No. 760,372. PATENTED MAY 17, 1904.

J. B. BEAM.

COKE OVEN.

APPLICATION FILED AUG. 20, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

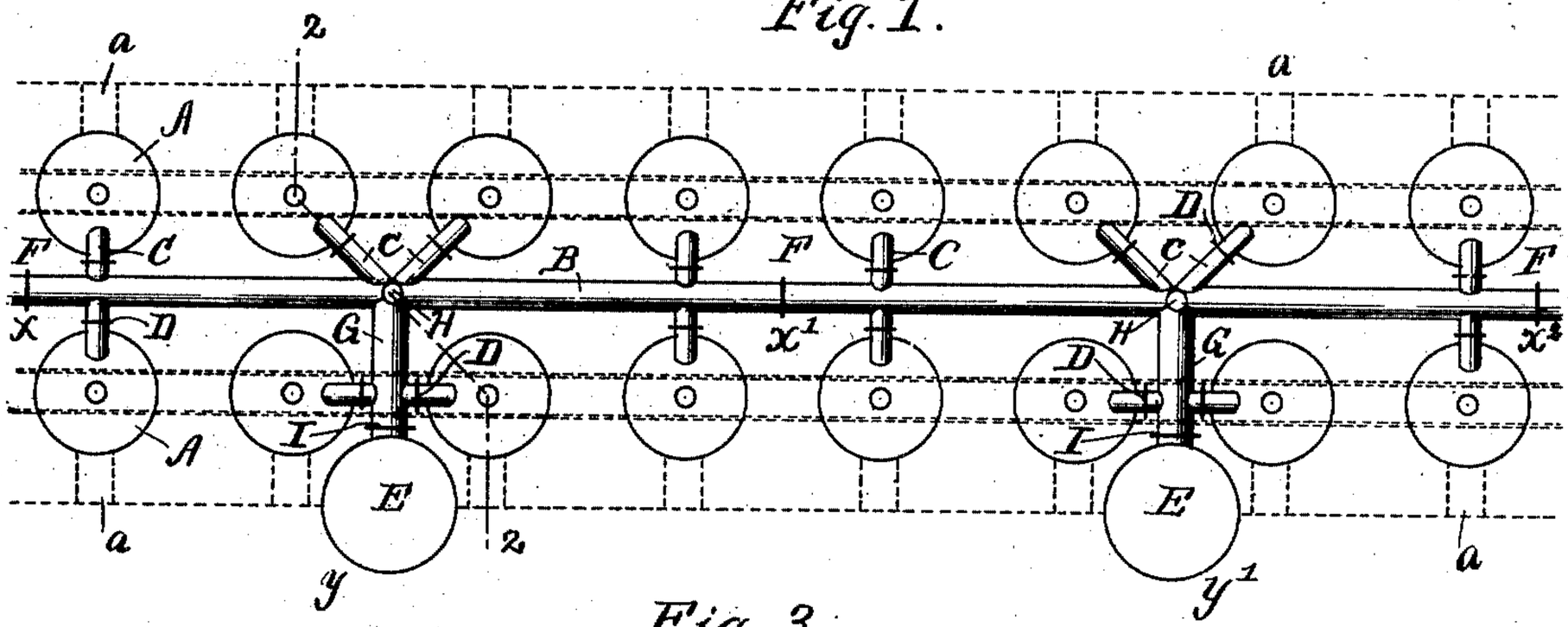

Fig. 3.

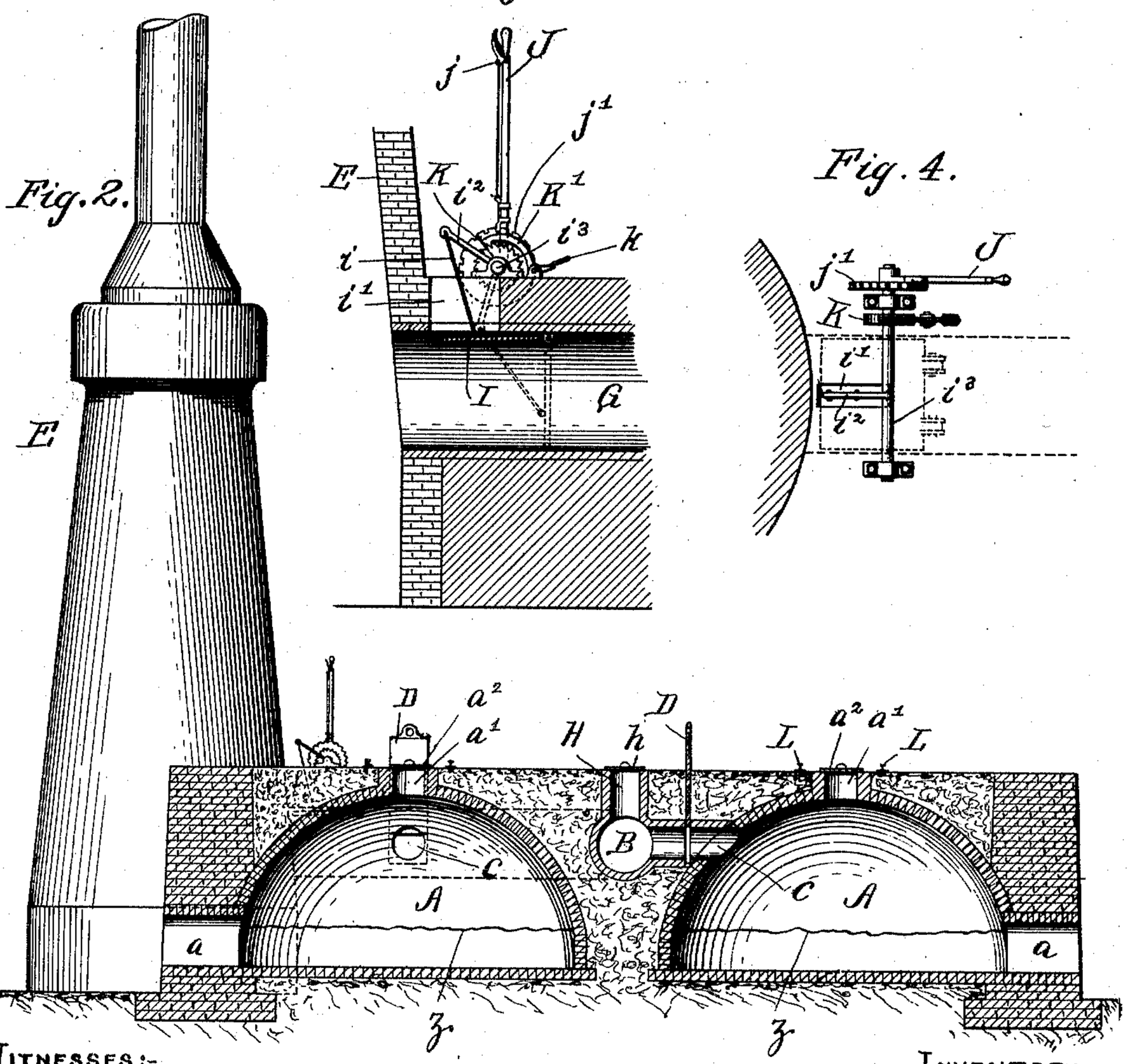

Fig. 4.

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 5.

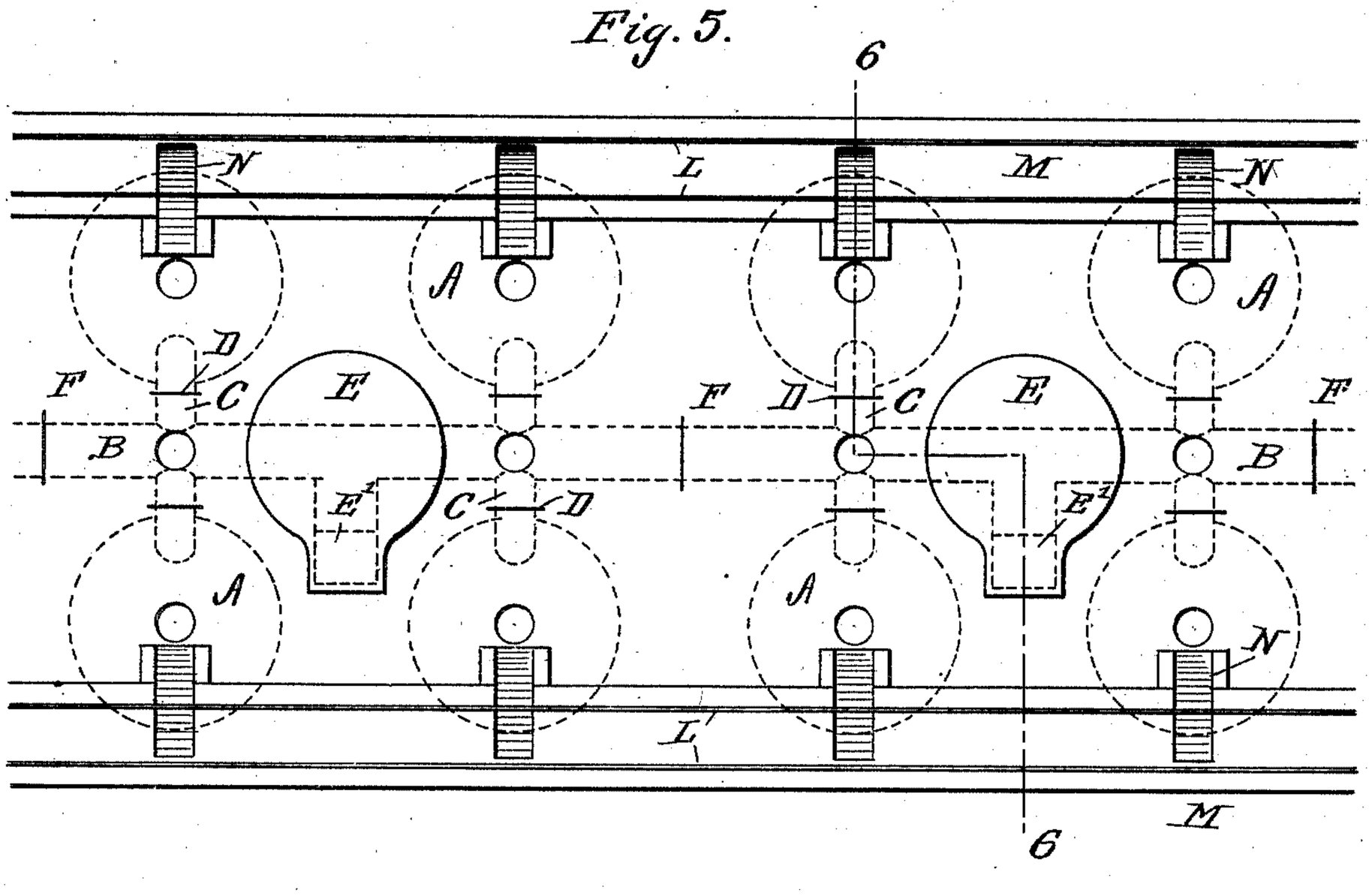
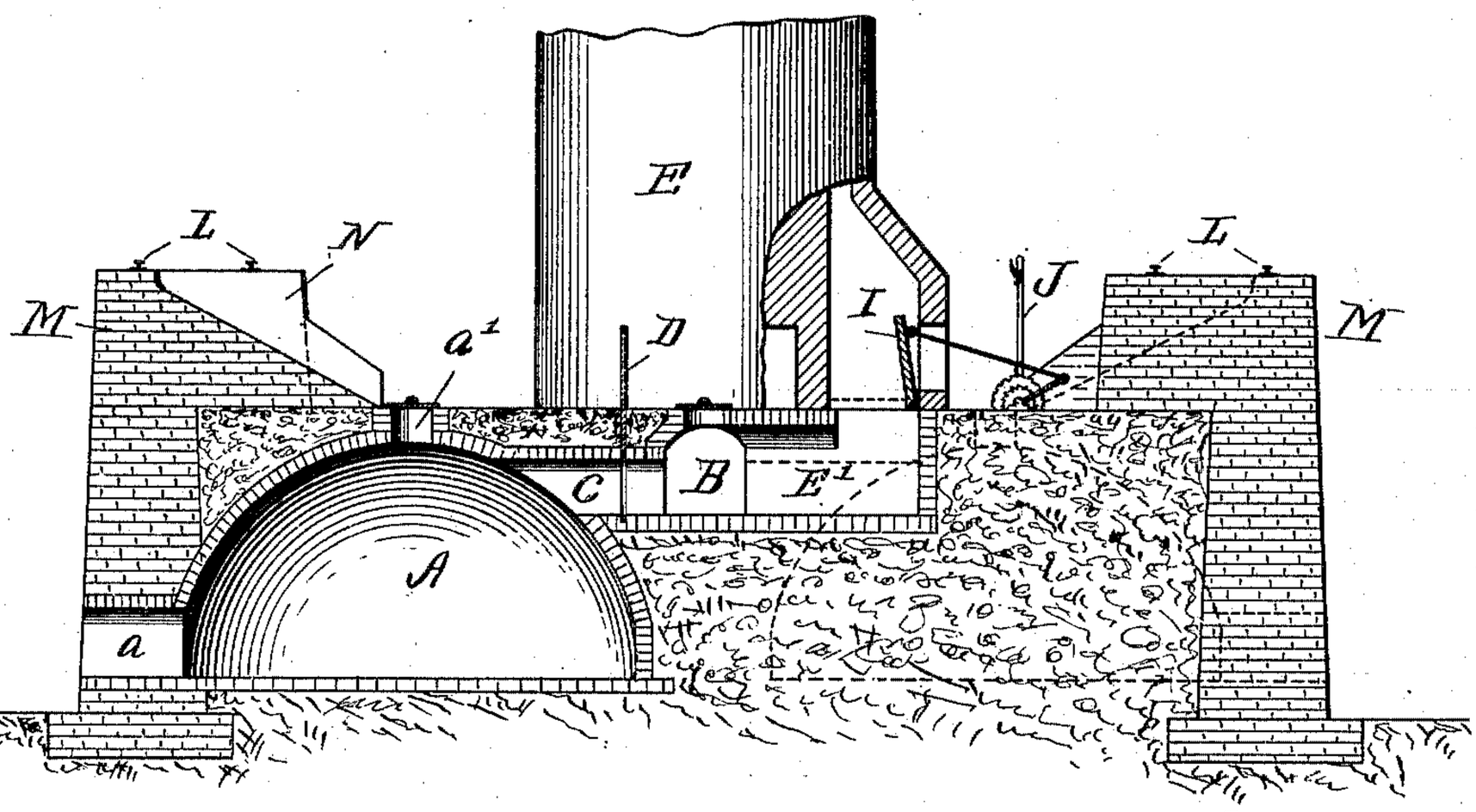


Fig. 6.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 7.

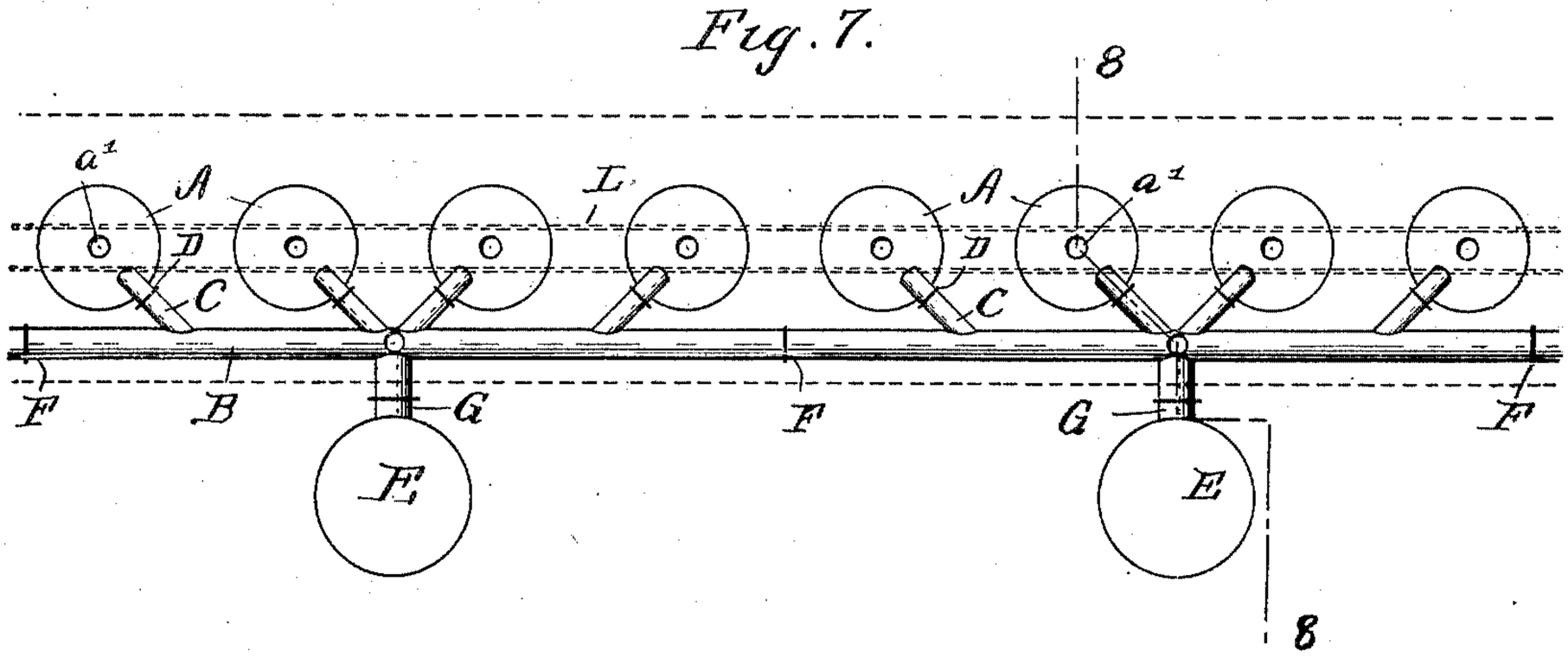
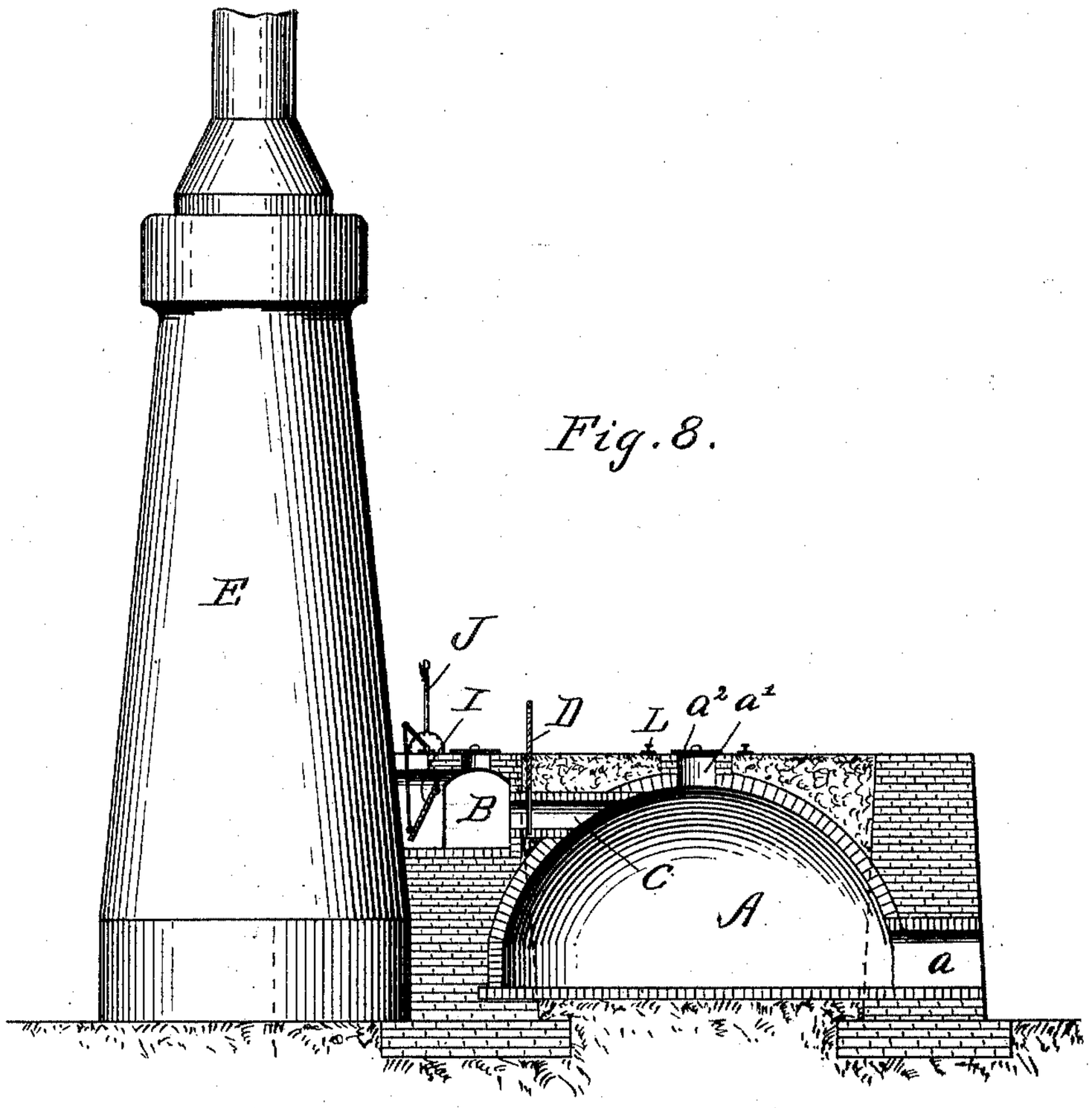


Fig. 8.



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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 9.

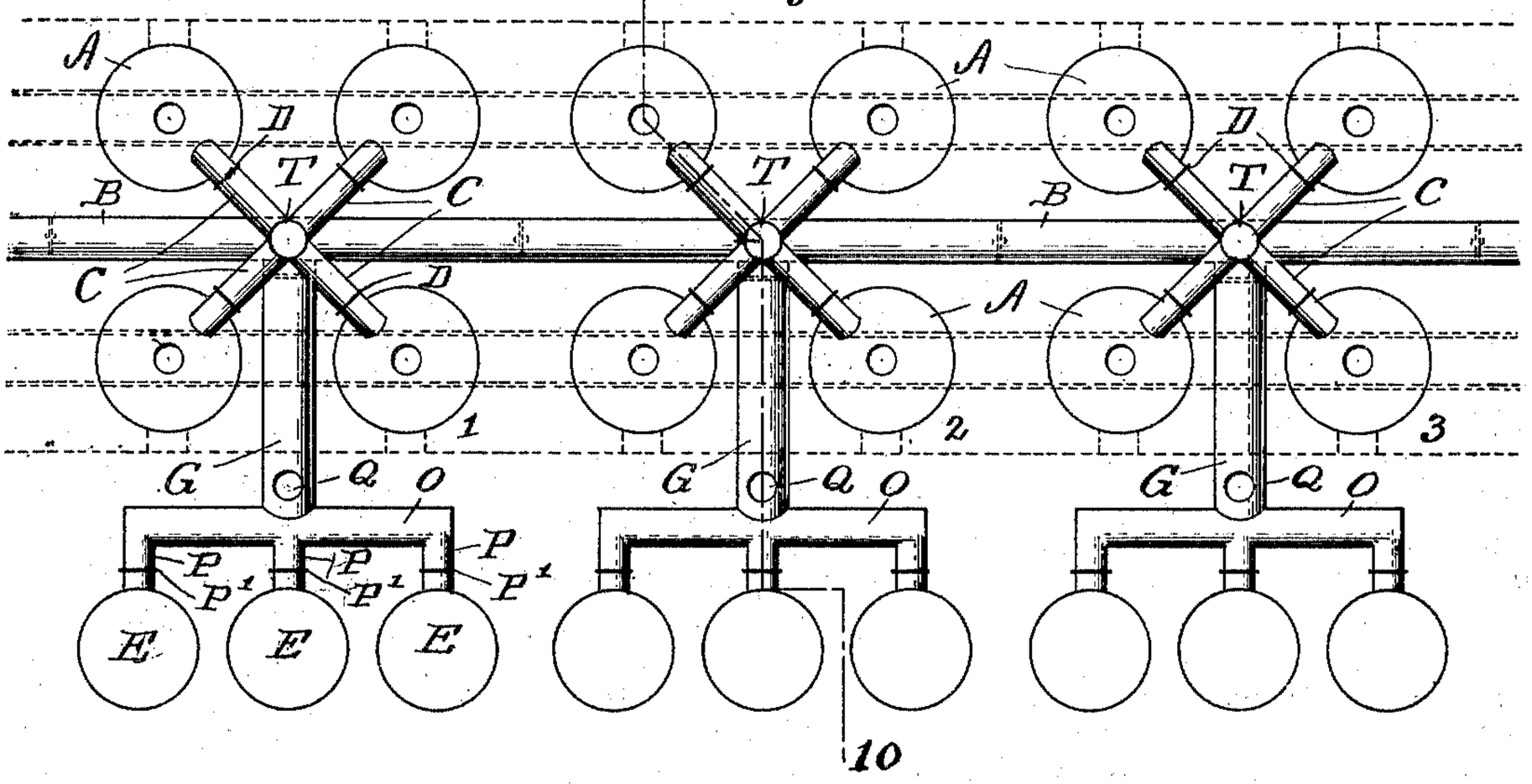

Fig. 11.

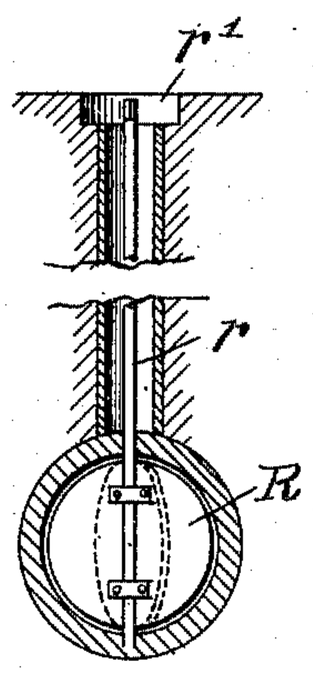

Fig. 12.

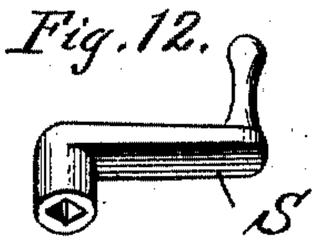

Fig. 10.

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UNITED STATES PATENT OFFICE.

JACOB B. BEAM, OF BIGRUN, PENNSYLVANIA, ASSIGNOR TO THE BEAM COKE OVEN STEAM BOILER POWER COMPANY, OF PUNXSUTAWNEY, PENNSYLVANIA, A CORPORATION OF NORTH DAKOTA.

COKE-OVEN.

SPECIFICATION forming part of Letters Patent No. 760,372, dated May 17, 1904.

Application filed August 20, 1903. Serial No. 170,214. (No model.)

To all whom it may concern:

Be it known that I, JACOB B. BEAM, a citizen of the United States, residing at Bigrun, in the county of Jefferson and State of Pennsylvania, have invented certain new and useful Improvements in Coke-Ovens, of which the following is a specification.

The object of my invention is to so construct and arrange coke-ovens that the gases which pass from them may be properly collected and conducted to steam-boiler furnaces, where they may be utilized for generating steam for various industrial purposes. It has heretofore been proposed to do this; but the ovens and their flues have not been so arranged as to conduct the gases without loss of heat or to prevent explosions or to allow the coking operation to proceed properly without interruption, nor have they been organized in such manner as to produce the highest efficiency in the use of the gases admitted under the boilers.

According to my invention I arrange the steam-generators close to the ovens and connect them with the ovens by means of flues located underground and so arranged that the hot gases may be conducted through them to the furnaces without undue loss by radiation, while such ovens as are being drawn or refilled or which are out of operation for any other reason have their heat maintained, so that their charges may be quickly ignited when they are properly prepared.

Each oven connects with the main flue by means of a branch flue, which opens into the oven a considerable distance above the level of the coke, and each of these branch flues is provided with a valve located close to the oven and serving to cut off such oven while it is being drawn or recharged and until the proper temperature is attained within it.

As usual, the ovens are arranged in two parallel rows, and the main flue, which is located between the rows of ovens, runs parallel with them. The furnaces are located specified distances apart, and valves in the flues are so distributed that any desired number of ovens may be made to supply a furnace. The organization is also such that after an oven has become cool while being drawn or recharged its temperature may be quickly raised by causing the hot gases from one or more adjacent ovens to enter it, and in order to more effectively carry off the gases during the coking operations and to promote combustion while passing through the flues and furnaces the branch flues from the ovens are located in such relation to the top openings in the ovens that air may be drawn through these openings and through the flues without in any way interfering with the coking operation.

In the accompanying drawings, Figure 1 is a diagram illustrating one way in which the ovens, flues, and furnaces may be arranged in accordance with my invention. Fig. 2 shows, on an enlarged scale and in section and more in detail, the arrangement of ovens, furnaces, flues, and valves indicated in outline in Fig. 1. Fig. 3 is an enlarged detail sectional view illustrating the valved flue leading into one of the boiler-furnaces. Fig. 4 is a detail plan view of the valve mechanism shown in Fig. 3. Fig. 5 is a diagram illustrating a modified way of arranging the boilers, ovens, and flues. Fig. 6 is a view on a larger scale and partly in section on the line 6 6 of Fig. 5. Fig 7 is a diagram illustrating another modification. Fig. 8 is an enlarged view, in vertical section, on the line 8 8 of Fig. 7. Fig. 9 is a diagram illustrating still another modification. Fig. 10 is an enlarged view, in vertical section, on the line 10 10 of Fig. 9. Fig. 11 is a detail sectional view of one of the valves employed. Fig. 12 is a perspective view of a crank-handle which may be employed for operating the valve shown in Fig. 11.

As illustrated in Fig. 1, there are two parallel rows of ovens A. They are of the ordinary beehive type, being lined with fire-brick and inclosed in masonry, with proper filling, in the usual manner. The doors or drawing-orifices a are located in the usual place, and each oven is formed with a central opening a' at the top, which may be closed by a suitable lid a^2.

Running parallel with the two rows of ovens below the top of the masonry is a main flue B. The ovens are connected with this main flue by means of branch flues C, which are located below the top level and open into the ovens a considerable distance above the level of the charges and close to the top openings a'. Each of these branch flues is provided with a valve D, preferably of the form shown, which when closed has its upper end quite close to the top level.

In Fig. 1 I have shown sixteen ovens. In some cases I prefer to supply each furnace E with hot gases from eight ovens. I therefore arrange valves F in the main in such manner as to separate groups of eight ovens from the others. If the valves at x, x', and x^2 are closed, it will be readily seen that the furnace at y will be supplied from the eight ovens to the left of the valve x', while the furnace at y' will be supplied from the eight ovens to the right of the valve x'; but the arrangement is such that the valves F may be shifted so that a furnace may be supplied from ovens anywhere along the line. If, for instance, half of the ovens to the left of the valve x' are out of operation and half of the ovens to the right of the valve x' are also out of operation, enough heat could probably not be obtained from a set of eight ovens to supply a furnace. By opening the valve at x' the hot gases from the ovens both to the right and to the left of this valve could be drawn into one of the furnaces. Thus one of the furnaces could be kept in operation, instead of throwing both of them out.

In Fig. 1 some of the ovens are shown connected directly with the main by branch flues C, arranged at right angles therewith. Some of the ovens, however, are connected with the main by means of diagonally-arranged flues c. The furnaces are connected with the main by relatively large flues G, which join the main where the branch flues c join it. At each of these points I preferably construct a manhole H, closed by a suitable cover h. Near the end of each flue G, next the furnace E, I arrange a valve I, by means of which the adjacent furnaces may be entirely cut off from the main or the passage of the hot gases to the furnace may be suitably regulated. This valve, as shown, consists of a hinged plate, to which is connected a rod i, that projects through a slotted opening i' in the covering above the flue G and connects with an arm i^2 on a rock-shaft i^3, mounted in suitable bearings over the flue. To one end of this rock-shaft is secured an operating-lever J, provided with detent mechanism j, engaging a toothed wheel j' on the rock-shaft. A ratchet-wheel K is also attached to the rock-shaft, and with this wheel engages a pawl K', which is pivoted in suitable stationary bearings and is provided with a foot-piece k. When the detent is released and the pawl K' is raised, the lever J may be turned in either direction to open or close the valve I, and the valve may be held in any desired position by suitably setting the pawl K'.

It will be observed that the main B is below the top level of the masonry, and hence there is no free radiation from it to the open air. Such radiation as there is from it is compensated for usually by the radiation from the ovens themselves, so that the heat of the gases drawn from the ovens is maintained until these gases reach the furnaces E; but where ovens are being drawn and recharged their temperature of course tends to fall, but their temperature is prevented from falling low in a large measure by means of the heat which radiates from the main B.

It is the common practice to draw every other oven in the series, so that the temperature of the ovens shall not unduly fall, and in ordinary weather the heat from the ovens not being drawn is sufficient to maintain the heat of the drawn ovens to such an extent that after these ovens are recharged and closed combustion will take place spontaneously; but in zero weather this is not always the case. By my improvement, however, where the main B is run close to all the ovens the temperature of the drawn ovens is maintained much more effectively. Furthermore, the organization is such that the heat or hot gases from adjacent ovens may be thrown into the drawn and recharged ovens. By closing the valve I the hot gases will be prevented from escaping from the flues, and hence will be forced back, and if the valves D of ovens which have been recharged are opened the gases will pass into the ovens and quickly raise their temperature, thus starting the combustion of the coal. Then the valve I may be opened and the hot gases be allowed to enter the furnaces E. The valves D may be closed at such ovens as are commencing to operate until the coal has properly ignited and the proper degree of combustion has been attained.

The inner ends of the flues C are a considerable distance above the coke-line z, (indicated in Fig. 2,) and they should be quite close to the top openings a'. This feature is better shown in Figs. 8 and 10. By removing the lids a^2 from the ovens air will be drawn in through the openings a' and out through the flues C, thus promoting combustion in the flues and in the furnaces E. The furnaces are provided with high stacks, which produce a strong draft through the flues. Hence the products of combustion do not tend to pass out through the openings a'; but air is drawn in through them and passes directly to the flues C without coming in contact with the coke or in any way interfering with the combustion of the charge. The air merely comes in contact with and mingles with the hot gases at the time when they are ready to escape. The tracks L for the dump-cars in this instance pass directly over the charging-

openings *a'*; but they may be otherwise arranged, as hereinafter described; but it will be observed that everything about the ovens is located below the top of the masonry, or close to the top thereof, so that the workmen can move about freely without obstruction.

In Figs. 1 and 2 the furnaces E are shown as being located close to the ovens and at the sides thereof. They may be located between the ovens, as hereinafter described; but it is important that they be located close to them in order that there may be no undue loss of heat by radiation. The steam generated by the furnaces may be used to operate engines in electric power and lighting plants, and the electricity thus generated may be carried to distant points for consumption.

In Figs. 5 and 6 the furnaces E are shown as being located between the two parallel rows of ovens A. In this instance the main B is divided by valves F in such manner that each furnace E is supplied from four ovens. Tracks L for the dump-cars are located on elevations M above the level of the filling-orifices *a'*, and these elevations are formed with chutes N, leading from between the rails to the filling-orifices. The furnaces E are connected with the main by flues E', and these flues E' are provided with valves I, similar to that correspondingly lettered in Fig. 3. The construction and operation of the ovens and the furnaces shown in Figs. 5 and 6 is in other respects similar to those heretofore described.

In Fig. 7 I have shown a single row of ovens with the track L arranged immediately over the filling-orifices *a'*. Valves F are located in the main B at suitable distances apart, and the furnaces E are connected with the main by valved flues G. Each furnace E is shown as being arranged to be supplied from four ovens; but by opening the valves F gases may be drawn from a larger number of ovens, if desired.

In Figs. 9 and 10 a somewhat different organization is illustrated. In the drawings before described the flues, while being arranged below the top level, are comparatively close to the surface, so that they may be built or laid without digging deep or interfering with the construction of the ovens, and hence it is easy to apply these improvements to ovens already built.

In Figs. 9 and 10 some of the flues are shown as being located below the bottom level of the ovens. This modification of my invention can best be applied to ovens while they are being built. It cannot so readily be applied to ovens already constructed. The main flue B runs parallel with and between the ovens A; but it is deep down in the ground below the bottom level of the ovens, and between each set of four ovens it connects with a vertical flue T, closed by a cover *t*. With this vertical flue are connected four branch flues C, similar to those before described, and each having a valve D. Where each vertical flue T joins the main B, a lateral flue G joins the main and passes out between two adjacent ovens and below the bottom level thereof, connecting with a transverse flue O, which communicates by branch flues P with furnaces E. The branches P are provided with valves P', by means of which the hot gases may be shut off from one or more of the furnaces, and a manhole Q is provided near the point where the flue G joins the transverse flue O. A valve R is located at the inner end of each flue G, near the main B. This valve is preferably of the ordinary stovepipe variety and has a long vertical stem *r*, reaching to near the top level. Its upper end is preferably arranged in a recess *r'* below the surface and is squared to receive a crank-handle S. By the use of such a valve I avoid projections above the top level, so that the space above the ovens is clear.

The principal advantage in the construction just described is that the heat is better maintained in the flues, and such ovens as tend to lower in temperature while being drawn and recharged are prevented largely from doing so by the heat which radiates from the flues B and G. Not only are the ovens heated by radiation from the flues B, which pass between the two series, but some of the ovens—viz., those on one side—are heated by the radiation from the flues G. It being remembered that in working the ovens only every other or each alternate one is drawn at a time, it will be seen that the temperature of such ovens as are being drawn will be prevented from falling too low by the heat which radiates from the flues. The flues G being arranged between each two ovens on one side, if the ovens 1 2 3 are thrown out of operation to be drawn and recharged they will be heated by the hot gases passing through the flues G, which are adjacent to them, as well as by the hot gases in the main flue B.

I am aware that various attempts have been made to utilize the hot gases from coke-ovens; but they have not come into general use owing to defects in the general organization proposed and in the details of construction. All parts of the ovens, flues, &c., made in accordance with my invention are strong and durable. Practically no modification of the ovens proper is necessary, and additions which I have made instead of interfering with the usual and proper operations of the ovens very materially facilitates such operation and in addition enables me to utilize hot gases heretofore commonly wasted.

I claim as my invention—

1. The combination of a series of ovens, a main flue running parallel with the ovens below the top level and communicating with the ovens by branch flues also below the top, valves placed at suitable distances apart and dividing the main flue into sections, valves in the branch flues controlling the passage of

gases from the ovens to the main flue, furnaces placed close to the ovens and connected with the main flue by branch flues and valves in said last-mentioned branch flues for regulating the admission of gases to the furnaces.

2. The combination of a series of ovens, a main flue running parallel therewith below the top level and communicating with the ovens by branch flues which enter the ovens above the coke-level and close to the filling-orifices of the ovens, valves placed at suitable distances apart and dividing the main flue into sections, valves in the branch flues controlling the passage of gases from the ovens to the main flue, furnaces close to the ovens and connected with the main flue by branch flues and valves in said branch flues for regulating the admission of gases to the furnaces.

3. The combination of a series of ovens, a main flue running parallel with the ovens below the top level and communicating with the ovens by branch flues which enter the ovens above the coke-level and close to the filling-orifices of the ovens, valves in the branch flues controlling the passage of gases from the ovens to the main flue, a furnace close to the ovens and connected with the main flue by a branch flue and a valve in said branch flue for regulating the admission of gases to the furnace and which when closed causes the gases to back up into a recently-charged oven.

4. The combination of a series of ovens, a main flue running parallel therewith below the top level, a furnace placed close to the ovens, an underground branch flue connecting the furnace with the main flue and passing between two ovens in such proximity thereto as to impart heat to said ovens and valved branch flues connecting the ovens with the flues leading to the furnace.

5. The combination of two parallel series of ovens, a main flue running parallel with the oven below their top level and in such proximity thereto as to impart heat to them, valved branch flues below the top level and connecting the ovens with the main flue, valves placed at intervals and dividing the main flue into sections, furnaces connected with the main flue by underground branch flues which pass between two adjacent ovens and in such proximity thereto as to impart heat to them and valves in said branch flues for regulating the admission of gases to the furnaces and which when closed cause gases to back up into recently-charged ovens.

6. The combination of a series of ovens, a main flue running parallel therewith and arranged below the bottom level of the ovens, vertical flues arranged at intervals and communicating with the main flue, valved branch flues connecting the vertical flues with the ovens, furnaces arranged at intervals close to the ovens and branch flues arranged between the ovens and below the bottom level thereof and each of which passes between two adjacent ovens and connects the main flue with a furnace.

7. The combination of two series of ovens, a main flue running parallel therewith between them and below the bottom level thereof, a vertical flue communicating with the main flue and connected by valved branch flues with a set of ovens, a furnace placed close to the ovens and a valved flue placed below the bottom level of the ovens which passes between two adjacent ovens and connects the main flue with the furnace.

8. The combination with two series of ovens, a main flue running parallel therewith between them, and below the bottom level thereof, a vertical flue connected with the main flue and connected by valved branch flues with a set of ovens, a furnace placed close to the ovens, a flue placed below the bottom level of the ovens which passes between two adjacent ovens and connects the main flue with the furnace, and a valve at the inner end of said last-mentioned flue and the main flue provided with a valve-stem reaching to the top level of the ovens.

9. The combination of two series of ovens, a main flue running parallel therewith between them and below the bottom level thereof, a vertical flue connected with the main flue and connected by valved branch flues with a set of ovens, a branch flue connected with the main flue and placed between two ovens below the bottom level thereof, a valve at the inner end of said flue next the main flue, a set of furnaces, a transverse flue at the outer end of the last-mentioned flue and valved branch flues leading from said transverse flue to said furnaces.

In testimony whereof I have hereunto subscribed my name.

JACOB B. BEAM.

Witnesses:
LLOYD B. WIGHT,
K. H. FENNING.