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A. L. BRUTON

2,391,443

REMOVAL OF DEPOSITS FROM THE INTERIOR SURFACES OF COKE OVENS

Filed Oct. 28, 1942

3 Sheets-Sheet 1

Fig. 1

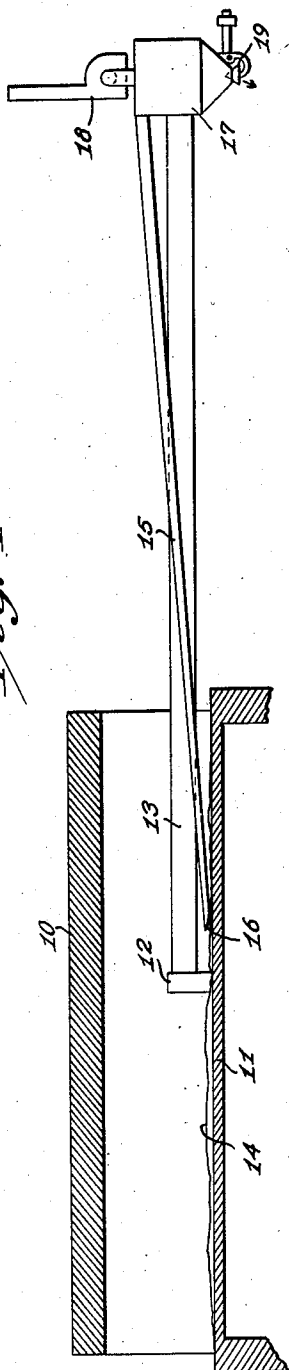
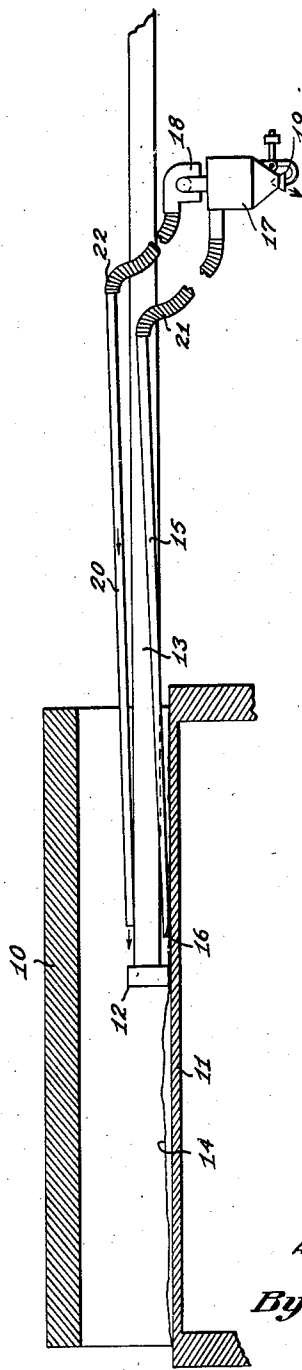


Fig. 2



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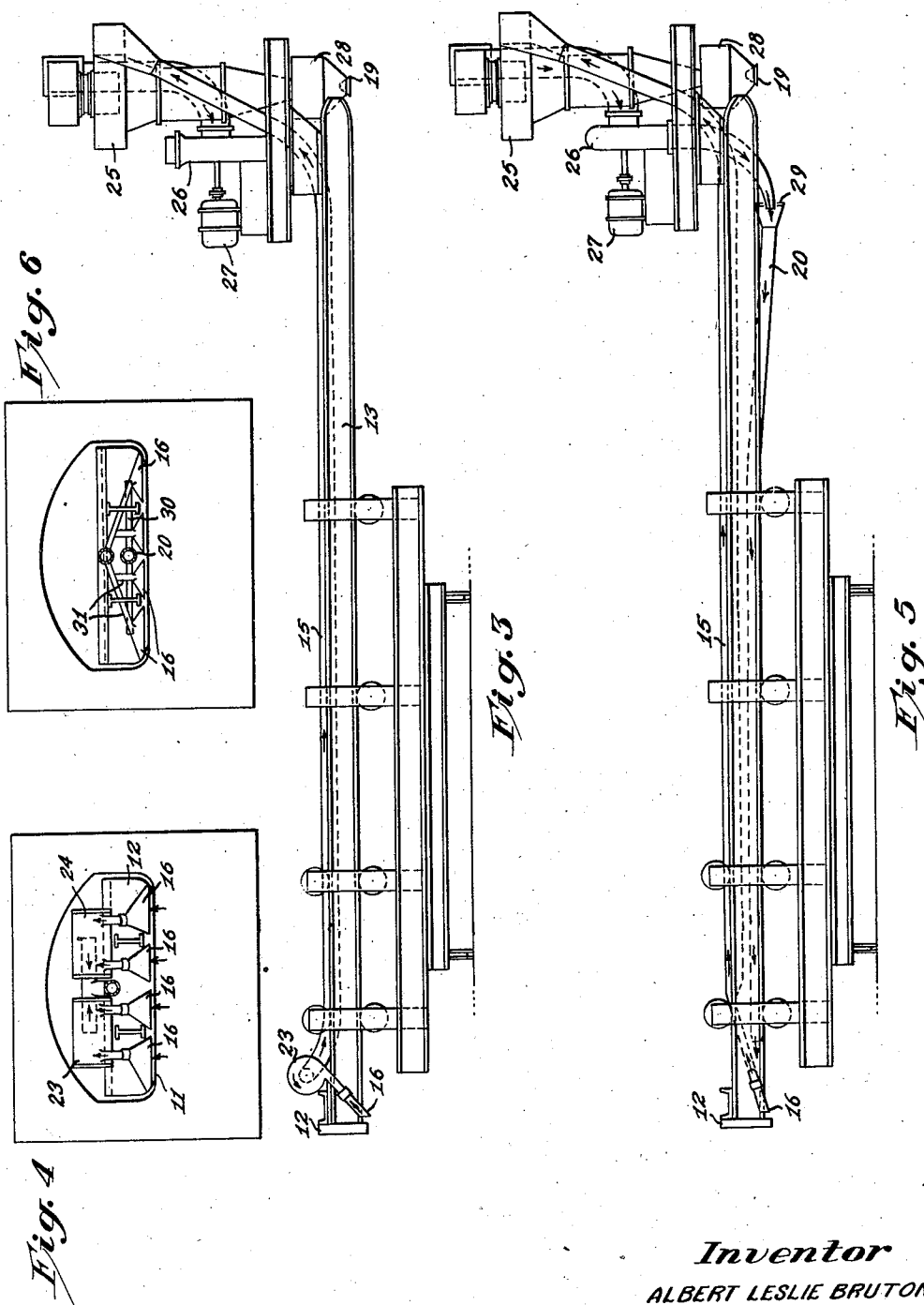
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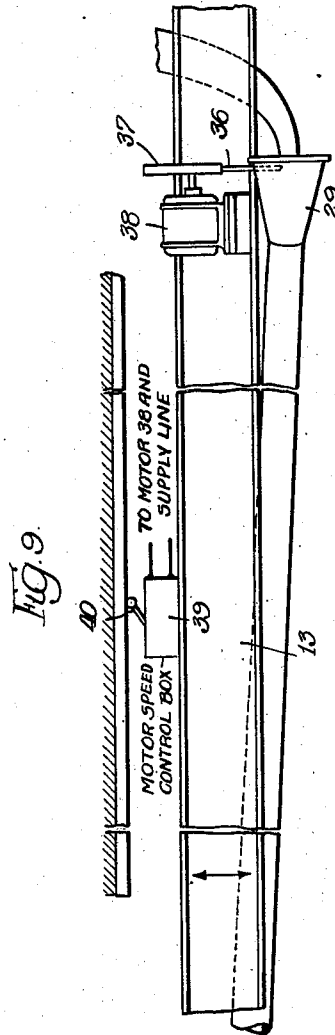
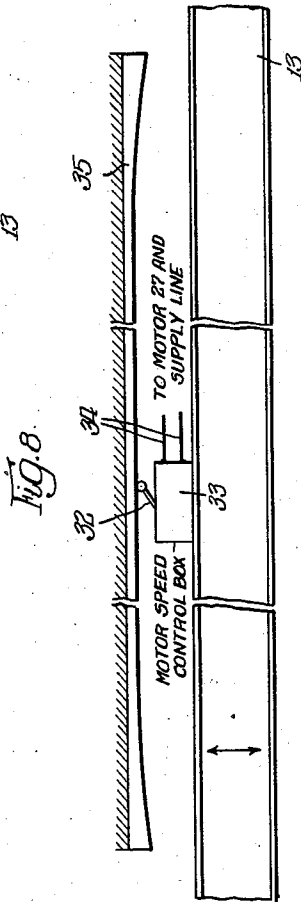
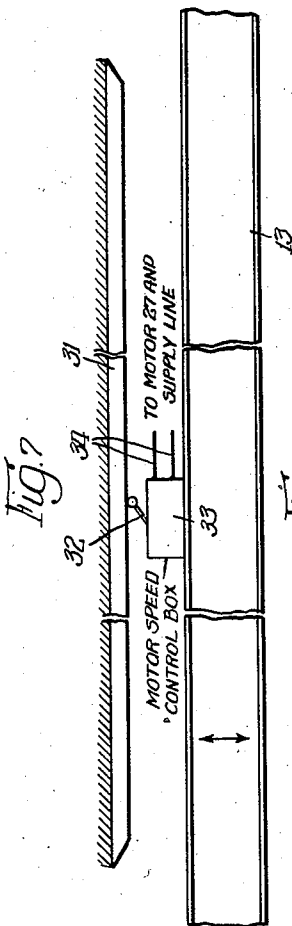
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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REMOVAL OF DEPOSITS FROM THE INTERIOR SURFACES OF COKE OVENS

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The present invention relates to coking ovens and is more particularly, although not exclusively, concerned with ovens of the horizontal, heated floor type, these ovens being commonly known as Knowles ovens.

During the operation of coke ovens generally trouble has been experienced as a result of deposits of carbon which tend to build up on the floor, roof and sides of the oven. These deposits reduce the efficiency of the oven not only as a result of the decreased heat conductivity of the floor and walls, but also because, after a time, the thickness of the deposit becomes such as to interfere seriously with the mechanical servicing of the oven such as the pushing of the coke.

In order to obviate this difficulty it has already been proposed, in the case of both horizontal and vertical types of ovens, to blow the deposit of carbon off the walls and roof in the case of the vertical type, and off the floor in the case of the horizontal type, each time after the coke has been pushed.

Whilst such an expedient may no doubt be satisfactory for vertical type ovens, the cross-sectional area of which (above the coke) is comparatively small, it has not been found entirely satisfactory for the horizontal type of oven, chiefly owing to the fact that the cross-sectional area above the coke is much larger and therefore an exceptionally large amount of air is required to blow even fine carbon dust out of the oven. In the case of the vertical ovens the deposit on the walls is probably produced by coal dust from the coal charge blowing up and settling on the hot wall of the oven where it melts and is subsequently coked, whereas in the case of the horizontal type the deposit is produced chiefly by loose pieces of coke left on the floor after the ram has pushed the coke and which pieces become cemented to the floor by the next flow of liquid hydrocarbons on to the floor. Here again, blowing has been found inadequate owing to the comparatively large size of the particles to be removed, and because a comparatively large amount of air is required to blow the particles along a horizontal oven, the cross-section of which above the coke is large as compared with that above the coke in a vertical type of oven.

A further disadvantage of the blowing method is that if the nozzle is on the front of the ram, as is advisable in order to ensure that the dust is blown out of the oven on to the coke side, the deposit-removing or scarfing operation, as it is known, entails two traverses of the ram through the oven, one to push the coke and the other to

blow the deposit out, which involves a loss of time.

It is an object of the present invention to provide a method for simply and efficiently removing the deposit from the floor, walls or roof of a coking oven.

In the following specification the expression "wall" is intended to cover not only the wall but also the roof and floor of a coking oven.

It is a further object of the invention to provide a method of sucking the deposit off the wall of an oven without drawing combustible gases or cold air into the oven over the hot floor so as to damage the latter.

Another object of the invention is to burn the deposit off the floor and subsequently suck the burnt deposit off the floor.

Other objects are to control automatically the strength of the suction and/or the combustion effect as the sucking device moves over the wall to be cleaned.

Preferred embodiments of the invention will now be described with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a longitudinal sectional elevation through a coking oven of the Knowles type illustrating a simple form of the invention,

Figure 2 is a similar view illustrating a modification,

Figure 3 is a side elevation of a ram for pushing coke out of a Knowles oven having mounted thereon sucking means operating in accordance with the present invention,

Figure 4 is a view in end elevation of a Knowles oven and showing the apparatus of Figure 3 within the oven,

Figure 5 is a view similar to that of Figure 3 but of a further modification whilst,

Figure 6 is a view in end elevation of a Knowles oven illustrating another arrangement of suction nozzles, and,

Figures 7, 8 and 9 illustrate schematically various controls responsive to the position of the pusher ram.

Referring now to Figure 1, a Knowles oven comprises a roof 10 and horizontal floor 11 upon which coke is formed by heat supplied from beneath the floor. After each coking operation the formed coke is pushed out of the oven from right to left by a ram-head 12 mounted upon movable ram-beam 13. During the normal operation of such a pushing device pieces of coke get left behind by the ram on its forward stroke, and on its return stroke are tamped down by the ram-head on to the coking floor 11 so that after

a time a hard layer of scurf 14 forms upon the floor. This layer 14 interferes seriously with the transmission of heat through the floor 11 of the oven and in time may even prevent the mechanical operation of the ram.

Hitherto it has been proposed to mount on the ram-head blowing nozzles; during the pushing stroke of the ram these blowing nozzles are pivoted to the rear of the ram-head and during a second forward stroke of the ram are pivoted to the front of the ram-head so that, as the latter moves from right to left, coke is blown out of the oven on to the coke side. As indicated above such a process is inefficient since it entails a loss of time and power.

In accordance with the present invention, however, a suction pipe 15 ending in one or more nozzles 16 is mounted upon the ram-beam 13, the nozzles terminating at the rear of the ram-head 12. As the ram-head moves from right to left on its pushing stroke the suction nozzles 16 take up dust and loose pieces of coke left behind by the ram-head and these are sucked along the pipe 15 to a dust-and-air separator 17 mounted at the rear end of the beam 13. Cleaned fluid is exhausted by means of a fan 18 to atmosphere whilst the collected dust is removed through a door 19.

As illustrated in Figure 2 the dust-and-air separator 17 and fan 18 are mounted independently of the beam 13 whilst the cleaned fluid instead of being exhausted to atmosphere is returned by the action of the fan 18 along a pipe 20 to the neighbourhood of the ram-head 12. With this arrangement the separator and fan are connected to the pipes 15 and 20 by way of flexible connections 21 and 22 respectively in order to allow for the travel of the ram.

It will be noticed that the scurf layer 14 is thickest at the centre of the oven, talling away practically to nothing at the two open ends. With the arrangement shown in Figure 1 the fluid sucked away by the nozzle 16 is replaced by atmospheric air drawn in through the two ends of the oven. This cold air would damage the floor of the oven adjacent the open ends since at these places it travels over practically bare refractory brick. This disadvantage is, however, eliminated by the arrangement shown in Figure 2 where the cleaned gases, which are also comparatively warm, are recirculated into the oven through pipe 20.

As illustrated in Figures 3 and 4, dust is sucked off the floor 11 of the oven by four nozzles 16, mounted immediately behind the ram-head 12, and the suction fluid is subjected to a primary cleaning in separators 23 and 24, or two cyclone dust bags, or other cleaning devices, whence the partially cleaned fluid is carried through pipe 15 to secondary cleaning apparatus 25 and is thence passed, by fan 26 driven by motor 27, to atmosphere, whilst the dust collects in dust box 28 fitted with door 19. In this arrangement both the primary and secondary cleaning devices are carried upon and move with the ram-beam 13.

The arrangement illustrated in Figure 5 is similar to that of Figures 3 and 4 except that the fluid, after being subjected to a secondary cleaning in the separator 25, is driven by the fan 26, through a hit and miss regulator 29, into a recirculation pipe 20. Through the pipe 20 the cleaned fluid, together with a certain proportion of air injected through the regulator 29, is returned to the neighbourhood of the ram-head 12. If desired the recirculated fluid may pass into a

manifold 30 (Figure 6) whence it is spread out over the oven in the transverse direction. As shown in the figure also, dust collected by the nozzles 16 passes through pipes 31 into the suction pipe 15.

In any of the devices described the suction power may be derived from electric, hydraulic, or other convenient source and the source may be switched on and off automatically in accordance with the position of the ram head. Thus for example the electric motor 27 of Figure 3 may be operated by a switch which can be opened and closed by a lever on the ram-beam 13 in such manner that as the ram-head 12 enters the oven the lever on the ram 13 closes the motor switch and as the ram-head 12 leaves the oven on its forward stroke the motor switch is opened, the same sequence of events taking place as the ram performs its reverse stroke. Means for accomplishing this purpose are illustrated schematically in Figure 7, wherein the ram beam 13 is adapted to cooperate with a camming member 31 which may be fixed relative to the oven. Said camming member 31 is adapted, when the ram head is in the oven, to engage the lever 32 of a motor speed control box 33, from which conductors 34-34 lead to the motor 27. Said lever 32 may be biased upwardly and the control box 33 may control the speed of the motor 27 proportionately to the elevation of said lever 32, stopping the motor when said lever 32 clears the two ends of the camming member 31. As will be pointed out presently, the recirculated fluid may be varied automatically in accordance with the height of the ram head 12 above a fixed point, such as the floor level of the oven, whereby it is insured that the deposit-removing capacity of the apparatus varies proportionately with the thickness of the scurf layer.

Furthermore, the suction power may be controlled continuously in accordance with the position of the ram in such manner that the suction power increases as the ram approaches the centre of the oven, and decreases as it moves from the centre towards the ends of the oven, thus ensuring the maximum suction effect where the scurf layer is thickest. Means for accomplishing this purpose are illustrated schematically in Figure 8, wherein the ram beam 13 carries the motor speed control box 33 having the lever 32 biased upwardly. The upper extremity of said lever 32 is adapted to cooperate with the camming member 35, which is adapted to progressively control the position of the lever 32 to control the speed of the motor 27.

With the arrangement shown in Figure 5 air injected through the regulator 29 serves, together with a proportion of cleaned fluid provided by the fan 26, to burn and loosen the scurf layer 14 on the oven floor. If desired the quantity of oxygen-containing gas returned to the ram-head may be controlled automatically by varying the opening of the regulator 29 in accordance with the position of the ram-beam along the longitudinal axis of the oven. Means for accomplishing this purpose are illustrated schematically in Figure 9, in which the regulator 29 is provided with a damper 36 adapted to be moved by the cam 37. Said cam 37 is connected to be driven by the reversible motor 38, which may have incorporated therewith gear reducing means (not shown). The direction of rotation of the motor 38 and consequently the direction of movement of the damper 36 may be controlled by the control box 39, which in turn is responsive to the elevation of

the lever 40. Said lever 40 may be operated similarly to the lever 32 in response to the position of the ram beam 13, as illustrated in either Figure 7 or Figure 8. It will be clear that the lever 32 and the lever 40 will respond to the position of the ram beam 13 not only in its longitudinal movements but in its vertical movement as well, caused by variation in the thickness of the scurf 14.

Alternatively either or both of the suction power provided and the combustibility of the recirculated fluid may be varied automatically in accordance with the height of the ram-head above a fixed point such as the floor level. By this means it is insured that the deposit-removing capacity of the apparatus varies proportionately with the thickness of the scurf layer 14.

It will be appreciated that less air and less power are required to suck dust and particles from the floor through nozzles of comparatively small cross-section, than to blow them along and out of the oven.

I claim:

1. A method of removing deposit from the wall of a coking oven while said oven is hot which consists in pushing said deposit from said wall and at the same time applying suction to said wall in rear of said pushing action, cleaning the fluid used in said suction action and returning it while still warm to the region where said suction action is being applied to said wall.

2. A method of removing deposit from the wall of a coking oven while said oven is hot which consists of pushing said deposit from said wall and at the same time applying a suction action in rear of said pushing action, cleaning the fluid used in said suction action, adding thereto a proportion of combustion supporting gas such as air and returning it in warm condition to the region of the suction action upon said wall whereby said deposit may be burned off and loosened from the wall before it is sucked away.

3. A method of removing deposit adhering to the wall of a coking oven which consists in pushing said deposit from said wall and at the same time applying a suction action in rear of said pushing action and controlling the amount of said suction action in accordance with the location of said pushing action.

4. A method of removing deposit from the wall of a coking oven which consists of pushing said deposit from said wall and at the same time applying a suction action in rear of said pushing action while progressively varying the intensity of the suction action in accordance with the location of said pushing action so that maximum suction occurs where the deposit is thickest.

5. A method of removing deposit from the wall of a coking oven which consists in pushing said deposit from said wall and at the same time applying a suction action in rear of said pushing action, cleaning the fluid used in the production of said suction action and returning it with the addition of combustion supporting gas such as air to the location of said suction action, and controlling the proportion of said gas to said cleaned fluid in accordance with the location of said suction action whereby maximum combustion occurs within the oven at places where the thickness of deposit is greatest.

6. A method of removing deposit from the wall of a coking oven while said oven is hot which consists in pushing said deposit from said wall and at the same time applying a suction action in rear of said pushing action, cleaning the fluid

used in the production of said suction action, and returning it in warm condition with the addition of combustion supporting gas such as air to the location of said suction action.

7. Means for removing deposit from a wall of a coking oven including a ram having a head for engaging said deposit, means movable with said ram and located in rear of said head for applying suction to said wall, and means for cleaning the fluid used in said suction action and returning said fluid to said suction applying means, said cleaning means including a primary cleaner located adjacent to the head of said ram, and a secondary cleaner located adjacent to the rear of said ram.

8. Means for removing deposit from a wall of a coking oven including a ram having a head for engaging said deposit, means movable with said ram and located in rear of said head for applying suction to said wall, means for cleaning the fluid used in said suction action and returning said fluid to said suction applying means, and means for adding a combustion supporting gas such as air to said cleaned fluid so that said deposit may be burned off and loosened from the wall before it is sucked away.

9. Means for removing deposit from the wall of a coking oven including a ram having a head for engaging said deposit, suction applying means movable with said ram located in rear of said head, and means responsive to the position of said ram for controlling the extent of the suction of said suction applying means.

10. Means for removing deposit from the wall of a coking oven including a ram having a head for engaging said deposit, suction applying means movable with said ram located in rear of said head, and means responsive to the longitudinal position of said ram for controlling the extent of the suction of said suction applying means.

11. Means for removing deposit from the wall of a coking oven including a ram having a head for engaging said deposit, suction applying means movable with said ram located in rear of said head, and means responsive to the elevation of said ram for controlling the extent of the suction of said suction applying means.

12. Means for removing deposit from the wall of a coking oven including a ram having a head for engaging said deposit, suction applying means movable with said ram located in rear of said head, and means responsive to the longitudinal position and the elevation of said ram for controlling the extent of the suction of said suction applying means.

13. Means for removing deposit from a wall of a coking oven including a ram having a head for engaging said deposit, means movable with said ram and located in rear of said head for applying suction to said wall, means for cleaning the fluid used in said suction action and returning said fluid to said suction applying means, means for adding a combustion supporting gas such as air to said cleaned fluid so that said deposit may be burned off and loosened from the wall before it is sucked away, and means for controlling the proportion of said combustion supporting gas to cleaned gas in accordance with the position of said ram.

14. Means for removing deposit from a wall of a coking oven including a ram having a head for engaging said deposit, means movable with said ram and located in rear of said head for applying suction to said wall, means for cleaning the fluid used in said suction action and return-

ing said fluid to said suction applying means, means for adding a combustion supporting gas such as air to said cleaned fluid so that said deposit may be burned off and loosened from the wall before it is sucked away, and means for controlling the proportion of said combustion supporting gas to cleaned gas in accordance with the longitudinal position of said ram.

15. Means for removing deposit from a wall of a coking oven including a ram having a head for engaging said deposit, means movable with said ram and located in rear of said head for applying suction to said wall, means for cleaning the fluid used in said suction action and returning said fluid to said suction applying means, means for adding a combustion supporting gas such as air to said cleaned fluid so that said deposit may be burned off and loosened from the wall before it is sucked away, and means for con-

trolling the proportion of said combustion supporting gas to cleaned gas in accordance with the elevation of said ram.

16. Means for removing deposit from a wall of a coking oven including a ram having a head for engaging said deposit, means movable with said ram and located in rear of said head for applying suction to said wall, means for cleaning the fluid used in said suction action and returning said fluid to said suction applying means, means for adding a combustion supporting gas such as air to said cleaned fluid so that said deposit may be burned off and loosened from the wall before it is sucked away, and means for controlling the proportion of said combustion supporting gas to cleaned gas in accordance with the longitudinal position and the elevation of said ram.

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