

(No Model.)

H. M. PIERCE.  
Manufacture of Charcoal.  
No. 243,301. Patented June 21, 1881.

Fig. 1.

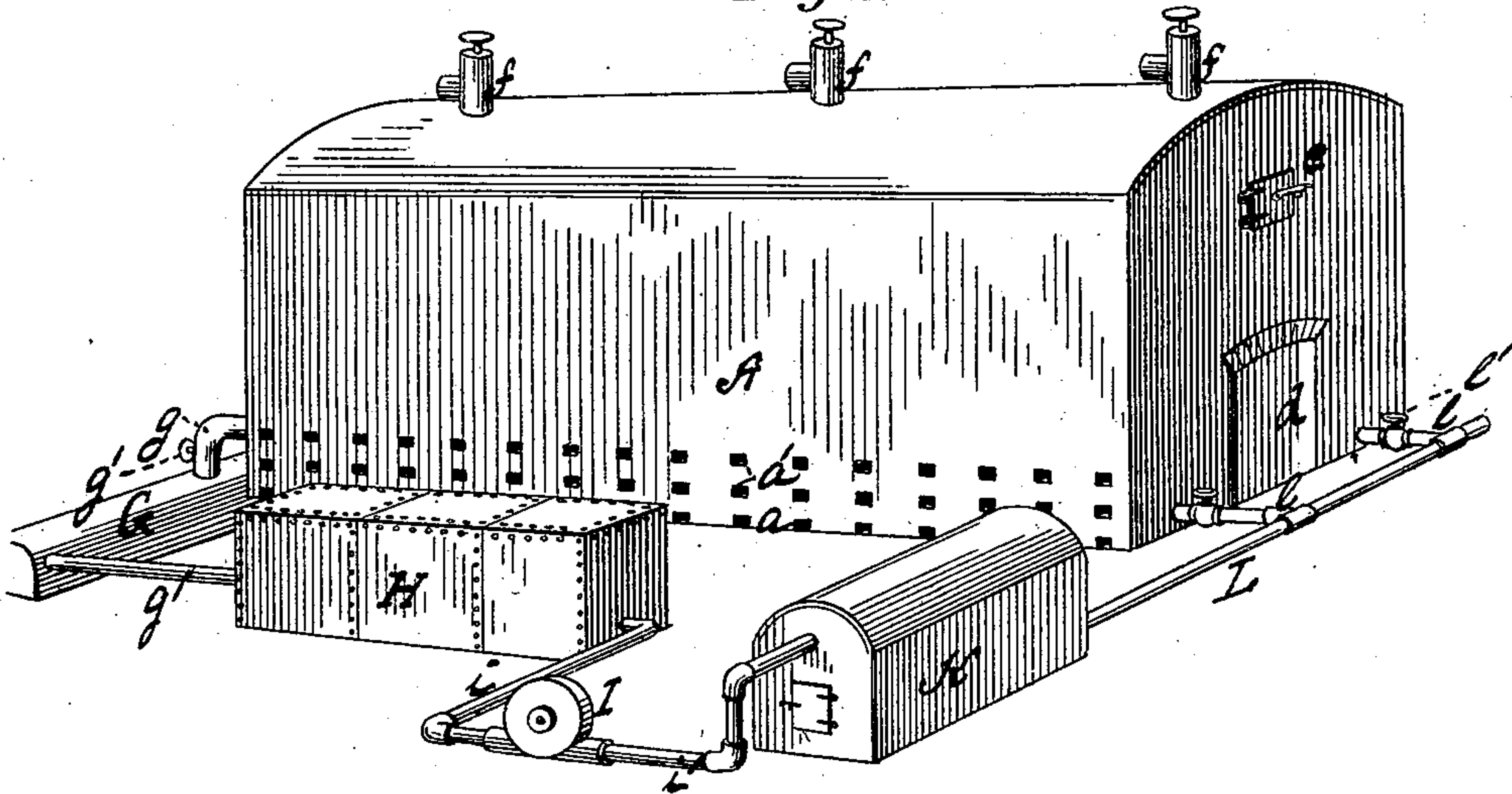


Fig. 2.

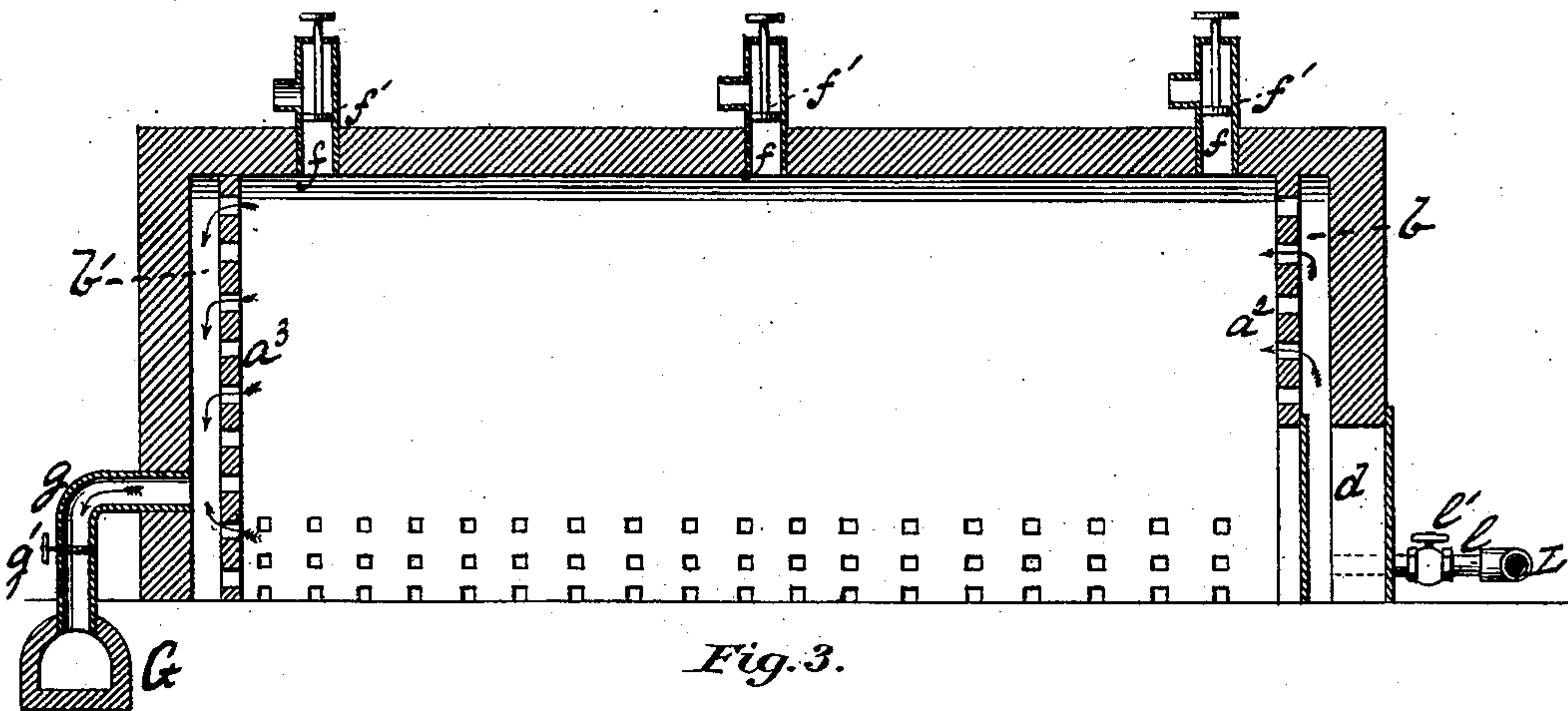
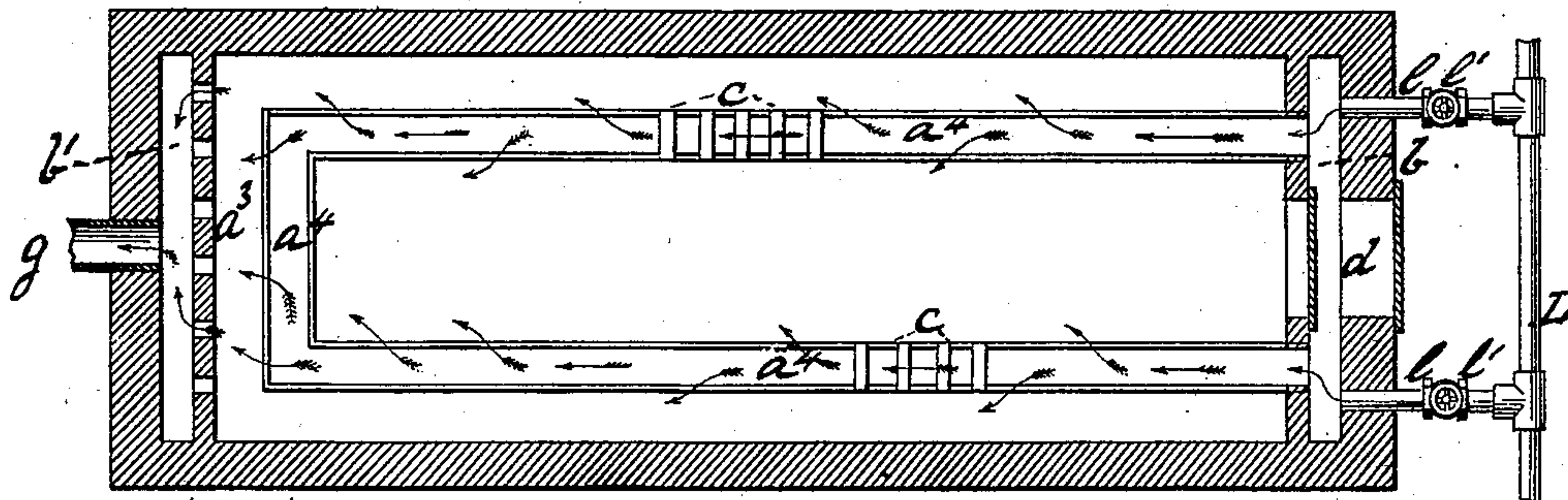


Fig. 3.



Attest:  
R. J. Barnes.  
S. B. Houlton.

Inventor:  
Henry M. Pierce  
by F. W. Rutter  
att'y



# UNITED STATES PATENT OFFICE.

HENRY M. PIERCE, OF GRAND RAPIDS, ASSIGNOR TO THE BANGOR CHEMICAL COMPANY, OF ELK RAPIDS, MICHIGAN.

## MANUFACTURE OF CHARCOAL.

SPECIFICATION forming part of Letters Patent No. 243,301, dated June 21, 1881.

Application filed December 21, 1880. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY M. PIERCE, a citizen of the United States, residing at Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in the Manufacture of Charcoal; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

In the drawings, Figure 1 is a perspective view of devices embodying my invention. Fig. 2 is a vertical section of one of the kilns. Fig. 3 is a horizontal section of a kiln, showing a modification in the arrangement of the kiln-flues.

Like letters refer to like parts wherever they occur.

My present invention relates to the utilization of those non-condensable and uncondensed gases and vapors given off in the carbonization of wood for the purpose of charring the wood, and has for its object to economize fuel and obtain a larger yield of charcoal from the kiln.

In Letters Patent No. 174,292, granted to me February 29, 1876, and No. 184,898, of November 28, 1876, I described methods and means for the withdrawal and recovery of the acetic acid contained in gases developed in the destructive distillation or carbonization of wood, and for utilizing the uncondensed gases and vapors. In such cases the gases, &c., were driven directly into the kiln and consumed therein. This, while advantageous in many respects, is not as economical as is desirable, for the reason that in supplying air to burn the gases in the kiln a portion of the kiln-wood must necessarily be burned and a corresponding proportion of charcoal lost. I have therefore devised special means for the utilization of the non-condensable and uncondensed gases, which I will now proceed to describe, so that others may apply my invention.

In the drawings, A indicates a kiln, or one of a series, for the carbonization of wood. This kiln may be built of any suitable material,

preferably of brick, and is provided with a series of flues or gas-passages to facilitate the passage of the gas, products of combustion, &c.

*a a'* indicate the air-inlets and gas-outlets common to charcoal-kilns as usually constructed; but in the present instance these holes are kept closed during the operation of the kiln, and are only employed as test-holes to enable the workman to determine when carbonization is complete.

In the drawings I have shown two arrangements of the flues which seem to me the best adapted for the purpose, and either or both of such arrangements may be used in a kiln. The first of these (shown best in Fig. 2) is constructed by arranging perforated partition-walls *a<sup>2</sup> a<sup>3</sup>* near each end of the kiln, so as to form the gas-chambers *b b'*, while the second arrangement (see Fig. 3) is obtained by sinking a channel, *a<sup>4</sup>*, in the bottom of the kiln and laying across the same bars *c*, or equivalent supports for the wood. The usual charging-doors, *d e*, are provided.

In the arch of the kiln, or at other suitable point, I provide one or more vent or escape pipes, *f*, each having a valve, *f'*, which may be weighted according to the pressure desired in the kiln at any given time.

*g* indicates a valved pipe for conducting the gases developed in the kiln to a main, *G*, which may be placed under ground; and from the main *G* a short pipe, *g'*, leads to a condenser, *H*, which may be of any desired pattern.

*I* indicates a fan or equivalent, connected by the pipe *i* with the condenser, and by the pipe *i'* with a furnace, *K*, from which the products of combustion pass, by main *L* and pipes *l*, to the kilns. The pipes *g* and *l* are provided with suitable valves, *g'* and *l'*, and where several kilns (constituting a system) are employed the mains *G* and *L* are common to all.

The devices being substantially such as specified, their operation will be as follows: The kiln having been charged with wood, a fire kindled in the furnace *K*, and the valves *g' l'* of the pipes *g l* opened, the fan or equivalent exhaust is started and draws the gases and vapors given off by the carbonization of the wood in the kiln through pipe *g* into main *G*, thence into condenser *H*, where the pyroligneous acid



is condensed. The uncondensed and non-condensable gases, which are highly inflammable, pass from the condenser H through the fan I, and are forced into the furnace K, where they  
 5 are consumed. As soon as the non-condensable inflammable gases are ignited and the furnace K thoroughly heated no more fuel will be required. The heated products of the combustion of the gas are driven from furnace K  
 10 into main L, and pass thence, by pipes *l*, into the flues (*b* or *a'*) of the kiln, to be distributed through and impart their heat to the wood contained in the kiln. This is the general operation of the devices when the process of carbonization is thoroughly established; but when  
 15 the kiln is freshly started the vapors given off are mostly aqueous and useless, and should be allowed to escape, for which purpose the valved vent-pipes *a* are provided; and as such vapors  
 20 cannot be utilized for heating purposes it is necessary to draw the gas-supply from some other source. Consequently I usually employ a series of kilns, A, connected to common mains G and L, and in starting a kiln I close the valve  
 25 *g'* of pipe *g* of said kiln, open the valve *l'* of pipes *l*, and weight the vent-valves *f'* to the pressure I desire to maintain in the kiln. I then obtain my supply of non-condensable gas from the other kilns of the series, and allow  
 30 the vapors and gases developed from the fresh wood to escape until their odor indicates the presence of pyroligneous acid, after which I open the valve *g'* of pipe *g* and allow the gases, &c., from the kiln to enter main G, when the  
 35 operation will be continued, as first specified. By conducting the gases from the kiln to a condenser, as in my former patents, the aqueous vapors, pyroligneous acid, &c., will be eliminated; but if the non-condensable gases are  
 40 then conducted directly to and consumed in the kiln it will necessitate the admission of a large volume of air, which will increase the loss of carbon by consumption of the kiln-wood. The same loss will also result, but in a greater  
 45 degree, if the aqueous vapors are not elimi-

nated before the gases are reconducted to the kiln; but by causing the combustion of the gases in an independent furnace or combustion-chamber, either with or without the previous elimination of the aqueous vapors, &c.,  
 50 their full value as heat-producers is obtained, and no air to induce or support combustion is admitted to the kiln.

It is evident that, if the carbonic oxide (CO) is forced to take an additional element of oxygen in the presence of carbon at a high temperature, it cannot obtain its combining volume until the free carbon present has obtained at least an equivalent of oxygen, receives its full supply of oxygen, or, in other words, combustion is induced before it enters the presence of the carbon.  
 55 60

The advantages of my invention are that I am enabled to utilize all uncondensed and non-condensable gases in carbonizing the wood in  
 65 the kiln without consuming any of the kiln-wood or any other fuel. I obtain a continuously-operating system and better results, both in quality and quantity of products.

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

1. The combination, with a closed charcoal-kiln, of a weighted or automatic vent valve or valves, a valved eduction-pipe, an induction-pipe, and an interposed fan, substantially  
 75 as and for the purpose specified.

2. The combination of the kiln A, provided with perforated partition-walls *a*<sup>2</sup> *a*<sup>3</sup> and automatic vent-valves *f'*, the valved eduction-pipe *g*, condenser H, fan I, independent furnace or combustion-chamber K, and induction-pipe *l*, substantially as and for the purpose specified.  
 80

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

HENRY M. PIERCE.

Witnesses:

F. W. RITTER, Jr.,  
 H. B. MOULTON.