Dec. 16, 1952 H. R. HORNER ET AL. 2,622,061

VERTICAL COKING RETORT WITH INTERNAL HEATING TUBES

Filed June 9, 1950 5 Sheets-Sheet 1

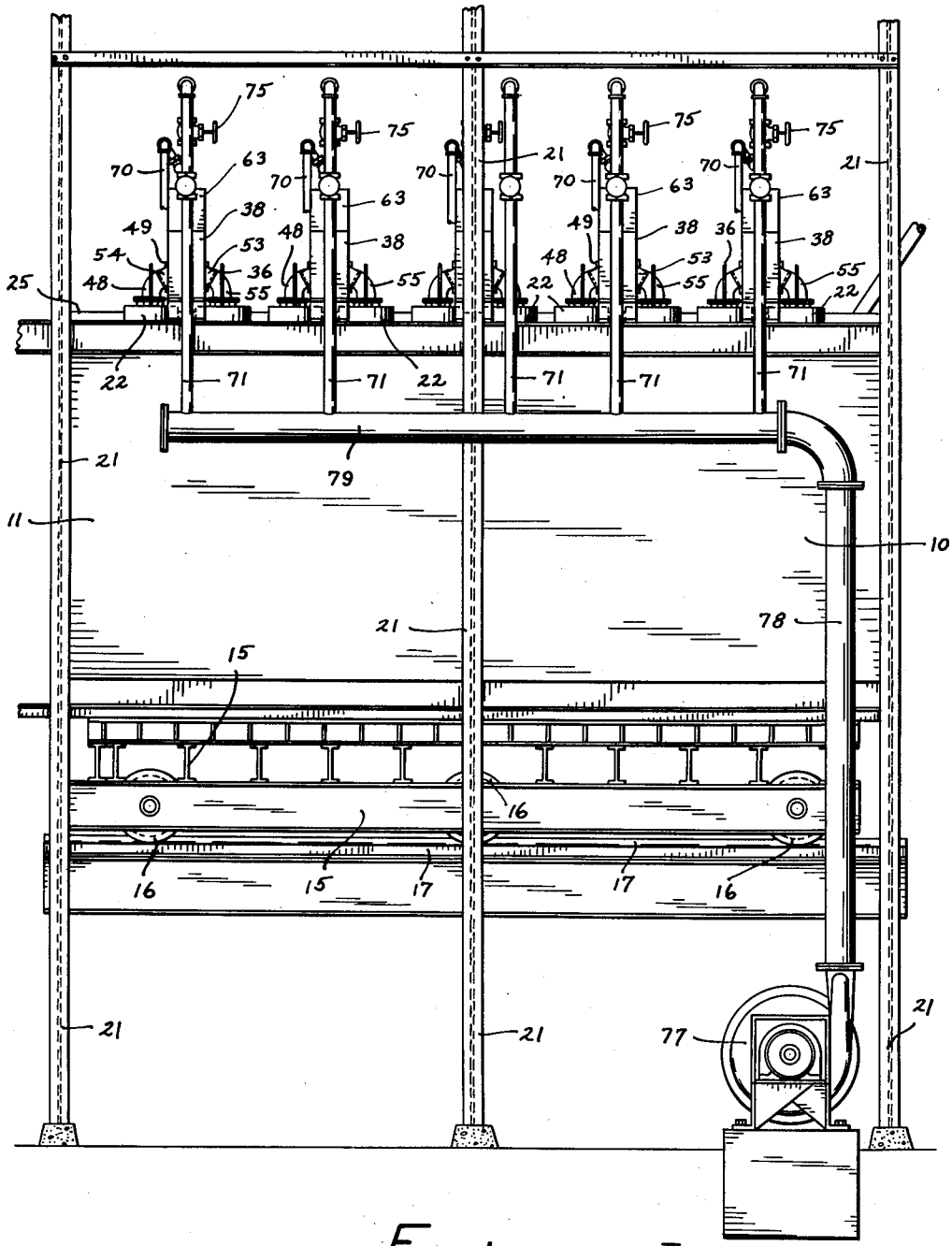


FIG. 1.

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VERTICAL COKING RETORT WITH INTERNAL HEATING TUBES

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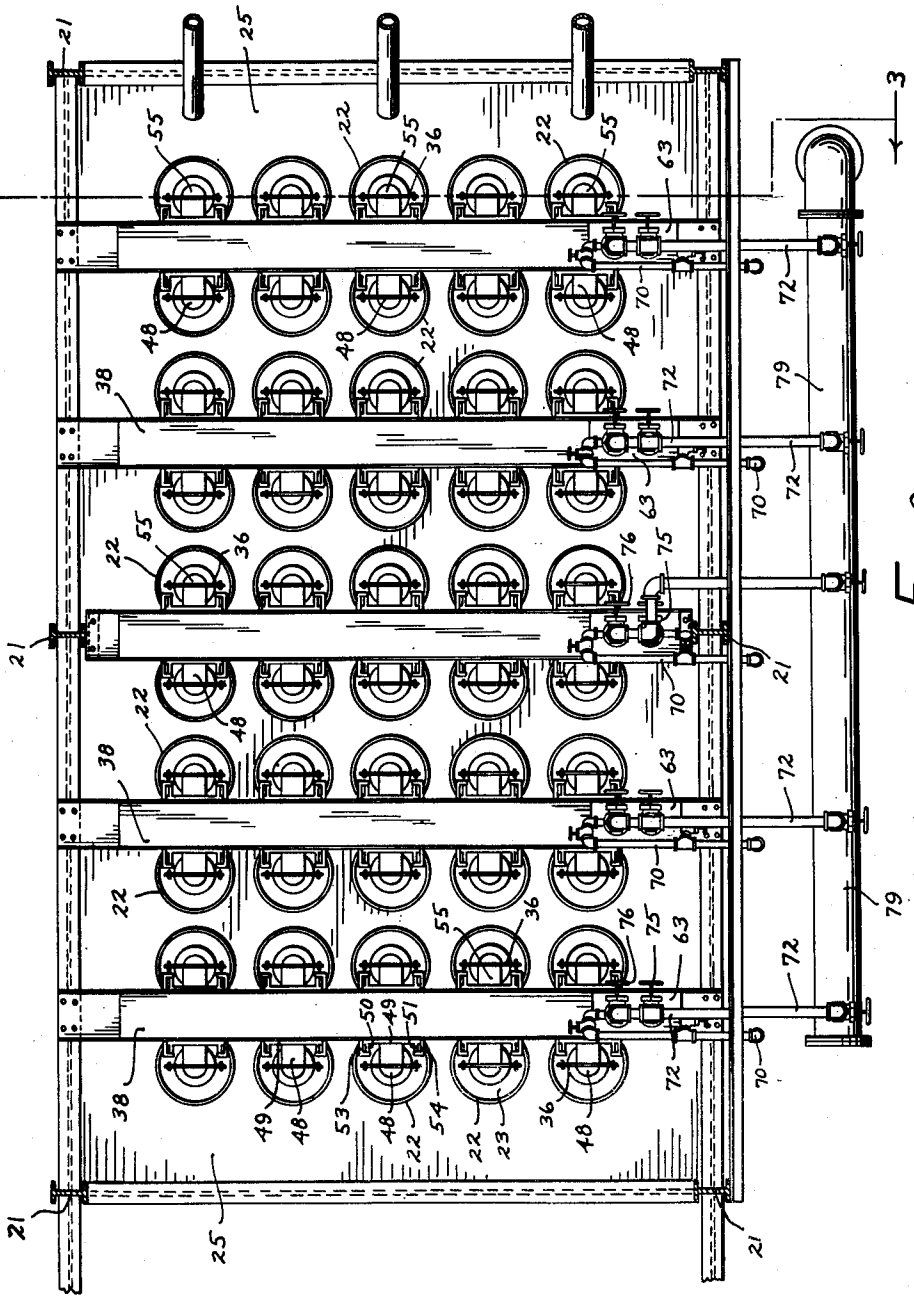


FIG. 2.

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VERTICAL COKING RETORT WITH INTERNAL HEATING TUBES

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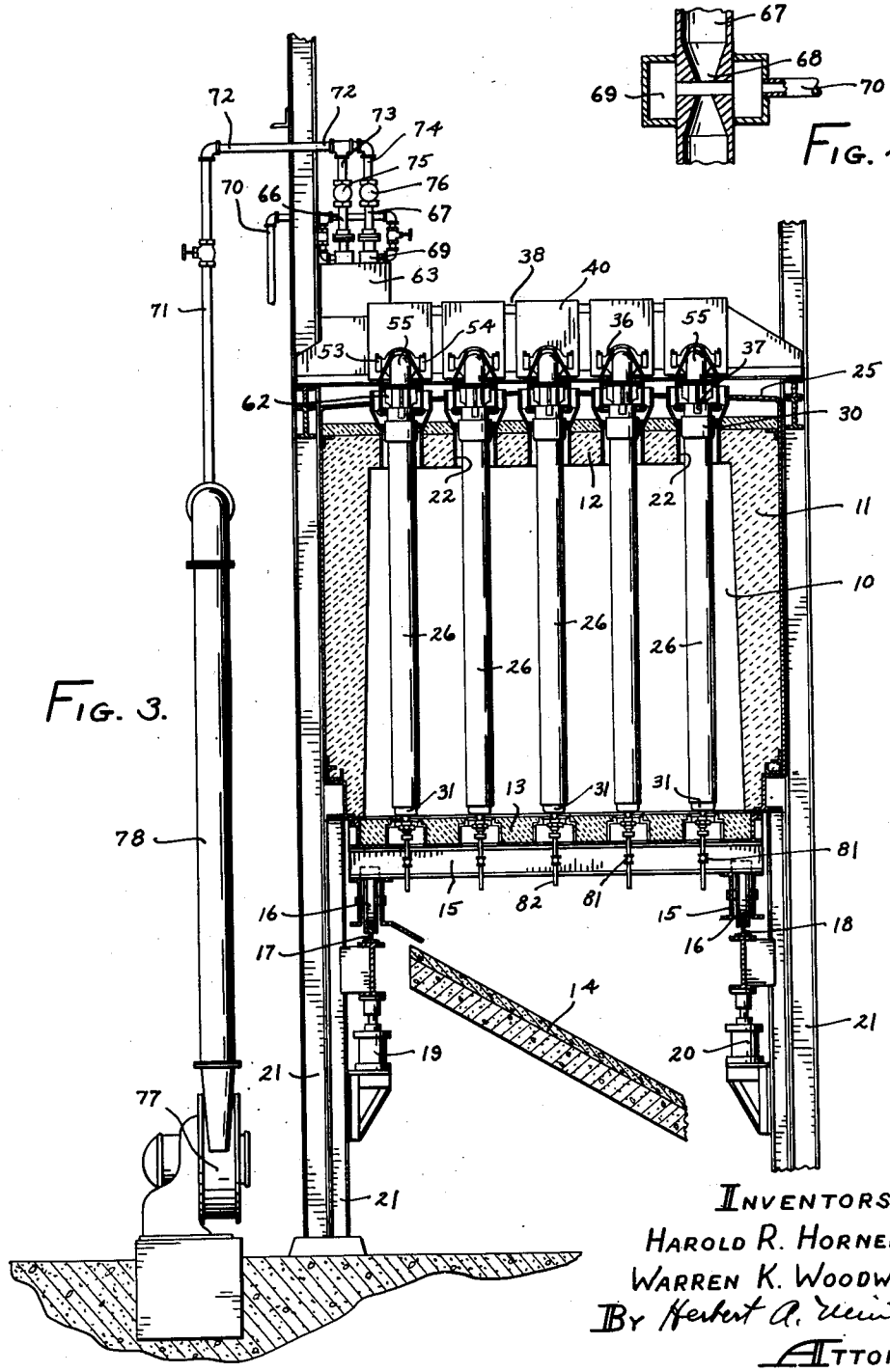


FIG. 3.

FIG. 4.

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VERTICAL COKING RETORT WITH INTERNAL HEATING TUBES

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FIG. 6.

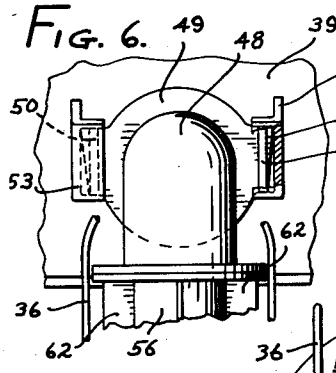


FIG. 7.

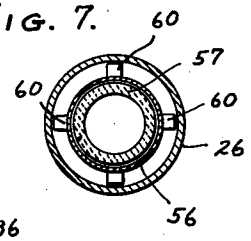


FIG. 5.

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VERTICAL COKING RETORT WITH INTERNAL HEATING TUBES

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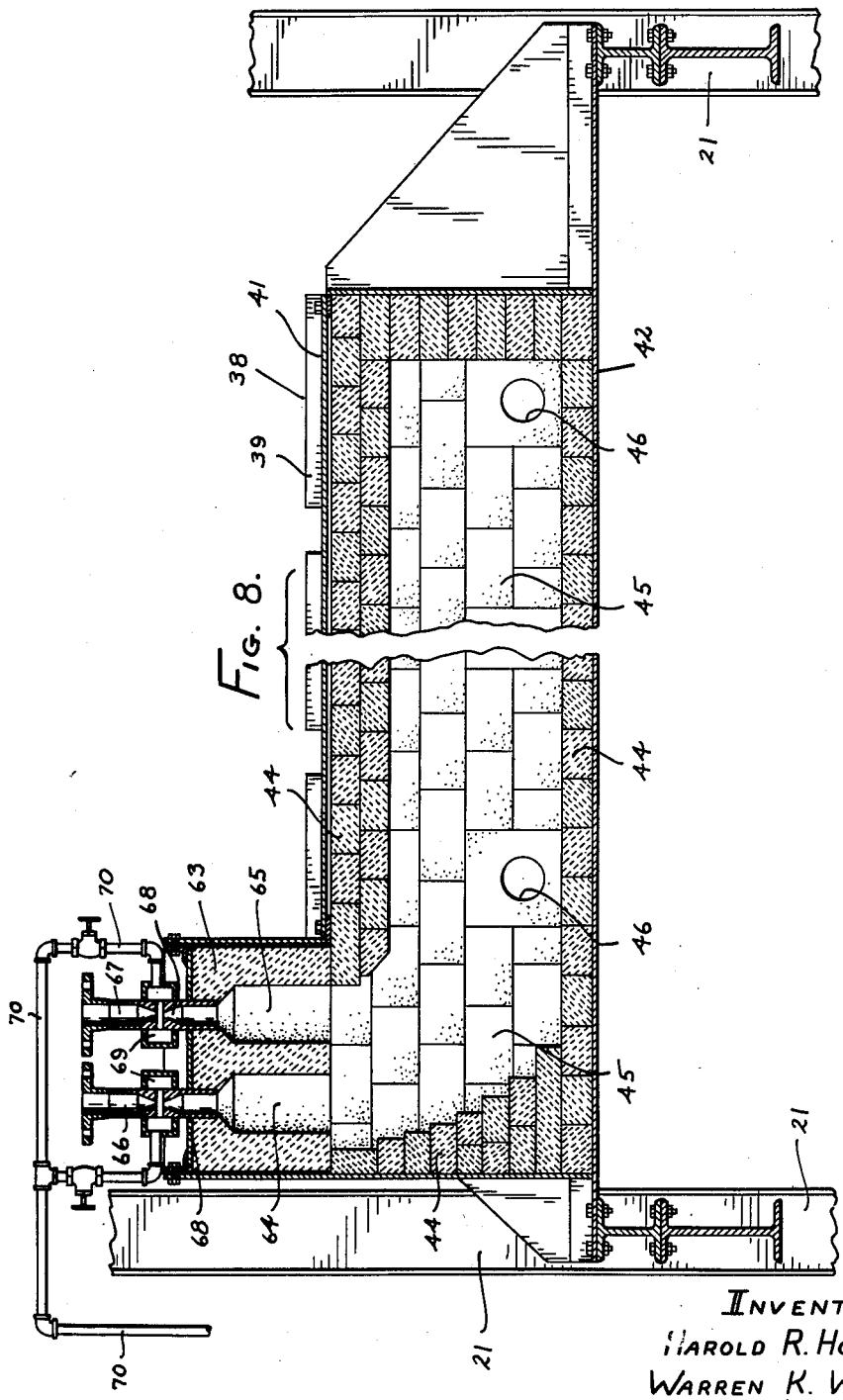


FIG. 8.

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Patented Dec. 16, 1952

2,622,061

UNITED STATES PATENT OFFICE

2,622,061

VERTICAL COKING RETORT WITH INTERNAL HEATING TUBES

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Application June 9, 1950, Serial No. 167,186

6 Claims. (Cl. 202—120)

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This invention relates to the art of coking and calcining carbonaceous materials such as coal and pitch for the production of high density coke. Reference is made to the co-pending application for U. S. Letters Patent Serial No. 757,286, filed June 26, 1947, by Harold R. Horner and Richard J. Hennessy, now matured into Patent No. 2,537,670, January 9, 1951, said Harold R. Horner being the same Harold R. Horner, one of the joint inventors making the present application.

As indicated, not only is the invention adapted to carbonized coal, but it will also handle various pitches. In the case of employing coal, the coal is preferably placed or maintained within the coke retort in a fluidized state up and until the coalescing state is reached.

The present invention is particularly well adapted to provide leak proof seals over the floor over openings through which gases may be introduced not only for fluidizing in the case of coal, but also for the purpose of calcining both in the use of coal and of pitch. Furthermore the invention provides for a centering and holding in alignment of the base ends of heating tubes, in conjunction with a floor which is to be lowered and shifted to one side for discharging the coke content of the retort.

As a part of the invention, there is combined in the structure embodying the invention particular means for demountably mounting heating tubes to extend vertically through the carbonizing chamber, and also to provide demountable heat or combustion tubes telescoping within the heat tubes whereby combustion of the heating medium such as gas may be maintained from an overhead combustion box or chamber and down through the combustion tube and then back up through the heating tube.

These and many other objects and advantages of the invention will become apparent to those versed in the art in the following description of the one particular form as illustrated in the accompanying drawings, in which

Fig. 1 is a view in side elevation of a structure embodying the invention;

Fig. 2 is a view in top plan of the structure;

Fig. 3 a view in vertical transverse section on the line 3—3 in Fig. 2;

Fig. 4 a detail in vertical section on an enlarged scale of a gas and air mixing chamber;

Fig. 5 is a view in vertical longitudinal section on an enlarged scale through a pair of adjacent heating tubes and the overhead combustion box;

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Fig. 6 is a detail in vertical elevation of a combustion tube connection with the combustion box;

Fig. 7 a view in transverse section on the line 7—7 in Fig. 5; and

Fig. 8 is a view in vertical section transversely of the retort and through the overhead combustion box.

Like characters of reference indicate like parts throughout the several views in drawings.

A coking chamber generally designated by the numeral 10 is formed in rectangular shape to have ceramic walls 11, a ceramic ceiling 12, and a ceramic floor 13. The chamber 10 is opened from the underside by means of lowering the floor 13 and pulling it to one side of the chamber 10 in order to permit the coke formed therein to drop out by gravity downwardly onto the wharf 14, Fig. 3.

The floor 13 is carried by an under carriage 15 which is mounted on wheels 16 in turn riding on the tracks 17 and 18 on each side of the structure. The tracks 17 and 18 are lowered and raised by any suitable means such as by hydraulic jacks 19 and 20. These jacks 19 and 20 are carried on the frame work 21 which supports the chamber 10.

The ceiling 12 is provided with a plurality of thimbles 22 built therein to open from the chamber 10 through the ceiling 12 and upwardly therebeyond. In the form herein shown, these thimbles 22 in each instance are provided with an upper outwardly flaring portion 23 from which the thimble continues upwardly by a cylindrical portion 24. A roof 25 is provided in spaced manner above the top of the floor 12, and the cylindrical portions 24 fit snugly through the roof 25. As indicated in Fig. 2, these thimbles 22 are spaced at regular intervals both transversely and longitudinally of the top ceiling 12, preferably at a spacing of two feet each way from center to center, although this spacing may be varied as may be desired in accordance with the nature of the material to be carbonized. The important thing is to secure a relative close spacing in each direction in order to provide for effective heat transmission from the heat conducting tubes 26 which are carried through the thimbles 22, Fig. 5.

Around the flared portion 23 of each thimble 22 there is secured a fitting 27 which carries around its annular interior surface a suitable packing means 28, herein shown as a plurality of packing rings. These rings are held in position against lifting from the member 27 by means of

a top clamp plate 29, Fig. 5. The heat transmitting tube 26 in each instance is sufficient to reach from this flared portion 23 downwardly through the chamber 10 to within close proximity with the floor 13. That portion of the tube 26 which extends through the thimble 22 at the junction of the flared portion 23 is provided with a surrounding collar 30 of a larger diameter than is the diameter of the tube 26. This collar 30 is given a diameter which will permit it to slide within the packing means 28 and maintain a gas tight seal therebetween. The length of this collar or sleeve 30 is made to be such that considerable travel of the collar 30 may be had by it longitudinally of the thimble 22 and still remain in sealing contact with the packing means 28.

The lower end of each tube 26 is provided with a head 31 fixed thereto in a gas tight manner and forming by its lower end a closure across the tube 26. An inverted conical plug 32 is secured on the lower end of the head 31 centrally of the tube 26 to extend downwardly and axially therefrom. This plug 32 may fit within a conical hole 33 provided in a closing off plate 34 which is fixed across an opening 35 provided in the floor 13 under each of the tubes 26. Each tube 26 is provided with a lifting and lowering bail 36 hingedly connected to the upper end of the tube.

When the floor 13 is in its upper and closed position across the under side of the chamber 10, the tube 26 in each instance being lowered through the thimble 22 has its plug 32 guided into the opening 33 and by reason of the conical arrangement therebetween, the tube 26 bears by its weight on this plug 32 against the periphery of the opening 33 to form a seal thereby. Before the floor 13 is to be lowered from under the chamber 10, the tubes 26 are lifted. A lug 37 secured at least on one side of the upper end of the tube 26 is provided as means to engage the tube to rotate it and loosen it in the coke mass.

Referring to Fig. 2, there is provided a combustion box 38 transversely across the retort in spaced relation above the top cover 25. The combustion box 38 is in each instance spaced centrally between two adjacent transverse rows of the thimbles 22. Referring to Figs. 5 and 8, each combustion box 38 is boxed in by externally appearing side plates 39, 40, and top and bottom plates 41 and 42 respectively. Within these plates, there is built up by use of ceramic blocks and bricks 44 a chamber 45 to appear centrally therein and thereacross. This chamber 45 as indicated in Fig. 5, is rectangular in shape and much higher than it is wide. At regularly spaced positions therealong, there are side passageways 46 and 47 from this chamber 45 to the outside thereof. The side openings 46 and 47 are spaced longitudinally of the chamber 10 to be centered on a vertical plane through the axes of the adjacent thimbles 22, whereby connections may be made between these passageways and the tubes 26 on each side thereof respectively.

These connections are made as follows. There is formed an elbow 48 which has a side flange 49 adapted to fit against the side plate 39 around the opening from the passageway 46, Fig. 5. This plate 49 has a plane surface so as to form a substantially gas tight fit against the face of the plate 39. The plate 49 has fixed thereto a pair of ears 50 and 51 which are spaced one from each lateral side of the elbow 48 and have their back edges in each instance sloping downwardly and toward the plate 49 to form inclined surfaces thereto. These surfaces are designated by the numeral 52. These ears 50 and 51 are formed to fit with a wedging action into the lugs 53 and 54 which have corresponding inclined surfaces so that the outer face of the plate 49 is guided downwardly and toward the outer face of the plate 39 in a wedging action by reason of the inclination of the respective contacting edges. The opposite elbow 55 fitting against the plate 38 is formed and engaged thereto in exactly the same manner.

From each of the elbows 48 and 55, there extends downwardly and in fixed relation thereto a tubular sleeve 56. Each sleeve 56 carries an inner lining 57 herein shown as built up from a series of abutting ceramic, short length tubes to form a continuous passageway therethrough from top to bottom of the sleeve 56. At the lower end of the sleeve 56 there are provided a plurality of inturned fingers 58 on which the lining 57 rests. The upper end of the lining 57 is abutted against the ceramic lining 59 which extends through the elbows 48 or 55 as the case may be. This lining 59 has its upper and side opening registering with the opening through the passageway 47 on the one side, and 46 on the other side when the elbows are in their lowered and secured positions as above indicated.

The external diameter of the sleeve 56 in each instance is less than the internal diameter of the tube 26 so that there is a flue space therebetween. The sleeve 56 is spaced centrally inside of the tube 26 by any suitable means, herein shown as by a plurality of lugs 60. As will be noted in Fig. 5 particularly, these sleeves 56 hang freely from their respective elbows 48 and 55 within the tubes 26, and in spaced relation therefrom, leaving in the present instance the upper ends of the tubes 26 open to the atmosphere around the sleeves 56.

Each of the sleeves 56 is provided with one or more abutments 61, herein shown as two in number, spaced normally above the upper end of the tube 26. These abutments 61, shown as being on the lower ends of fins 62, are provided as means for lifting and disconnecting the elbows 48 and 55 from the combustion box. That is, by pulling upwardly on the bails 36, the upper ends of the tubes 26 will strike the abutments 61, and thereby carry upwardly the elbow and sleeve assembly.

At one end of each of the combustion boxes 38 there is built upwardly therefrom a header 63, herein shown as having two spaced apart vertically disposed passageways 64 and 65 therethrough, the upper ends of which connect with feed pipes 66 and 67 respectively. Preferably each of these pipes 66 and 67 is equipped with an antiflash back velocity control orifice 68.

Assuming that gas is to be employed as the combustible medium, there is mounted around these pipes 66 and 67, a gas supply chamber 69, Figs. 4 and 8, into which is fed gas through the pipe 70. Air under pressure is fed through the pipe 71, and a pipe 72, dividing into two pipe lines 73 and 74, connecting respectively through control valves 75 and 76 with the pipes 66 and 67. The gas enters the air stream at the opening 68. Air under pressure may be supplied to the pipe 71 in each instance from a blower 77 forcing air up through the supply line 78 and into the cross header 79. The gas-air mixture is ignited within the combustion chamber 45, to initiate combustion there, and the mixture is forced under pressure along through the chamber 45 to escape

laterally therefrom through the various side openings 46 and 47, to continue downwardly through the tube liners 57 to escape into the tubes 26, and reverse its flow in turn and rise vertically through those tubes and tend to escape from the top ends thereof. The rate of feeding the mixture into the box 38 and therefrom is such that combustion will be maintained not alone in the box 38, but throughout the liners 57, which with the sleeves 56, may be called combustion tubes, and substantially upwardly throughout the length of the tube 26, so that the flame will reach approximately the top ends of those tubes 26, but not be particularly visible from thereabove. In other words a temperature control is had by having combustion of the mixture continue throughout those tubes as indicated.

With the material to be carbonized placed within the chamber 10, about these tubes 26, heat will be conducted and radiated from the heater tubes 26 into the mass of that material. Since the tubes 26 are relatively close one to another, and in the case of pitch, or fluidized coal, the bed is fluid, the heat transmission is readily made throughout that mass of material.

When the material in the chamber 10 has been sufficiently carbonized and it is desired that the material be calcined, the bails 36 are pulled upwardly to lift the plugs 32 to permit openings therearound to exist through the plate opening 33 in each instance, which communicates with the chamber 80, into which can be discharged, in a controlled manner by means of a valve 81, gas to flow through the pipe 82. This gas will be ignited at the chamber 80 and can flow upwardly through the flue-ways provided in the carbonized material within the chamber 10, when these tubes 26 and their internally carried sleeve 56 are entirely lifted from the chamber 10, Of course the combustion is cut off of the gases entering the combustion chamber 45 at this stage. Following the calcining stage, the valves 81 are closed, and then the floor 13 lowered and pulled to one side as above indicated to drop the coke from the chamber 10. The fluid tight seal between the tube plug 32 and the periphery of the opening 33 is effective by means of the plate 34 through which the hole 33 is provided being secured in the upper end of a tubular thimble 83 which is built into the floor 13. These plates 34 may be replaced when necessary should they become warped or damaged by the heat generated in the chamber 10. Obviously the pipe line 82 is mounted in a manner which will permit it to be lifted and lowered as the floor 13 is shifted. The particular mechanism for this is not herein shown, since it does not enter into the invention per se.

While we have herein shown and described our invention in the one particular form, it is obvious that many structural variations may be employed without departing from the spirit of the invention, and we therefore do not desire to be limited to that precise form beyond the limitations which may be imposed by the following claims.

We claim:

1. In a coke retort, vertically spaced ceiling and floor members each having a plurality of openings therethrough in vertical alignment, a ceiling opening with a floor opening; a heater tube insertable through the ceiling opening in each instance; sealing means at said ceiling opening and around said tube for maintaining a substantially gas tight seal under longitudinal travel of the tube; a closure across the lower end of the tube; a plug carried by said lower end insertable in said floor opening to form a substantially fluid tight seal therein; a combustion tube mounted axially of and within the heater tube to define an annular space therebetween, said combustion tube terminating by its lower end at a distance above said heater tube end closure; and a combustion box to which the upper end of said combustion tube is attached externally of said heater tube; said combustion box being located to one side of said combustion tube; an elbow on the upper end of the combustion tube, having a face to fit against said box; sockets on the combustion box; wedge ears carried by said elbow to engage with said sockets by lowering of the elbow to effect a substantially gas-tight fit between said face and the box, said combustion tube being normally suspended in said heated tube from said sockets.

2. In a coke retort, vertically speed ceiling and floor members each having a plurality of openings therethrough in vertical alignment, a ceiling opening with a floor opening; a heater tube insertable through the ceiling opening in each instance; sealing means at said ceiling opening and around said tube for maintaining a substantially gas tight seal under longitudinal travel of the tube; a closure across the lower end of the tube; a plug carried by said lower end insertable in said floor opening to form a substantially fluid tight seal therein; a combustion tube mounted axially of and within the heater tube to define an annular space therebetween, said combustion tube terminating by its lower end at a distance above said heater tube end closure; and a combustion box to which the upper end of said combustion tube is attached externally of said heater tube; said combustion box being located to one side of said combustion tube; an elbow on the upper end of the combustion tube, having a face to fit against said box; sockets on the combustion box; wedge ears carried by said elbow to engage with said sockets by lowering of the elbow to effect a substantially gas-tight fit between said face and the box, said combustion tube being normally suspended in said heater tube from said sockets; an abutment on said combustion tube in the path of the upper end of the heater tube and spaced thereabove; and means on said heater tube to permit pulling it through the retort ceiling opening and, after an initial travel, strike said combustion tube abutment and carry the combustion tube upwardly therewith.

3. A coke retort comprising a carbonizing chamber having a ceiling and a floor vertically shiftable into sealing and opening positions across the chamber; said ceiling having a plurality of passageways therethrough; said floor having a plurality of openings therethrough arranged to be in alignment on a vertical axis, one floor opening with one ceiling passageway; said floor openings being of less diameter than that of the ceiling passageways; a plurality of heater tubes, one for each ceiling passageway each of said tubes being open at the top and closed at the bottom; a floor opening closure member carried on the lower end of each of said tubes, designed to be centered by entering the floor opening, close it off, and support the tube by resting about the margin of the opening; said tubes having lengths which will position their upper end portions within the ceiling passageways when the tubes rest on said margins; sealing means in said passageways engaging around said tube upper portions

travel of the tube; a closure across the lower end of the tube; a plug carried by said lower end insertable in said floor opening to form a substantially fluid tight seal therein; a combustion tube mounted axially of and within the heater tube to define an annular space therebetween, said combustion tube terminating by its lower end at a distance above said heater tube end closure; and a combustion box to which the upper end of said combustion tube is attached externally of said heater tube; said combustion box being located to one side of said combustion tube; an elbow on the upper end of the combustion tube, having a face to fit against said box; sockets on the combustion box; wedge ears carried by said elbow to engage with said sockets by lowering of the elbow to effect a substantially gas-tight fit between said face and the box, said combustion tube being normally suspended in said heated tube from said sockets.

permitting longitudinal travel of the tubes; a combustion box across said ceiling externally of said chamber and positioned to extend above and between two adjacent rows of said ceiling passageways, and having a side opening for each of those passageways; a plurality of combustion tubes, one for each of said heater tubes, having an upper end elbowed to provide an opening therein on a horizontal axis; elbow and box interengaging means operable by substantially vertical travel for interconnecting the elbow with the box to register the elbow opening with a box opening, and from which means said combustion tube is suspended to hang in each instance within said heater tubes; said combustion tubes being open at their lower ends located in the lower end portions of the heater tubes, and having a diameter less than the heater tubes to provide an annular return space between the tubes.

4. A coke retort comprising a carbonizing chamber having a ceiling and a floor vertically shiftable into sealing and opening positions across the chamber; said ceiling having a plurality of passageways therethrough; said floor having a plurality of openings therethrough arranged to be in alignment on a vertical axis, one floor opening with one ceiling passageway; said floor openings being of less diameter than that of the ceiling passageways; a plurality of heater tubes, one for each ceiling passageway each of said tubes being open at the top and closed at the bottom; a floor opening closure member carried on the lower end of each of said tubes, designed to be centered by entering the floor opening, close it off, and support the tube by resting about the margin of the opening; said tubes having lengths which will position their upper end portions within the ceiling passageways when the tubes rest on said margins; ceiling means in said passageways engaging around said tube upper portions permitting longitudinal travel of the tubes; a combustion box across said ceiling externally of said chamber and positioned to extend above and between two adjacent rows of said ceiling passageways, and having a side opening for each of those passageways; a plurality of combustion tubes, one for each of said heater tubes, having an upper end elbowed to provide an opening therein on a horizontal axis; elbow and box interengaging means operable by substantially vertical travel for interconnecting the elbow with the box to register the elbow opening with a box opening, and from which means said combustion tube is suspended to hang in each instance within said heater tubes; said combustion tubes being open at their lower ends located in the lower end portions of the heater tubes, and having a diameter less than the heater tubes, to provide an annular return space between the tubes; plates in said floor, in which said openings are formed, the margins of said openings being inverted frustoconical in shape; and said closure member consisting of an inverted conical plug shaped to enter the plate opening with a wedging fit.

5. A coke retort comprising a carbonizing chamber having a ceiling and a floor vertically shiftable into sealing and opening positions across the chamber; said ceiling having a plurality of passageways therethrough; said floor having a plurality of openings therethrough arranged to be in alignment on a vertical axis, one floor opening with one ceiling passageway; said floor openings being of less diameter than that of the ceiling passageways; a plurality of heater tubes, one for each ceiling passageway each of said tubes being open at the top and closed at the bottom; a floor opening closure member carried on the lower end of each of said tubes, designed to be centered by entering the floor opening, close it off, and support the tube by resting about the margin of the opening; said tubes having lengths which will position their upper end portions within the ceiling passageways when the tubes rest on said margins; sealing means in said passageways engaging around said tube upper portions permitting longitudinal travel of the tubes; a combustion box across said ceiling externally of said chamber and positioned to extend above and between two adjacent rows of said ceiling passageways, and having a side opening for each of those passageways; a plurality of combustion tubes, one for each of said heater tubes, having an upper end elbowed to provide an opening therein on a horizontal axis; elbow and box interengaging means operable by substantially vertical travel for interconnecting the elbow with the box to register the elbow opening with a box opening, and from which means said combustion tube is suspended to hang in each instance within said heater tubes; said combustion tubes being open at their lower ends located in the lower end portions of the heater tubes, and having a diameter less than the heater tubes to provide an annular return space between the tubes; means by which said heater tubes may be pulled from said chamber through said ceiling passageways; and an abutment on each of the combustion tubes in the path of its heater tube whereby the combustion tube may be lifted with the heater tube; and fuel burners under said floor directed toward said floor openings for calcining purposes when said tubes are pulled.

6. A coke retort comprising a carbonizing chamber having a ceiling and a floor vertically shiftable into sealing and opening positions across the chamber; said ceiling having a plurality of passageways therethrough; said floor having a plurality of openings therethrough arranged to be in alignment on a vertical axis, one floor opening with one ceiling passageway; said floor openings being of less diameter than that of the ceiling passageways; a plurality of heater tubes, one for each ceiling passageway, each of said tubes being open at the top and closed at the bottom; a floor opening closure member carried on the lower end of each of said tubes, designed to be centered by entering the floor opening, close it off, and support the tube by resting about the margin of the opening; said tubes having lengths which will position their upper end portions within the ceiling passageways when the tubes rest on said margins; sealing means in said passageways engaging around said tube upper portions permitting longitudinal travel of the tubes; a combustion box across said ceiling externally of said chamber and positioned to extend above and between two adjacent rows of said ceiling passageways, and having a side opening for each of those passageways; a plurality of combustion tubes, one for each of said heater tubes, having an upper end elbowed to provide an opening therein on a horizontal axis; elbow and box interengaging means operable by substantially vertical travel for interconnecting the elbow with the box to register the elbow opening with a box opening, and from which means said combustion tube is suspended to hang in each instance within said heater tubes; said combustion tubes being open at their lower ends located in the lower end portions of the heater tubes, and having a

diameter less than the heater tubes to provide an annular return space between the tubes; means by which said heater tubes may be pulled from said chamber through said ceiling passageways; and an abutment on each of the combustion tubes in the path of its heater tube whereby the combustion tube may be lifted with the heater tube; and fuel burners under said floor directed toward said floor openings for calcining purposes when said tubes are pulled; said floor plates having their undersides directly exposed from the underside of said floor.

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