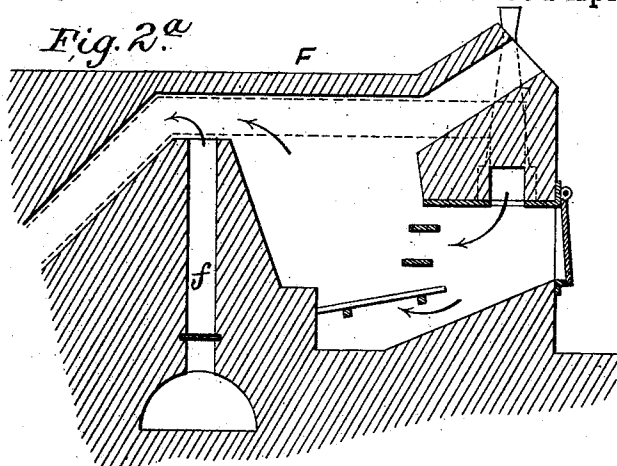
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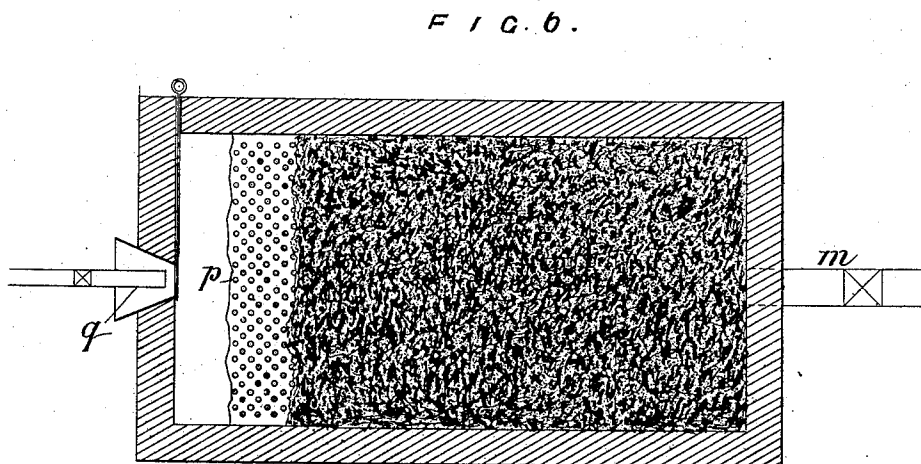
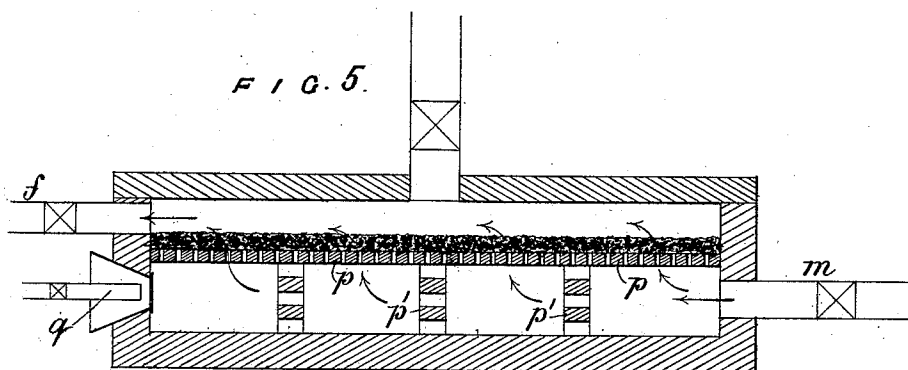
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UNITED STATES PATENT OFFICE.

FREDERICK JOSIAH JONES, OF BEDFORD, ENGLAND, ASSIGNOR TO THE ECONOMIC GAS AND COKE COMPANY, LIMITED, OF LONDON, ENGLAND.

PROCESS OF MAKING COKE.

SPECIFICATION forming part of Letters Patent No. 472,621, dated April 12, 1892.

Application filed February 18, 1891. Serial No. 382,001. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK JOSIAH JONES, engineer, of 61 Goldington Road, Bedford, in the county of Bedford, England, have
5 invented new and useful Improvements in the Process of Making Coke, of which the following is a full, clear, and exact description.

My invention relates to improvements in that process of making coke wherein the coking of the coal is effected by the passage
10 transversely through a thin vertical stratum of coal of the hot gases resulting from the combustion of fuel in a separate gas-producer furnace. In this process as heretofore conducted the coke produced is liable under certain
15 circumstances to be contaminated by the impurities—particularly the sulphur—contained in the fuel consumed in the gas-producer furnace, while the gases resulting from the coking operation are to a large extent virtually
20 wasted.

The object of my present improvement is both to avoid this contamination with sulphur and to utilize to greater advantage the gases
25 given off by the charge of coal to be coked.

To this end the invention consists in using the gases given off in the coking operation (or in the preliminary stage thereof) in a purified and reheated condition for the purpose
30 either of coking another charge or for completing the coking of the same charge and at the same time sweeping out the impurities contained in the charge. If, therefore, the gases given off in the operation of coking a
35 charge are sufficient to repeat the operation on another charge, the gases from the producer need only be used at starting for the purpose of coking the charge in the first oven (or first pair of ovens) of a series, the coking
40 of the charges in the succeeding ovens of the series being effected by the gases (purified and reheated) coming off from the other ovens, the timing of the heats and of the intermediate operations being so arranged as to make
45 the cycle of operations continuous through the whole series of ovens. The process thus differs from all others in that there is theoretically no loss of heat and the gases used are theoretically everlasting, simply alternating in composition from a rich gas consisting
50 largely of carbonic oxide to a gas consisting

of carbon dioxide, and back again from carbon dioxide to the rich gas, &c., as in each complete cycle the carbon dioxide made in the combustion-chamber becomes changed in
55 passing through the body of the hot coking mass and highly charged with tarry vapors, ammonia, and other gaseous constituents. In practice, however, the gases after purification are reheated by being mixed with the gases
60 from the gas-producer, which is fed with the "breeze" or small pure coke resulting from a previous charge coked by this process.

By purifying the gases and using them as above described a much purer kind of coke
65 will be produced than when crude gases from the producer furnace are used, and the ammonia, sulphur, and other valuable by-products may be recovered.

The invention will be described with reference to the accompanying drawings, forming
70 part of this specification, in which—

Figure 1 is a general plan of the ovens, the apparatus for purifying the coke-oven gases, extracting the by-products therefrom, and
75 returning the purified gases to the ovens. Fig. 2 is a side elevation, partly in section, on line 1 1, Fig. 3, of a set of six pairs of ovens, the producer-furnace in connection therewith being shown in Fig. 2^a. Fig. 3 is a cross-sectional
80 elevation through a pair of ovens, one being open and the charge in the act of being drawn. Fig. 4 is a section through one of the gas-collecting chambers. Fig. 5 is a vertical section, and Fig. 6 a horizontal section, of one
85 of the purifiers.

The same letters of reference indicate the same parts in all the figures, and I will now more fully describe the process with reference thereto.
90

A A' A A' are pairs of ovens, each pair being situated between a combustion-chamber B on the one side and a gas-collecting chamber C on the other side, these chambers being
95 common to the two ovens of a pair which communicate with said chambers, respectively, by orifices *b c* in the division-walls. Each combustion-chamber B is preferably placed between two pairs of ovens A A' and is common to both pairs.
100

Each oven A is a long narrow upright chamber of approximately equal length and

height, but of a breadth of only about one-tenth the height. The roof and floor are inclined at a pitch of about thirty-three degrees, the side and end walls being vertical.

5 The roof is preferably covered with a deep layer of partially non-conducting material, as ashes, asbestos, or sand or lime, forming a thick roof, as shown. The most important dimension is the breadth, which would be limited
10 according to the permeability of the mass by the gases of combustion, which would depend on the kind of coal and size of the pieces. I find that one foot is a good working dimension for the breadth of the oven for coking
15 what is known as "smudge" or "duff," or eighteen inches for coking rough slack. The orifices *b c* are of such size that they will not be filled and choked by the coal and may be made either by using perforated lumps or leaving open (to the extent of about half an inch)
20 all the vertical joints of the brick-work of the side walls from the floor *a* up to the shoulder *a'*, above which the brick-work is solid, these perforated walls being prevented from bulging by headers or cross-ties of fire-brick crossing the chambers *B C* and binding their opposite walls together, as shown in Fig. 2. The opposite side walls of the ovens being thus perforated, the products of combustion in
25 passing from chamber *B* to the gas-collecting chamber *C* will pass across the ovens and transverse in the direction of its least thickness the mass of coal contained therein.

The ovens of each pair *A A'* are set back to
35 back or with their higher ends together, and each pair has a charging-mouth *A²*, closed by a cover and common to the two ovens *A A'*, the division-wall between the ovens being only high enough to separate the masses of coke without interfering with the free charging of both ovens from the one mouth *A²*. In
40 order to enable the coke to be discharged *en bloc* and with little waste or labor, each oven-floor *a* is inclined downward toward the front end, where is situated the discharging-aperture extending the full width and height of the oven and closed by sand-luted doors *D D'*, the downward inclination of the floor being continued outside the oven to enable
45 the mass of coke to be slid out with little or no breakage. The perforated side walls of the ovens have each when using a shrinking coal a ledge or shoulder *a'*, before referred to, inclined at a slightly greater pitch than the floor *a* and situated at such a height that a
50 sufficiency of the charge, which fills the oven nearly to the roof, will rest on the shoulders *a'* and by sealing the passage left by the contraction in bulk of the coal in coking prevent
55 the gases of combustion passing around instead of through the charge. In order to insure the sufficient heating of the charge from below, the space *E* beneath the floor *a* (which is of fire-brick) communicates with the lower
60 part of the combustion-chamber *B* by orifices *e*.

F is a gas-producer furnace communicating with the several combustion-chambers by a

flue *G*, provided with valves *g* of fire-brick for controlling the passage of the furnace-gases to the combustion-chambers. The furnace has air-heating flues *H*, through which
70 the air-supply to the combustion-chamber passes:

At starting the cycle of operations the combustion-chambers *B* receive the gases resulting from imperfect combustion in the gas-producer furnace *F*, charged, for this time only, with wood or charcoal, thus insuring the production of a pure coke in the ovens from the very commencement of the operation.
75 The combustion of these gases is completed in the chambers *B* by the admission of just sufficient air (admitted through flues *H* and apertures *h*) to the chambers *B* to produce nearly, but not quite, perfect combustion, and
80 the resulting gases traverse the charge of coal in the ovens and are collected in chambers *C*. In the subsequent repetitions of the operation the gases supplied to the combustion-chambers *B* are mainly those derived from the coking of
85 another charge, (after purification and reheating, as hereinafter described,) the producer gases being only used alone in starting operations. The gases after traversing the ovens are received in the gas-collecting chambers *C*,
90 whence they pass off through a flue *I*, common to all the gas-collecting chambers *C*, the communication of which with the said flue is controlled by suitable valves *i* of fire-clay. The gases are conveyed by the flue *I* to a condenser *K*, which may be of the ordinary construction as used in gas-works. From this the uncondensed gases are extracted by an
95 exhauster (situated at *L*, for example) and forced through a scrubber *M*, also of the ordinary kind used in gas-works, the condensed products from both the condenser and scrubber flowing into a tar-settling tank *N*, whence the ammonia separated therein overflows into a tank *O*. From the scrubber *M* the washed
100 gases pass to one of two purifiers *P P'*, in which the operations of purifying the gases and revivifying the purifying agent are alternately performed, the purifying operation going on in the one while the revivifying operation is performed in the other. From the purifier the purified gases return to the furnace *F*, where they are raised to the requisite temperature before being returned to the combustion-chambers *B* for the purpose of being
105 again passed through the charges to be coked, as above described. This reheating-furnace is the ordinary gas-producer, except that it is provided with a gas-inlet flue *f*, leading up through the furnace-bridge. The gases coming from the purifier *P* or *P'* pass through the flue *f* and are mixed above the bridge with the gases resulting from imperfect combustion in said producer. After starting the cycle of operations with charcoal, as above
110 mentioned, this furnace is fed with small pure coke or breeze resulting from a previous coking operation by this process, so that the gases produced by it will be pure. The mixed

pure gases generated in the gas-producer and returned from the purifier through flue *f* are then conveyed to the several combustion-chambers B and thence through the ovens.

5 The purifiers P P' are of the ordinary construction used in gas-works, except that they are entirely constructed of refractory materials, in order that the spent lime may be desulphurized by burning without being removed from the purifier. With this object in
10 view the layer of lime (which is the purifying agent employed) is supported on perforated slabs of fire-clay *p*, supported on intermediate bearer-walls *p'*, apertured to permit free
15 circulation of the gases. The gas-inlet from the scrubber is at *m* and the outlet to the reheater is at *f*.

For the purpose of desulphurizing the lime a mixture of the previously-purified gas and
20 air is burned in the purifier, the gas being admitted at a nozzle *q* and drawing in its own supply of air, or a current of hot air or of products of combustion, or of both, may be passed through or over the spent lime for the
25 purpose of roasting out the sulphur and revivifying the lime. The waste gases from this operation may be utilized by being burned in a steam-boiler furnace or heated for the extraction of their sulphur. The communications of the scrubber M with the several
30 purifiers P P' and of the latter with the furnace F and the boiler-furnace, if any, are controlled by valves, all made of fire-clay, so arranged that the purifying and revivifying
35 operations may go on concurrently and alternately in each purifier.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

40 1. The improvement in the process of making coke herein referred to, which consists in purifying the mixed gases resulting from the coking operation herein described, reheating said gases by admixture with fresh gas-producer gases, effecting their combustion with
45 air, and causing the gases resulting from such combustion to pass across through a charge of coal to be coked, as specified.

2. In the herein-described process of making
50 coke and obtaining by-products, the improvement which consists in cooling and washing the mixed gases resulting from the coking operation herein referred to, collecting the condensable constituents, passing the cooled and
55 washed gases through a purifier, then mixing them with fresh gas-producer gases generated from coke and with air, and finally passing the gases resulting from the combustion of the purified and reheated gaseous mixture
60 through a fresh or partially-coked charge, as specified.

The foregoing specification of my improvements in the production of coke for foundry and other purposes signed by me this 7th day
65 of February, 1891.

FREDERICK JOSIAH JONES.

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