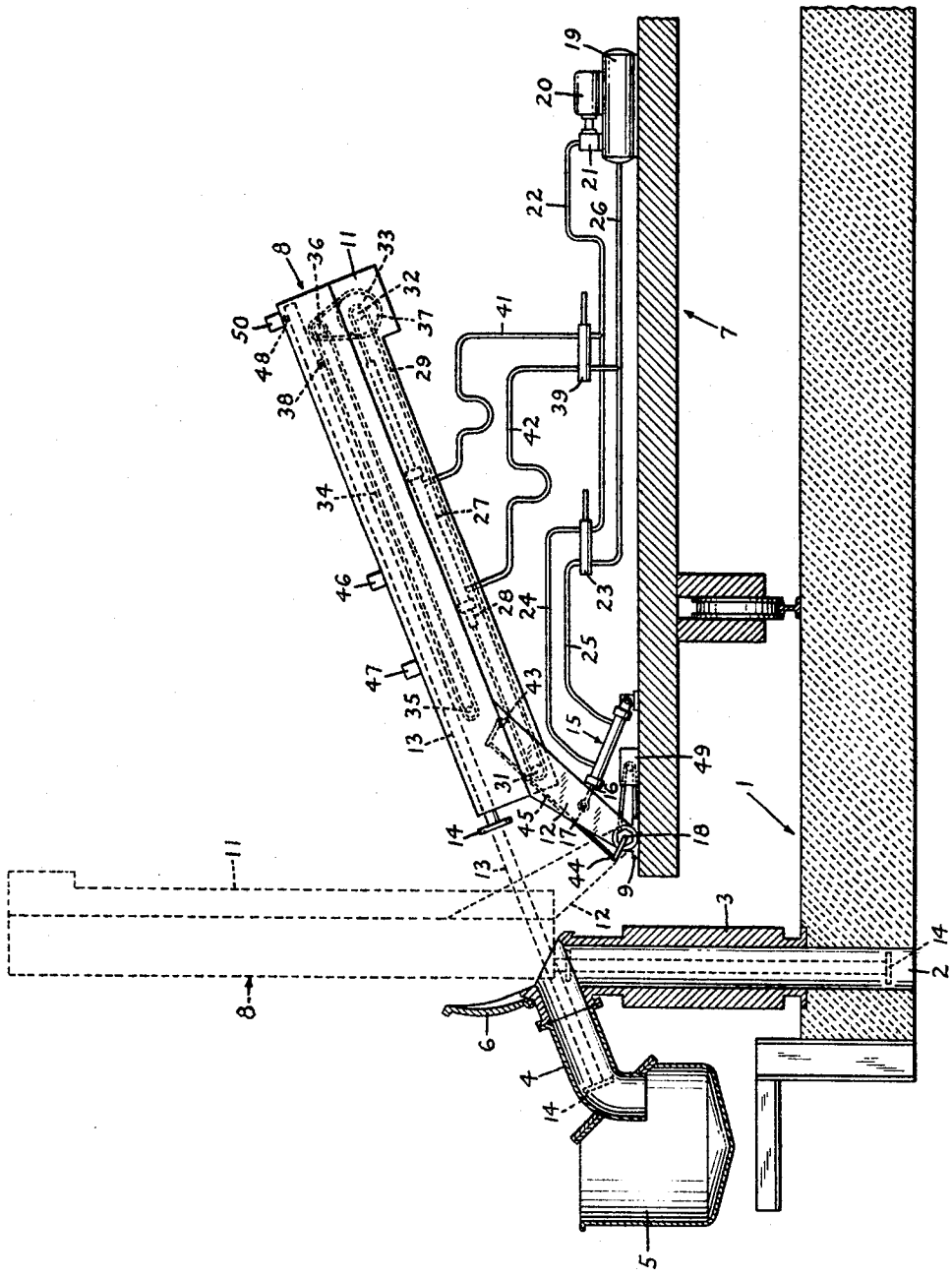
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COKE OVEN STANDPIPE AND ELBOW CLEANING APPARATUS

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COKE OVEN STANDPIPE AND ELBOW CLEANING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A coke oven standpipe and elbow cleaner having an extensible arm equipped with a cleaning head mounted in a hinged housing which is positioned by means of a hydraulic cylinder so as to either clean the vertical leg or elbow leg of the standpipe.

This invention relates to coke ovens and more particularly to an apparatus suitable for use as a combination coke oven standpipe and standpipe elbow cleaner.

In the operation of coke ovens as usually practiced, the gases and vapors produced during operation are normally discharged through a coke oven standpipe and standpipe elbow to a collector main for treatment to recover valuable by-products. These exiting gases contain solids such as carbon, coal tar, etc., which, after a short period of time, tend to adhere to the inner surface of the standpipe and elbow, causing a gas passage restriction which seriously impairs the operating efficiency of the coke oven. As a result, the standpipe and elbow must be periodically cleaned to remove these solids. Under conventional procedures, this cleaning operation is manually performed at a time when the coke oven is not in operation. However, the manual cleaning of the standpipe and elbow is time consuming and dangerous to the operator and frequently, because of the unpleasant nature of the operation, e.g., the cleaning is usually performed under excessive heat conditions, there is incomplete cleaning and there remains in the standpipe and standpipe elbow, quantities of unremoved solids.

It is an object of the present invention to provide an apparatus to facilitate removal of material from the coke oven standpipe and elbow and effect a clean removal of substantially all material from the standpipe. Another object is to provide an apparatus which is capable of selectively cleaning the standpipe and elbow with one spotting of the coal charging car. Other objects and advantages will be apparent from the following detailed description.

In accordance with the present invention, there is provided a coke oven comprising a coking chamber, a gas exit standpipe communicating with the top of the coke oven and having an elbow portion at the upper end thereof, and means, including a housing and an axially movable rod communicating with said standpipe and elbow for selectively axially moving said rod through said standpipe and elbow to effect a cleaning thereof.

The invention will be described with reference to the accompanying drawing which is an elevated view of the apparatus of the invention.

In the drawing, one selected embodiment is shown for purpose of illustration of the standpipe and elbow cleaner and of the method in which it may be employed. It is understood that various changes in detailed features and the arrangement of elements may be made without departing in essential respects from this invention.

In the drawing, a top fragment of a coke oven **1** is shown in section, such oven having the usual outlet passage **2** therefrom for carrying off the by-product gases and other products through a standpipe **3**, the lower portion of said standpipe being connected to the oven in a manner well known in the art. The gases are conducted from the standpipe **3** through the elbow **4** into the collector main **5**, which is shown supported at a horizontal position to one side of the standpipe. A standpipe cover **6** shown in the drawing in the open position, is mounted on the upper portion of the standpipe **3** and is hinged at one side to open directly to the atmosphere during charging of the coke oven.

Normally, the period in the coking cycle during which the cleaning of the standpipe and elbow is effected is during the period immediately preceding the charging of the coke oven. At this time, the coal charging car **7** is adjacent the standpipe **3**, as shown in the drawing. The standpipe and elbow cleaner **8** is mounted on the coal charging car **7** on the side of the coal car adjacent the standpipe and is secured to the coal charging car by means of base member **9**. The standpipe cleaner **8** is positioned in such a manner as to be capable of cleaning in one operation the elbow portion **4** of the standpipe and in another operation the vertical portion of the standpipe **3** as will hereinafter be described.

The standpipe cleaner **8** comprises a housing **11** having a tapered leg **12** extending from one end of the housing and an axially movable rod **13** which is adapted to enter the elbow portion **4** of the standpipe when the housing is in the inclined position, and the vertical portion of the standpipe when the housing is in the vertical position. The rod **13** is equipped with a cleaning head **14** having a circumference slightly less than that of the standpipe and elbow so that the cleaning head rides freely through the standpipe and elbow passage and is adapted to move axially within the standpipe and elbow passage in contact with the walls thereof to produce a plunger or wiping effect to cleanse the walls of the standpipe and elbow of any adhering gummy carbonaceous or other substances obstructing the same.

Normally, the cleaner is in the inclined position with the rod completely retracted. In order to axially align the rod with the standpipe, there is provided a hydraulic cylinder **15** having a piston **16** which engages tapered leg **12** at **17**. The tapered leg is mounted on shaft **18** extending across and rotatably engaging base member **9** which is mounted on coal charging car **7** by means of nuts, bolts or other securing devices. The housing is raised to the vertical position over the standpipe by hydraulic cylinder **15** which when activated causes the piston to extend and the leg and housing to pivot about shaft **18**. The leg and housing traverses an arcuate path until the rod **13** is in axial alignment with the vertical portion of the standpipe. Activation of hydraulic cylinder **15** is effected by permitting fluid from tank **19** to pass through solenoid operated four-way valve **23** via pump **21** and pipe **22** entering hydraulic cylinder **15** through pipe **24**. The hydraulic cylinder is deactivated by discharging the fluid through pipe **25** through valve **23** and thence to tank **19** through pipe **26**.

The rod **13** extends from the housing for cleaning of the standpipe and elbow and retracts after completion of cleaning by means of a driving assembly located within the housing **11**. For this purpose, there is provided a hydraulic cylinder **27** having a piston **28** which is connected to one end of a chain belt **29**, the other end of the chain belt being connected to the opposite end of the hydraulic cylinder **27**. Upon activation of hydraulic cylinder **27**, the piston extends causing belt **29** to rotate about shafts **31** and **32** which in turn rotates disc **33** mounted on shaft **32**. Disposed immediately below rod **13** is another chain belt **34** which rotates about shafts **35** and **36** and is driven by belt **37** which contacts disc **33** and shaft **36**. The rod **13** has an extension **38** and is attached to chain belt **34**, so that when the chain belt

moves counterclockwise, the rod extends from the housing. The hydraulic cylinder **27** is activated by permitting fluid to flow from tank **19** through pump **21** driven by motor **20**, thence through pipe **22** and into the solenoid operated four-way valve **39**. At the proper time in the cycle, the fluid then leaves solenoid operated four-way valve through flexible piping **41** and enters hydraulic cylinder **27**. Activation of the hydraulic cylinder causes the piston **28** to be driven forward and by means of the driving assembly causes the rod **13** to extend from the housing and into the elbow portion of the standpipe. The hydraulic cylinder **27** is deactivated by permitting the fluid to pass through flexible pipe **42**, thence through valve **39** entering tank **19** through pipe **26**.

As can be seen from the drawing, the rod travels a shorter distance when cleaning the elbow portion of the standpipe. In order to control this limited travel, the piston **28** engages finger **43** which prevents the piston from extending to its full capacity and through the driving assembly, prevents overtravel of rod **13** into the elbow portion **4** of the standpipe. When the housing is swung to the vertical position, the lug **44** which is fixedly secured to shaft **18** rotates counterclockwise and exerts a pulling effect on tensioner **45** which causes finger **43** to pivot out of contact with the piston permitting the piston to extend to its full capacity.

The operation can be made fully automatic by employment of conventional limit switches, relays and solenoid operated four-way valves strategically placed in the apparatus. Thus, for example, limit switches **46** and **47** and activator **48** mounted on rod **13** can be employed to regulate the extent of travel of the rod into the standpipe and elbow. Limit switches **49** and **50** in cooperation with an external circuit, not shown, regulate hydraulic cylinder **15** so that the cleaner housing is raised to the vertical position.

The cleaning cycle starts with the cleaner **8** in its inclined position and the rod retracted. In a typical operation, a push button is depressed and causes fluid to pass through four-way valve **39** and into hydraulic cylinder **27** through flexible pipe **41**. Activation of hydraulic cylinder **27** in combination with the driving assembly causes rod **13** to extend into the elbow portion of the standpipe. Limit switch **46** which is operated by actuator **48** in cooperation with limit switch **49** as set by the inclined position of the housing stops the rod **13** at the end of the elbow and automatically reverses the stroke. In the event that the limit switches fail to function properly, finger **43** will prevent overtravel of the rod into the elbow portion as previously explained. When the rod **13** is fully retracted, limit switch **50** in conjunction with switch **49** and an external circuit, not shown, energizes the four-way valve **23** which controls hydraulic cylinder **15** causing the piston **16** to extend thereby causing the housing to traverse an arcuate path until it is in axial alignment with the vertical portion of the standpipe. As the housing is raised, the lug **44** is rotated and through the tensioner **45** causes the finger **43** to rotate into the clear so that the piston **28** can travel its full stroke. When the cleaner housing is rotated to the vertical position, limit switch **49** actuates four-way valve **39** permitting fluid to pass through four-way valve **39** into pipe **41** and thence into hydraulic cylinder **27**. By the action of the driving assembly, the rod **13** is permitted to travel its full stroke into the standpipe. In the vertical position of the housing, actuator **48** operates and passes by limit switch **46** without stopping the rod stroke. At the end of the full stroke, actuator **48** operates limit switch **47** causing the hydraulic cylinder to reverse its stroke, and, through the driving assembly, to completely retract the rod. At the end of the retraction stroke, limit switch **50** is again operated which in conjunction with switch **49** and an external circuit, causes the hydraulic cylinder **15** to lower the housing to its inclined position. As the housing arrives in the inclined position, limit switch **49** through the external circuit shuts down the operation of the cleaner.

The advantages of my invention will be readily apparent to those skilled in the art to which such invention relates. The entire mechanism is relatively simple and such that it can be readily kept in order and while the arrangement of the parts as shown and described illustrates an operative embodiment of my invention, it is to be understood that I do not limit myself to the exact details of the combinations and arrangements of the parts as illustrated, since many changes in the detailed assemblage and co-operative connection of the said described and shown parts may be made, without departing from the scope and spirit of my invention as defined by the claim.

For example, instead of the hydraulic cylinders previously described for the operation, there may be used as activating members electric or air-motor drives to position the housing and to drive and retract the rod.

I claim:

1. A coke oven standpipe and elbow cleaner comprising a housing having a leg extending from one end of said housing, an axially movable rod within said housing, positioning means communicating with said housing to selectively axially align said rod with said standpipe and elbow, said means including a base member, a shaft extending across and mounted on said base member, the said leg pivoting its free end on the shaft, a hydraulic cylinder engaging said leg and adapted to cause said leg and housing to travel an arcuate path about the shaft to axially align said rod selectively with said standpipe and elbow; a driving assembly associated with said rod and adapted to drive and retract said rod axially through said standpipe and elbow including an activating member, a chain drive associated with said activating member and said rod and locking means associated with said positioning means and driving assembly to limit the travel of said rod through said elbow and standpipe including a lug fixedly secured to said shaft, a pivotal finger communicating with said hydraulic cylinder and a tensioning device disposed between said lug and pivotal finger and adapted to cause said pivotal finger to be in an out of contact relation with said hydraulic cylinder upon counterclockwise rotation of said lug.

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