March 14, 1967 L. ALDERMAN 3,309,286

COKE OVEN ASCENSION PIPE OFFTAKE MEANS

Filed Aug. 2, 1965 2 Sheets-Sheet 1

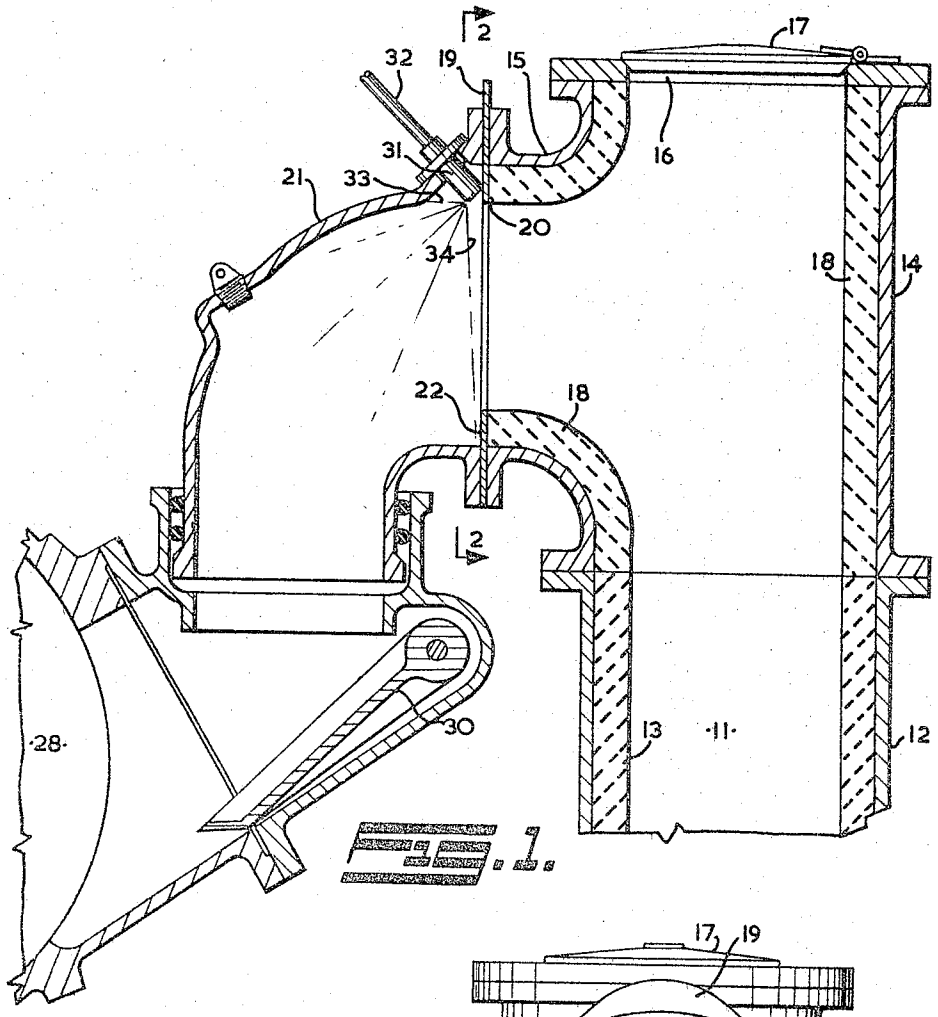


Fig. 1.

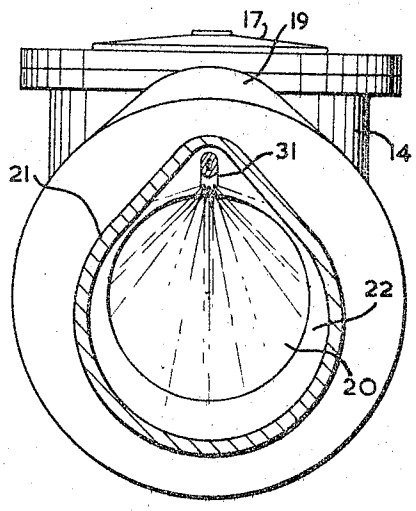


Fig. 2

INVENTOR
LEWIS ALDERMAN
By Morris & Bateman, Attys.

March 14, 1967 L. ALDERMAN 3,309,286

COKE OVEN ASCENSION PIPE OFFTAKE MEANS

Filed Aug. 2, 1965 2 Sheets-Sheet 2

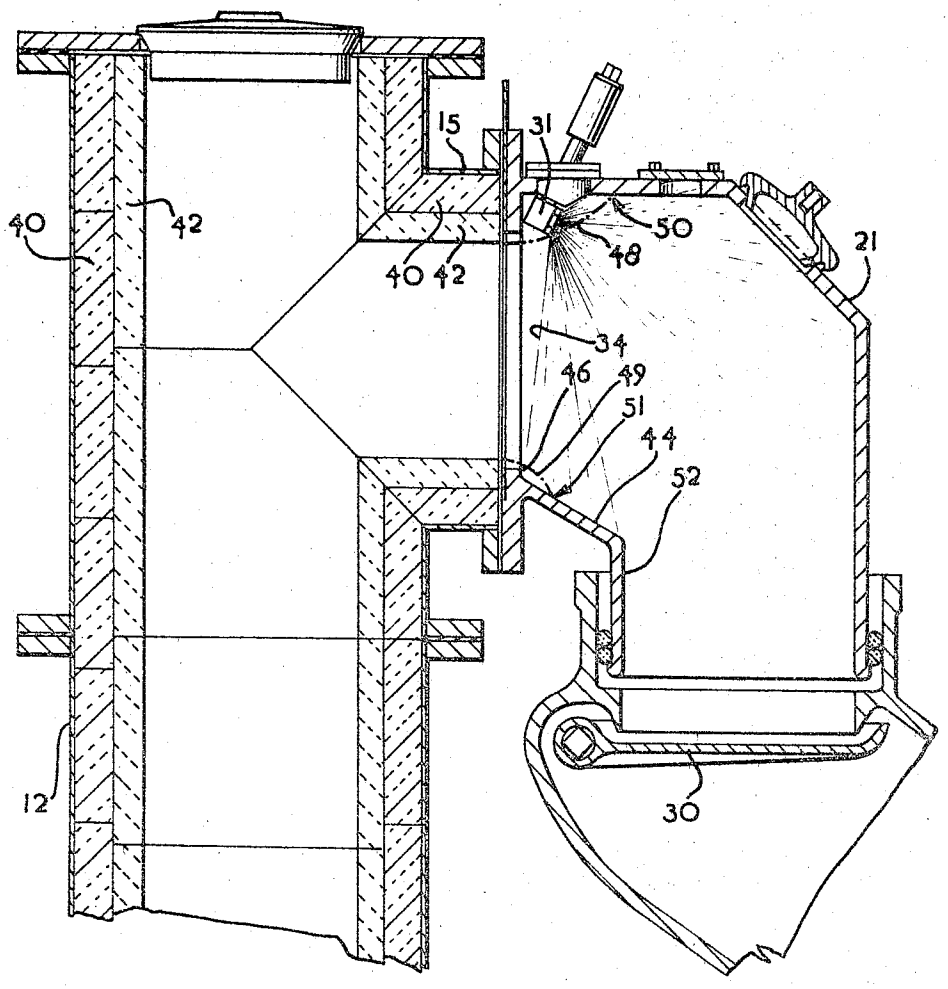


Fig. 3.

LEWIS ALDERMAN

By Norman Bateman, Atty.

United States Patent Office 3,309,286 Patented Mar. 14, 1967

3,309,286

COKE OVEN ASCENSION PIPE OFFTAKE MEANS

Lewis Alderman, Romiley, England, assignor to Simon-Carves Limited, Stockport, England, a British company

Filed Aug. 2, 1965, Ser. No. 476,634
Claims priority, application Great Britain, Apr. 13, 1962, 14,295/62
1 Claim. (Cl. 202—258)

This application is a continuation-in-part of our co-pending application Ser. No. 270,735, filed Apr. 4, 1963, now abandoned.

This invention relates to improvements in coke oven ascension pipe offtake means and in particular to the arrangement of the liquor sprays therein.

The prime purpose of these sprays is to cool the gases issuing from the coking chambers of the ovens before they are passed to the collector mains. The present invention is, however, concerned with a secondary cleaning action of these sprays.

Ascension pipes in coke ovens are installed, one (or two) at each oven of a coke oven battery, to draw off the coal gas formed in the oven during carbonisation of the coal charge; the gas being transferred through a conduit bend in each ascension pipe into a collector main or mains running along one or both sides of the battery. The gas may subsequently be used for heating the ovens for the carbonisation of the coal charges therein.

The gas produced by carbonisation enters the ascension pipe at a high temperature, and to protect the ascension pipes against the extreme heat they are lined with refractory material.

To cool the gases, it is normal practice to fit a liquor spray in the outer wall of an unlined conduit bend connecting an outlet from the ascension pipe to a collector main, and to spray liquor continuously into the gas stream. This cooling causes deposition of heavy tar condensates which cling to the walls of the bend and after building up in thickness reduce its effective bore.

In the subsequent stages of carbonisation the gases are evolved at higher temperatures, resulting in the distillation of the heavy tar condensate deposits, leaving a hard carbonised residue which is difficult to remove. It thus becomes necessary to remove these deposits periodically by manual or mechanical means. This is an unpleasant and difficult task and is only partly effective, as it is almost impossible to remove the deposit from the inner wall of the outer periphery of the bend.

It has been observed that these deposits do not occur to any noticeable extent upon those parts of the bends which are under the direct influence of the sprays, but only upon those portions which, due to the form and position of the sprays, are incompletely sprayed, or not sprayed at all. Previous forms of ascension pipe top assemblies have not, however, made full use of this cleaning action of the sprays since it involves risk of spalling damage to the refractory lining if the spray liquor is brought too close to the lining and comes into contact with it.

The object of the present invention is to utilise the secondary cleaning action of the liquor spray to produce an ascension pipe offtake means which is self-cleaning and does not require the regular cleaning maintenance referred to, and which involves no contact of sprayed liquor with the ascension pipe lining.

To achieve this object it has been necessary to precisely position the spray nozzle within the conduit bend, to accurately define the boundary of the spray cone produced by the nozzle with respect to the refractory lining of the ascension pipe and then to ensure that no sprayed liquor can run back on to this refractory lining, which would result in spalling of the refractory.

According to the invention therefore, there is provided coke oven ascension pipe offtake means comprising:

(a) An ascension pipe,

(b) An outlet from said ascension pipe,

(c) Refractory lining to said ascension pipe and to said outlet of heat conductivity sufficiently low to prevent deposition of tar upon said lining,

(d) An unlined conduit bend attached to said ascension pipe outlet,

(e) Liquor spray nozzle means located within said conduit bend closely adjacent the junction thereof with the ascension pipe outlet for producing a spray cone a portion of whose boundary lies closely adjacent the interface of the outlet and the conduit bend, said spray cone lying wholly within the conduit bend and wetting all the inner surface thereof exposed to the flow stream of gas within the bend, the nozzle means being recessed to lie outside said flow stream, and

(f) Means for preventing the access of sprayed liquor to said refractory lining from said conduit bend.

A better understanding of the invention may be obtained from the following description when this is read with reference to the accompanying drawings. This description is given by way of example of the invention only and not by way of limitation thereof.

In the accompanying drawings:

FIGURE 1 is a vertical section through the upper portion of a coke oven ascension pipe, portion of a gas collector main and the connection therebetween;

FIGURE 2 is a section on the line 2—2 of FIGURE 1; and

FIGURE 3 is a view, similar to FIGURE 1, of a further form of the invention.

Referring to the embodiment of FIGURES 1 and 2, the ascension pipe **11** is of known type and comprises a vertical pipe **12** lined with refractory material **13** and open at its lower end to the coking chamber of a coke oven in known manner. At its upper end, the pipe **12** is open to a refractory-lined T-piece **14**, the outlet **15** of which is directed away from the oven structure (not shown). The upper opening **16** of the T-piece **14** is closed by a suitable pivoted cap **17**. The refractory lining **18** of the T-piece **14** ceases at the outer end of the outlet **15** in abutment with a thin metal disc **19** which has a central aperture **20** of the same diameter as the central passage through the refractory lining **18** in the outlet **15**.

The reason for continuing the refractory lining **18** of the ascension pipe into the T-piece outlet **15** is to ensure that, in operation, condensation of heavy tar products in the gas does not commence until the gas leaves the T-piece.

The refractory lining of the ascension pipe and of the T-piece are formed of refractory brick, and the heat conductivity of the lining has a value sufficiently low to prevent deposition of tar on the lining due to drop in temperature of the gas in its passage through the ascension pipe.

To the outer surface of the metal plate **19** is abutted one end of a 90° conduit bend **21** through which gas passes via an isolating valve **30** to a collector main **28**. The conduit bend **21** is secured, in abutment with the metal plate **19**, to the open end of the T-piece outlet **15**. The inner diameter of the bend **21** is greater than the inner diameter of the refractory lining **18** at the outlet, and the metal plate **19** and adjacent end of the bend **21** thus define an annular step **22** having the same depth as the refractory lining **18**.

At the upper end of the bend **21**, closely adjacent its point of attachment to the outlet **15**, a spray nozzle **31** is inserted through the wall of the bend so that it lies at an angle from the vertical inclined towards the ascen-

sion pipe **11**. This nozzle **31** is connected to the liquor spray system of the oven by a conduit **32**.

The nozzle **31** projects only so far into the bend **21** that it is wholly contained in the annular step **22** at the junction of the bend **21** and the T-piece outlet **15**, and does not project into the gas stream flowing in the bend **21**. By this means, condensation of tar on the spray nozzle is avoided. The spray hole or holes in the nozzle **31** are so arranged that an upper portion **33** of the boundary of the spray cone produced by the nozzle is substantially horizontal and directed away from the metal plate **19**, whilst a lower portion **34** of the spray cone boundary is vertical, and lies closely adjacent the interface between the outlet **15** and the conduit bend **21**. Thus the spray cone is located wholly within the bend **21**. No spray liquor is allowed to fall on the refractory lining **18**, but the whole of the interior of the bend **21** is continually and completely wetted. The presence of the step **22** between the conduit bend **21** and the outlet **15** prevents sprayed liquor from running into the outlet **15**.

In the operation of the assembly, hot coke oven gas formed in the coking chambers of the oven passes up the ascension pipe **12** to the outlet **15**, its temperature being maintained as hereinafter discussed by the insulating function of the refractory lining **13**. Upon emerging from the outlet **15** to the unlined conduit bend **21** it immediately meets the spray liquor boundary **34** and is cooled, causing condensation of tar. Part of this condensed tar is carried in the gas stream past the isolating valve **30** to the collector main **28**. The remainder is precipitated on to the walls of the conduit bend **21**, but since the whole of the bend exposed to the gas stream is either directly sprayed with or wetted by liquor from the nozzle **31**, it is continuously washed from the walls of the conduit bend into the collector main. Thus no build-up of deposit occurs on the walls of the conduit bend to be carbonised at a later stage of the coking cycle. The offtake means is therefore self-cleaning in its action, and no routine cleaning maintenance is required as in known ascension pipe offtake layouts.

In the form of the invention shown in FIGURE 3, the refractory lining of the ascension pipe and its outlet is a composite layer comprising a layer of insulating refractory brick **40** adjacent the wall **12** of the ascension pipe and the wall **15** of the outlet, and a further layer of fireclay refractory brick **42** upon the layer of insulating brick **40**. The fireclay brick **42** is thus exposed to the flow of hot gas within the ascension pipe and outlet, while the insulating brick **40**, which is protected from the hot gas stream, serves to lower the overall heat loss through the refractory lining due to its relatively low coefficient of heat conductivity.

In any individual installation, the choice of a single or composite refractory lining depends on factors such as the gas velocity within the ascension pipe, the volatile matter content of the coal being carbonised, and the temperature in the free space at the head of each oven chamber during operation. In either case, it is essential for the purposes of the invention that the overall heat conductivity of the refractory lining is sufficiently low to prevent deposition of tar upon the lining due to cooling of the gas in its passage through the ascension pipe. In some cases, a drop of 20 or 30° C. may be large enough to cause such deposition.

In the embodiment of FIGURE 3 the means employed to prevent sprayed liquor from running back from the conduit bend **15** on to the refractory lining **42** is as follows. In place of the step **22** of FIGURE 1, a portion **44** of the conduit bend opposite to the spray nozzle **31** is angled downwardly from the junction of the bend **21** and outlet **15**. The inner surface of the bend portion **44** is thus disposed at an angle to the general direction of impingement of the spray, and so directs the spray away from the ascension pipe outlet and prevents sprayed liquor from running on to the refractory lining **42**. A small step **46** is formed in the portion **44** of the conduit bend, and the spray cone from the nozzle **31** is precisely aligned so that the portion **34** of the spray cone boundary falls just within the step **46**.

For the object of the invention to be achieved in respect of the self-cleaning action of the spray, precise alignment of the nozzle **31** is necessary to ensure correct location of the spray cone within the bend **21**, and correct location of the boundary portion **34** with regard to the termination of the refractory lining **42**, as hereinabove described.

It is also necessary for the angle subtended by the spray cone at the nozzle **31** to be precisely defined. The nozzle **31** is located just outside the flow stream of the gas issuing from the outlet **15**. In FIGURE 3 the approximate upper boundary of this flow stream is shown at **48**, meeting the upper wall of the conduit bend at **50**, and the approximate lower boundary of the flow stream is shown at **49**, meeting the lower wall of the conduit bend at **51**. It is at positions downstream of the points **50** and **51** that deposits are liable to build up on the surface of the bend. The angle subtended by the spray cone at the nozzle is therefore arranged to be such that spray impinges on the bend upstream of the points **50** and **51**. Not only is the nozzle **31** protected from the formation of deposits by lying outside the flow stream of the gas, but so also are those portions of the inner surface of the conduit bend adjacent the nozzle and up to the point **50**.

The only other part of the bend **21** which is not in the direct path of spray from the nozzle is the inner lower portion **52**. This is, however, effectively wetted by sprayed liquor running downwards off the angled portion **44**.

I claim:

In combination with a coke oven ascension take off pipe, means defining a lateral gas outlet in said pipe, and a refractory lining at the inner surface of said pipe and said outlet and having sufficiently low heat conductive properties that heat loss through said lining, pipe, and outlet is low enough to prevent deposition of tar upon the internal surface of said lining, an unlined conduit bend adapted to connect said pipe to a collector means and having angularly related inlet and outlet openings, said conduit bend being connected to said pipe with its outlet opening facing downwardly and with its inlet opening in aligned, direct communication with said gas outlet to provide a continuation of the gas flow passage defined by said gas outlet, means providing an annular, radially extending step at the interface between said gas outlet and said inlet opening, surface means formed in said conduit bend and cooperating with said annular step to provide an abrupt radial enlargement of said gas flow passage, said enlargement being in the direction of gas flow through said gas outlet and said conduit bend to provide for the initial peripheral impingement of the main gas stream flowing through said conduit bend at a region on the conduit bend internal wall surfaces that is spaced a predetermined distance downstream of said inlet opening, said surface means, said annular step, and the periphery of said gas stream before it impinges on said internal wall surfaces delimiting an annular pocket, liquor spray nozzle means disposed entirely within said pocket immediately adjacent to said annular step for providing a liquor spray cone (a) which peripherally impinges on the internal wall surfaces of said conduit bend at a region upstream from the region where said gas stream initially impinges on said internal wall surfaces and (b) which wets all of the interior conduit bend wall surface extending downstream from its region of initial impingement, and further surface means cooperating with said annular step for directing the sprayed liquor away from said gas outlet to prevent access of said sprayed liquor to said refractory lining.

(References on following page)

References Cited by the Examiner

UNITED STATES PATENTS

1,597,541	8/1926	Plantinga	202—258
1,800,717	4/1931	Cole	202—254
2,082,118	6/1937	Potter	202—258
2,311,114	2/1943	Koppers	202—254

2,759,885	8/1956	Thompson	202—256

FOREIGN PATENTS

744,440	1/1944	Germany.

MORRIS O. WOLK, *Primary Examiner.*

JOSEPH SCOVRONEK, *Examiner.*