Feb. 24, 1942. C. OTTO 2,273,885

UNDERFIRED COKE OVEN

Filed Oct. 9, 1939 2 Sheets-Sheet 1

Fig. 2.

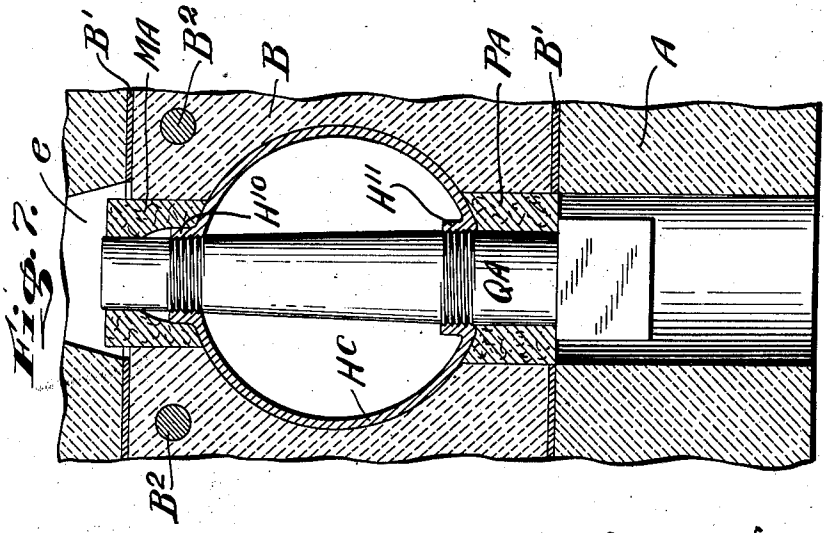
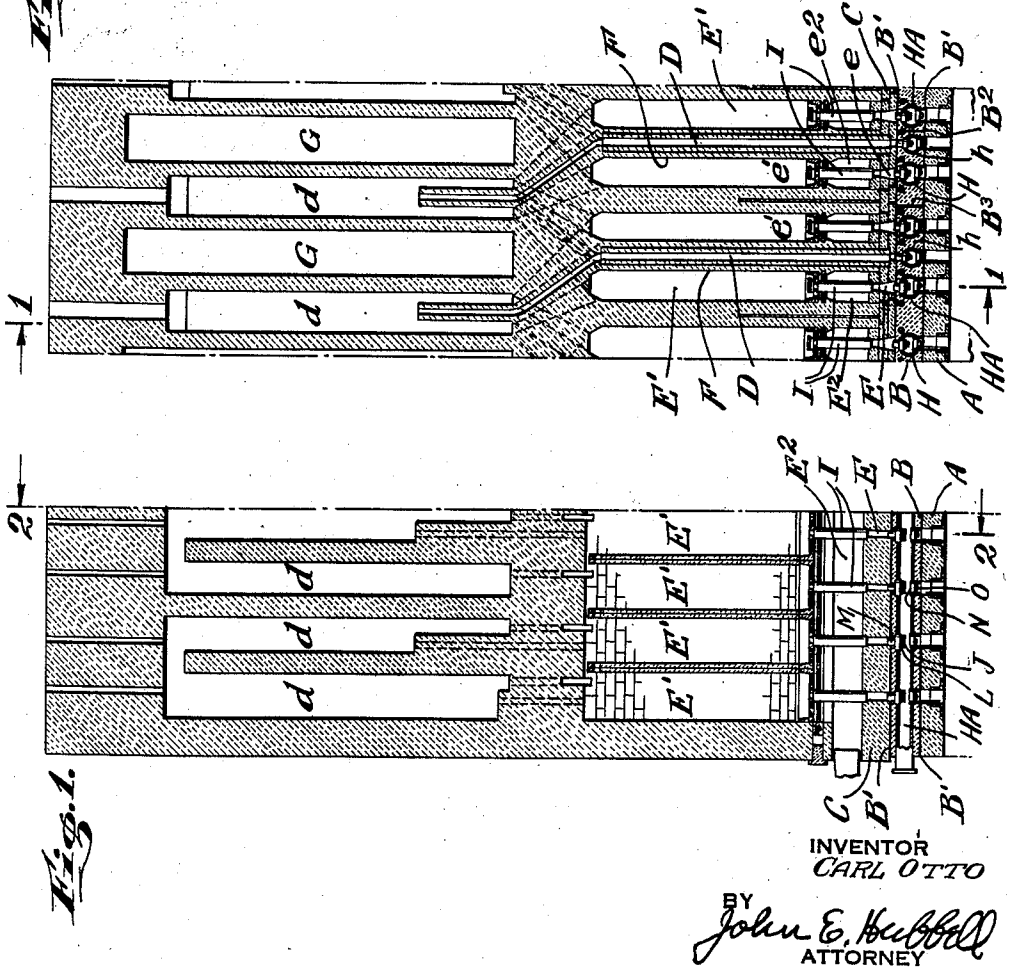


Fig. 1.



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Filed Oct. 9, 1939 2 Sheets-Sheet 2

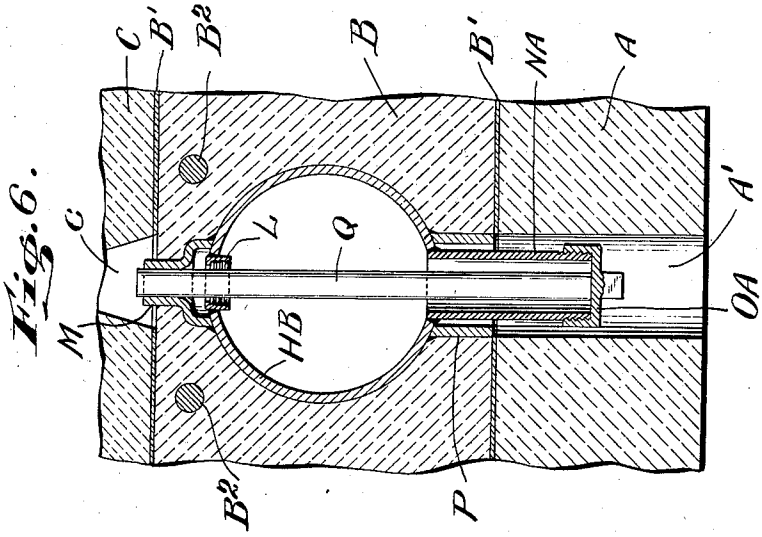


Fig. 6.

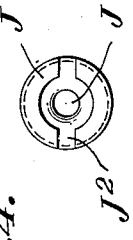


Fig. 4.

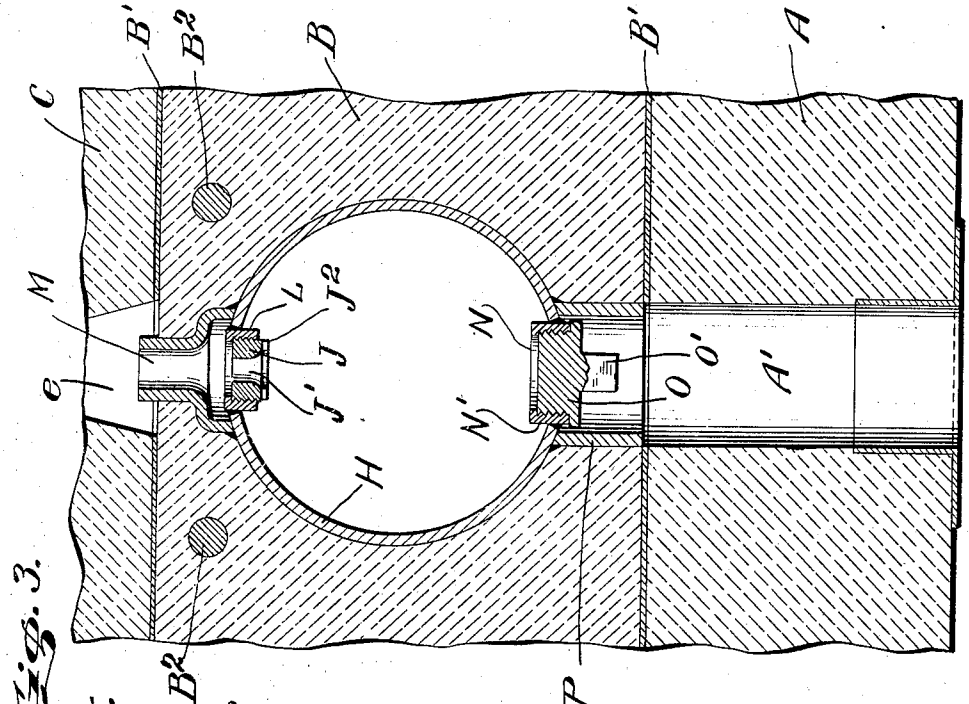


Fig. 3.

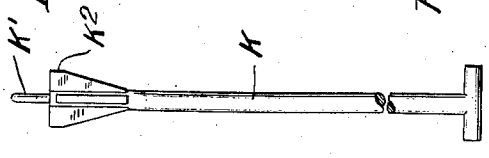


Fig. 5.

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2,273,885

UNDERFIRED COKE OVEN

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Application October 9, 1939, Serial No. 298,526

6 Claims. (Cl. 202—141)

The present invention relates to underfired regenerative coke oven batteries and particularly to coke oven batteries of the type comprising heating walls and regenerators extending transversely of the battery and in which each heating wall is formed with a row of vertical combustion flues. The general object of the present invention is to provide improved means for supplying the combustible agents used in heating such a battery to the latter at points suitably distributed transversely of the battery. The invention may be used with advantage in supplying to regenerators combustion air, and lean fuel gas when the latter is used in heating the battery, and in supplying rich fuel gas to the different combustion flues when the battery is heated by the combustion of rich fuel gas.

The present invention comprises improvements in a coke oven battery of the type disclosed in my prior application Serial No. 212,084, filed June 6, 1938, in which the combustible agents are supplied and distributed through horizontal distribution pipes, each extending transversely of the battery and imbedded in the lower portion of the battery masonry.

A specific object of the present invention is to provide distribution pipes which are embedded in a concrete layer interposed between the supporting deck of the battery and coke oven brick proper, with external core parts which are adapted to form passages in the concrete layer in register with longitudinally distributed outlet openings of the pipes and leading from said openings to the top of the layer, and which are adapted to distort or break loose from the pipe when necessary to permit longitudinal expansion and contraction of the pipe to the concrete layer without injury to the pipe or layer. In a preferred form of the invention, the core parts are tubular metallic sections, tightly welded to the pipe so that little force is required to break them loose but the core parts may also be formed of wood or paper which will char and disintegrate as the battery is being initially heated up. Ordinarily, also, the pipes support core parts which are adapted to form passages extending to the underside of the concrete layer and through which adjustments are effected to regulate the outflow through the different pipe discharge passages.

Another specific object of the invention is to provide the distribution pipes with improved provisions for regulating the outflow through the discharge outlets. In a preferred form of the invention, the discharge outlets are formed in the top wall of each pipe, and the latter is provided with internally threaded seats for externally threaded flow regulating orifice members each orifice member being replaceable by another of different flow capacity through a corresponding normally closed opening in the bottom wall of the pipe. The invention is characterized by the mechanical simplicity, strength, durability and inherently low cost of construction of the distribution pipes and associated regulating provisions.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and specific objects attained with its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a partial longitudinal section through a coke oven battery, taken on the line 1—1 of Fig. 2;

Fig. 2 is a partial transverse section taken on the broken line 2—2 of Fig. 1;

Fig. 3 is an enlarged reproduction of a portion of Fig. 1;

Fig. 4 is an end elevation of a replaceable discharge orifice member;

Fig. 5 is an elevation of an implement for use in replacing orifice members; and

Figs. 6 and 7 are partial sections taken similarly to, and each illustrating a different modification of the construction shown in Fig. 3.

In Figs. 1 and 2, I have illustrated the use of the present invention in an underfired coke oven battery of a general type and form disclosed in my said prior application, and in which steel distribution pipes H, HA and *h*, each extending transversely of the coke oven battery, are incorporated in a special masonry layer B interposed between the reinforced concrete deck member A, and the coke oven brickwork mass C. The pipes H, HA and *h* may all be similar in construction, but the pipes *h* are ordinarily smaller in diameter than the pipes H and HA. The deck member A which supports the battery superstructure above it, and forms the roof of the characteristic basement space of the underfired coke oven battery, may be supported by pillar walls or columns in the usual manner. The masonry layer B is advantageously formed of concrete of such composition that it has approximately the same thermal coefficient of expansion as the steel

distribution pipes H, HA and *h* imbedded therein, under normal working temperature conditions. To avoid damage as a result of the bodily expansion of the layer B relative to the deck A, and relative to the brickwork C, particularly during the initial heating up of the battery, heavy tar layers B' are interposed between the layer B and deck A, and between the layer B and the masonry C. The layer B may advantageously be reenforced, also, by transverse tierods B^2, and is advantageously divided into longitudinal sections separated by expansion joints B^3.

As will be understood, when the battery is being heated by the combustion of rich gas supplied through the distribution pipes *h*, the distribution pipes H are employed to supply combustion air only, and ordinarily when the oven is being heated by the combustion of lean gas supplied through the distribution pipes H, no rich fuel gas is supplied through the pipes *h*. References to other features of the battery heating provisions are unnecessary herein, as they may be of the type fully disclosed in my said prior application, and as they form no part of the invention claimed herein, which is adapted for use in coke oven batteries having other heating provisions.

Each distribution pipe H is adapted to pass the combustible agent, air or lean gas fuel, which it receives, to a multiplicity of uprising regenerator inlet channels *e* at one side, and distributed along the length, of a pillar wall F beneath an adjacent coking chamber G, and an adjacent distribution pipe HA adapted to supply combustion air to a multiplicity of uprising regenerator inlet channels E at the other side, and distributed along the length, of the same pillar wall F, and each pipe *h* is adapted to supply rich fuel gas to a multiplicity of uprising supply channels D formed in a corresponding pillar wall F and leading to flues *d* in the heating walls at the opposite sides of the adjacent oven chamber G.

In the particular battery construction illustrated, each of the inlets *e* associated with a single distribution pipe H, is connected by an individual pipe I to a corresponding one of a plurality of regenerator chambers or cells *e'* into which the regenerator space above the pipe is divided as by portions of the regenerator checkerbrick shown in Fig. 1. The pipes I thus connected to a row of regenerator inlets *e*, traverse the sole channel e^2 beneath and adapted to receive waste gases from the corresponding regenerator spaces *e'* to which the upper ends of said pipes I open. Similarly, each regenerator inlet E is connected by an individual pipe I to a corresponding regenerator space E' directly above the sole channel E^2 traversed by the row of pipes I above a distribution pipe HA.

In the form of the invention shown in Figs. 1–4, each regenerator inlet *e* receives air or lean gas from the corresponding distribution pipe H through the measuring orifice J' in an orifice member J removably mounted in a corresponding discharge opening in the top wall of the pipe. As shown in Fig. 3, each orifice member is externally threaded and is received in an internally threaded seat with which the pipe is provided, and which is shown in Fig. 3 as formed by internally threading a short pipe section L, which extends through the corresponding opening in the top wall of the pipe H, and is welded to the pipe with its upper end approximately flush with the top surface of the pipe.

The fluid discharged through each orifice J' passes to the corresponding channel E through a corresponding passage formed in the portion of the concrete layer B between the pipe and the channel *e* and lined by a tubular metallic part M. The latter serves in the formation of the layer B as a core part about which the concrete is poured. Each part M may advantageously be welded at a few points to the corresponding pipe H to provide a frangible welded connection, adapted to break when necessary to accommodate relative longitudinal expansion and contraction of the pipe H relative to the concrete B without injury to the pipe or concrete. The core parts should be suitably proportioned so that when the maximum expansion or contraction of the pipe relative to the concrete has occurred, there will still be a free flow passage of ample cross section between each orifice J' and the corresponding passage *e*. By welding the parts M to the pipe H, the parts are held against accidental displacement during the formation of the concrete layer B. As will be apparent, however, it is not necessary that the joint between each member M and the corresponding pipe H be gas tight, and, if, as a result of relative expansion or contraction, a part M is broken loose from the pipe H, no detrimental operating effect will result.

At its bottom, the pipe H is formed with openings, which are respectively in vertical alignment with the different orifice members J, and are normally closed by removable stoppers O. The latter as shown, are in the form of externally threaded plugs screwed into internally threaded annular members N, which are larger in diameter but may be otherwise like the previously mentioned members L, and are similarly welded to the pipe H. To facilitate the ready removal of each stopper member O, when access to the orifice member J above it is desired, the stopper is preferably provided at its lower side with a squared extension N' for socket wrench engagement, or is otherwise adapted to be operatively engaged by a wrench or analogous implement. In the preferred construction shown, the pipe H has welded to its underside cylindrical members P, each coaxial with but larger in diameter than a corresponding member N. The parts P are like the parts M, in that each part P serves as a hollow core to define a corresponding passage in the concrete layer B when the latter is poured about the pipe. The vertical passage surrounded by each member P is in communication at its lower end with the upper end of a corresponding vertical passage A' formed in the deck member A. As will be understood, each part M may be a simple cylinder, like the parts P, instead of being smaller in diameter at its upper end than at its lower end.

To facilitate the replacement of an orifice member J having an orifice J' of one diameter, by another member J having an orifice J' of different diameter, each orifice member J is shaped for operative connection to a suitable tool, such as the screw-driver-like implement K, shown in Fig. 5. The latter is provided at its orifice engaging end with an axial centering pin part K', adapted to enter the orifice J' of a member J to be adjusted, and is formed with diametrically opposed wings K^2 adapted to enter portions of a diametrical kerf J^2 formed in the underside of the nozzle. Each implement K is of suitable length to have its lower handle portion at a convenient distance below the underside of the deck

A when the implement K is in operative engagement with a nozzle member.

All of the pipes H, HA and *h* may be similar in type, and each may be associated in a similar manner with uprising distribution channels formed in the concrete layer B above the pipe, and with access channels formed beneath the pipe in the concrete layer B and deck A.

The construction shown in Fig. 6 differs from that shown in Figs. 1–4, only in the form of the closures for the distribution pipe bottom openings, the distribution pipe HB shown in Fig. 6 differing from the pipe H shown in Fig. 3 in that a tubular pipe section NA having its upper end welded in the corresponding bottom opening of the pipe HB, is long enough to have its lower end at a considerable distance below the pipe HB. The resultant lowering of the corresponding stopper OA facilitates the removal and replacement of the latter. The elongation of the tubular part NA need not interfere with the capacity for relative longitudinal expansion and contraction of the pipe HB relative to the concrete layer B, since it is feasible to provide ample clearance between each member NA and the surrounding member P to accommodate such expansion and contraction. Similarly, each tubular part NA may be sufficiently smaller in diameter than the corresponding passage A' to accommodate such relative horizontal expansion of the deck A and concrete layer B, as may occur. The stopper OA of Fig. 6, is an internally threaded cap. As will be apparent, the member MA might be elongated sufficiently to have its lower end below the underside of the deck, but when it terminates within the deck member as shown in Fig. 6, it is out of the way of and does not interfere with the operations or movements of attendants working and moving about in the basement space of the battery.

In normal operation, an orifice member, which may be exactly like the previously described orifice member J, is threaded into each part L of the construction shown in Fig. 6, but as actually shown in Fig. 6 no orifice member is seated in the member L, and a member Q, supported by the corresponding stopper OA, extends vertically upward through the pipe HB and annular part L, and into the corresponding part O. The purpose of the part Q, which, as shown, fills and closes the bore of the smaller upper end portion of the member M, is to prevent the accidental entrance of mortar, broken brick parts, or the like, into the distribution piping during the construction of the battery. After the latter is constructed and before the distribution pipes are put into use, the members Q are removed and suitable orifice members J are screwed into the corresponding parts L. As will be apparent, members Q of suitable length may be similarly used with the construction shown in Figs. 1–4.

While a steel distribution pipe used as are the pipes H, HA, HB and *h*, will ordinarily have a wall too thin to permit simple openings in its top and bottom portions to be threaded for effective engagement by corresponding threaded inlet and closure parts, respectively, the need for welding separate internally threaded tubular parts, such as the parts L, N, and NA to the distribution pipe, may be avoided in the manner illustrated by Fig. 7. The distribution pipe HC shown in Fig. 7, has its top outlet openings and its bottom access openings formed by punching operations so carried out as to provide the pipe with an integral tubular boss portion H^{10} surrounding each upper discharge opening of the pipe, and with an integral tubular boss portion H^{11} surrounding each access opening in the bottom of the pipe. The boss H^{10} is internally threaded to adapt it to receive a replaceable orifice member, which may be exactly like the previously described orifice member J. Similarly, each boss H^{11} may be internally threaded to receive a suitable removable closure device, which may be exactly like the device O shown in Fig. 3.

It is possible to provide the distribution pipe HC shown in Fig. 7 with external tubular metallic core parts lightly welded to the distribution pipe, as are the core parts M and P in the constructions previously described. As shown in Fig. 7, however, the upper and lower core parts MA and PA, respectively, associated with the pipe HC, are tubular bodies of wood, paper board, or other material adapted to crush when subjected to expansion stresses incident to the heating up of the battery, and to char or burn out as the working battery temperatures are attained. As shown in Fig. 7, each aligned pair of parts NA and PA are initially secured in place by a pin QA which may be formed of wood, and which serves the above described purposes of the part Q, and which is shaped and proportioned for a driving fit in one or both of the bosses H^{10} and H^{11} and also to hold the part PA against down movement relative to the pin.

As those skilled in the art will understand, a single coke oven battery of commercial size constructed in accordance with the present invention, may include more than four thousand orifice members J. Those orifice members will have orifices of a number of different diameters. Some at least of the orifice members may need to be replaced from time to time by others having different sized orifices as a result of changes in operating conditions, and in general, the sizes of the different orifices which will give the best operating results, can be determined only by the operation of the battery. Furtherfore, it is ordinarily necessary to remove the orifice members from time to time to permit the registering distribution channels above the distribution pipe outlets to be cleaned, and also to permit joint tightening operations, particularly in the initial operation of the battery. As will be apparent, the multiplicity of orifice members J required in a coke oven battery, may be readily manufactured with the desired accuracy, and at a relatively low cost, and can be very easily installed and removed and replaced when necessary.

A brickwork joint tightening operation to which an underfired coke oven battery is customarily subjected, following a short initial period of operation, consists in forcing fluid mortar upward into each of the rich gas supply channels D, practically to the upper end of the channel, and after a short period withdrawing the major, still fluid, residue portion of the mortar. This grouting, or joint tightening, operation, in an oven having distribution pipes *h* of the character described, is facilitated by the fact that the pipe through which mortar under suitable pressure is forced up into each channel D may be readily screwed into the threaded seat in the top outlet opening of the distribution pipe *h*, in which a corresponding orifice member J is normally seated.

While in accordance with the provisions of the statutes, I have illustrated and described the best forms of embodiment of my invention now known

to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. An underfired regenerative coke oven battery comprising a basement space, a masonry mass above said space and including coking chambers, flued heating walls, and regenerators, and combustible agent distribution pipes embedded in the lower portion of said mass and extending transversely of the battery, each of said pipes having a plurality of internally threaded outlet openings in the upper portion of its wall and distributed longitudinally of the pipe, and having access openings in the lower portion of its wall and arranged one beneath each of said outlet openings, externally threaded orifice members one for and screwed in each of said outlet openings, and each replaceable through the corresponding access opening, and a removable closure for each of said access openings.

2. A coke oven battery as specified in claim 1, in which each of said internally threaded openings is formed by an internally threaded tubular part welded to the corresponding distribution pipe.

3. An underfired regenerative coke oven battery comprising a basement space, a masonry mass above said space and including coking chamber, flued heating walls, and regenerators, and combustible agent distribution pipes embedded in the lower portion of said mass and extending transversely of the battery, each of said pipes having a plurality of outlet openings in the upper portion of its wall and distributed longitudinally of the pipe, and having lower openings in the lower portion of its wall and arranged one beneath each of said outlet openings, each of said upper openings being surrounded by an integral, internally threaded, tubular portion of said pipe, externally threaded orifice members threaded one into each of said outlet openings, and each replaceable through the corresponding lower opening, a removable closure for each of said lower openings.

4. The combination in an underfired regenerative coke oven battery comprising a basement space, of a masonry mass above said space including a lower concrete layer and brickwork above said layer, with coking chambers, flued heating walls and regenerator chambers formed in said brickwork and uprising channels leading from the bottom of the brickwork up to the regenerator chambers and flued heating walls, combustible agent distribution pipes imbedded in said concrete layer and each extending transversely of the battery and having a plurality of outlet openings in its wall, and core parts mounted on each of said pipes and adapted, when the layer forming concrete is poured about said pipe, to form passages in the layer through which the said outlet openings of the pipe communicate with corresponding uprising passages in the brickwork, the core parts associated with each distribution pipe being displaceable relative thereto to accommodate longitudinal expansion and contraction of the pipe relative to the concrete layer.

5. A combination as specified in claim 4, in which the core parts are tubular bodies of metal lightly welded to the pipes with which they are associated.

6. A combination as specified in claim 4, in which the outlet openings in each distribution pipe are formed in the top portion of the pipe wall and in which access openings are formed in the bottom portion of the pipe wall respectively beneath the outlet openings and in which core parts are displaceably connected to the distribution pipe and are adapted, when the layer forming concrete is poured, to form passages extending downward from said access opening to the underside of the concrete layer.

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