# United States Patent [19]

**Mole**

[11] **3,857,758**

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[54] **METHOD AND APPARATUS FOR EMISSION FREE OPERATION OF BY-PRODUCT COKE OVENS**


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[73] Assignees: **Alvin W. Block; Stephen Levy; Alvin Becker,** all of Chicago, Ill. ; a part interest



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[52] **U.S. Cl.** ..... **201/40,** 202/263, 214/18 PH, 214/35

[51] **Int. Cl.**..... **C10b 31/04**

[58] **Field of Search** ..... 202/262, 263, 254, 255, 202/256; 201/40; 214/35 R, 18 PH



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*Primary Examiner*—A. Louis Monacell
*Attorney, Agent, or Firm*—Wolfe, Hubbard, Leydig, Voit & Osann, Ltd.



[57] **ABSTRACT**

Methods and apparatus for emission free charging of by-product coke ovens wherein the larry car hoppers are sealed and a manifold arrangement including an induced draft fan is utilized to direct charging emissions up through the hoppers to the ascension pipe of the main leading to the by-product processing system. The apparatus includes means for manually or automatically effecting sealing engagement between the manifold and the ascension pipe elbow cap opening and for effectively sealing the discharge chutes of the larry car hoppers with their respective oven charging ports.


**6 Claims, 7 Drawing Figures**

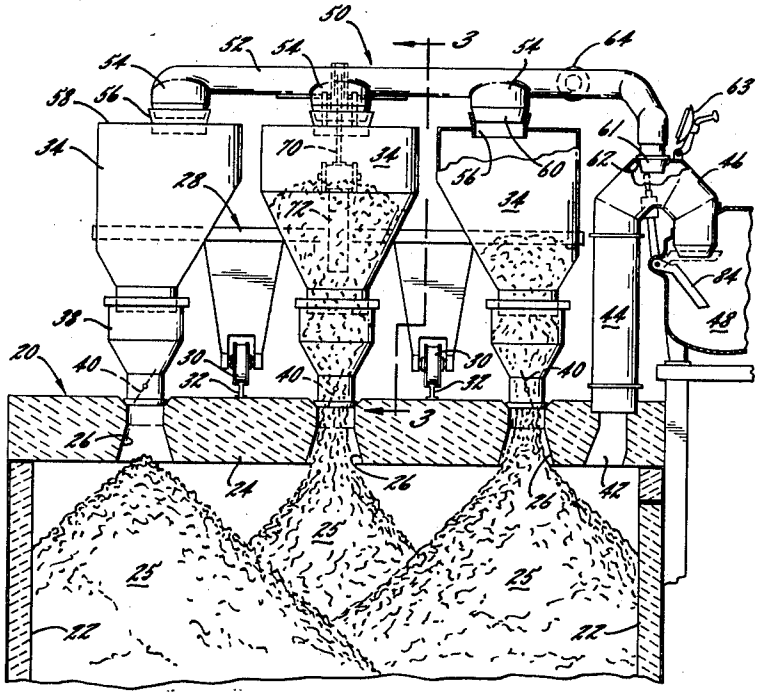
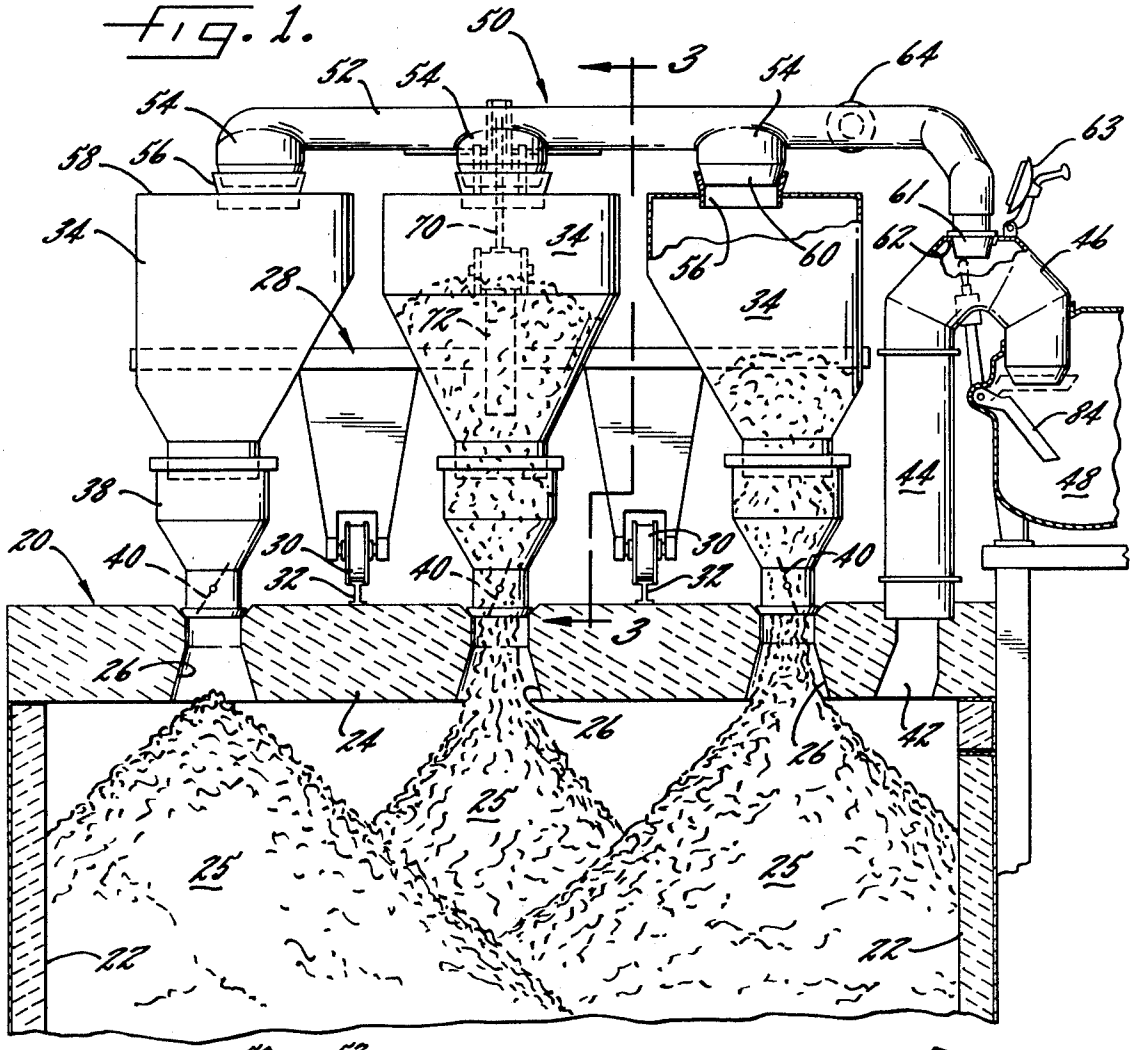


Fig. 1.



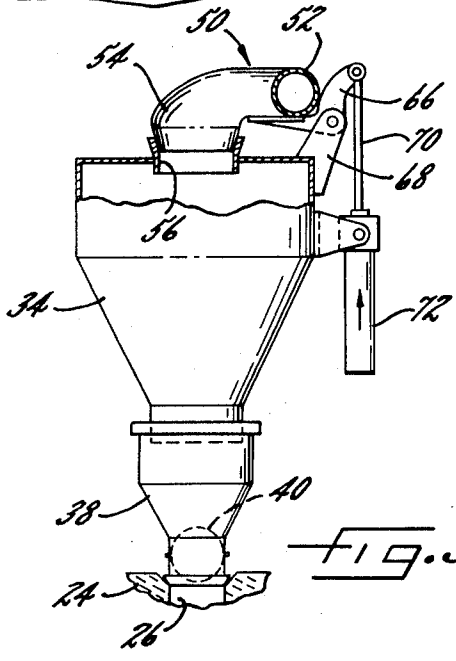




Fig. 3.

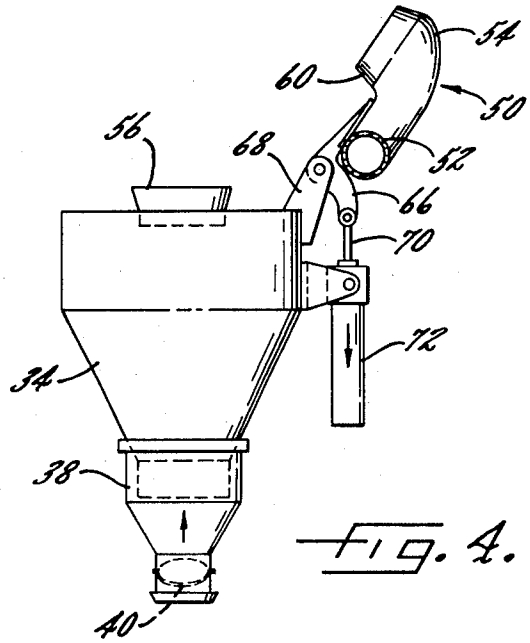



Fig. 4.

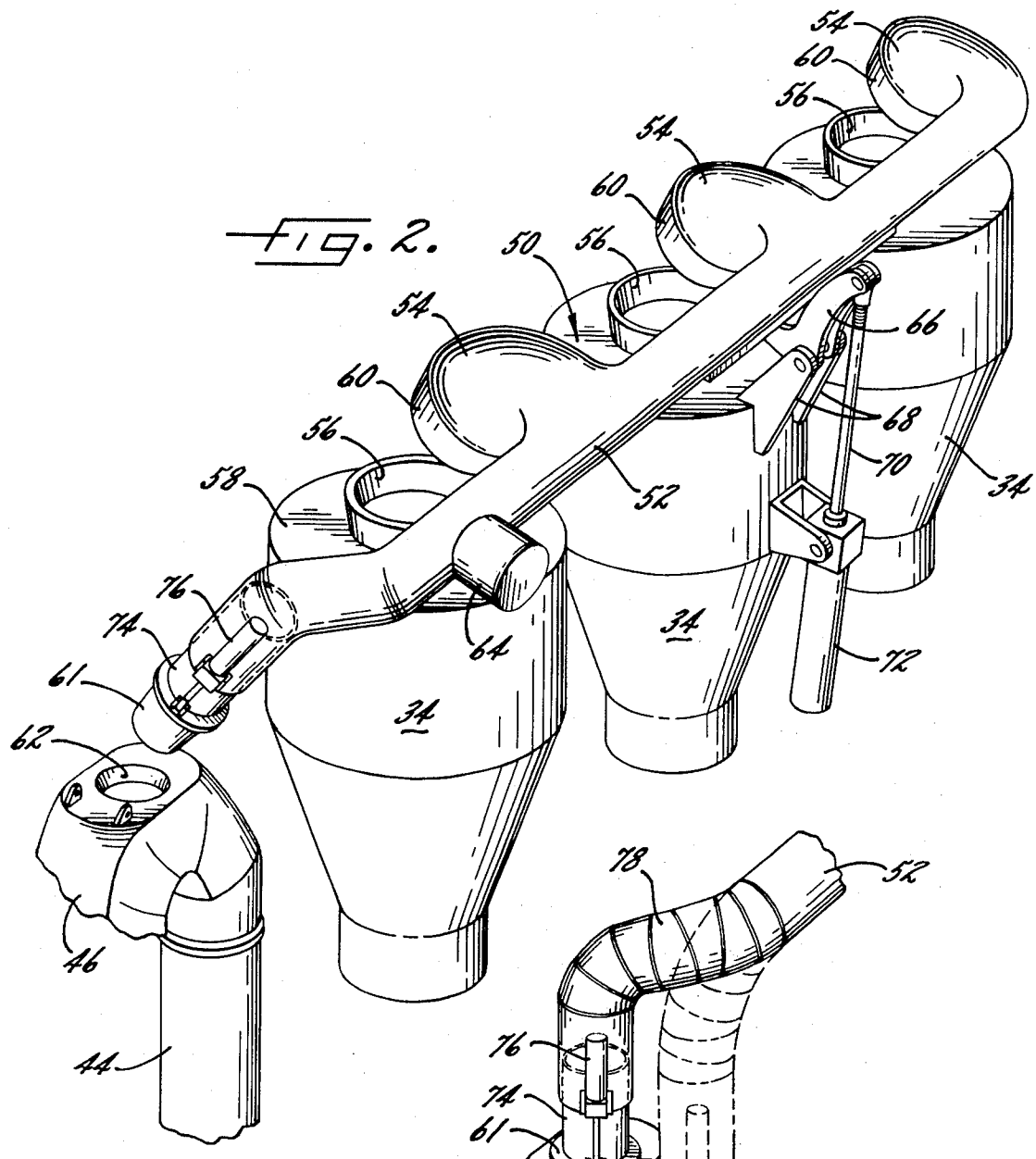

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Fig. 2.

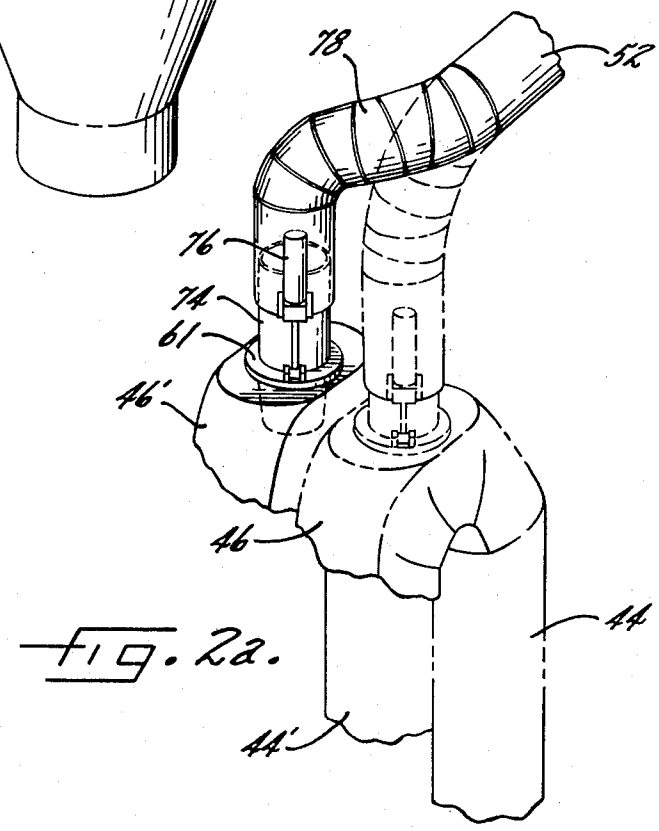

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Fig. 2a.

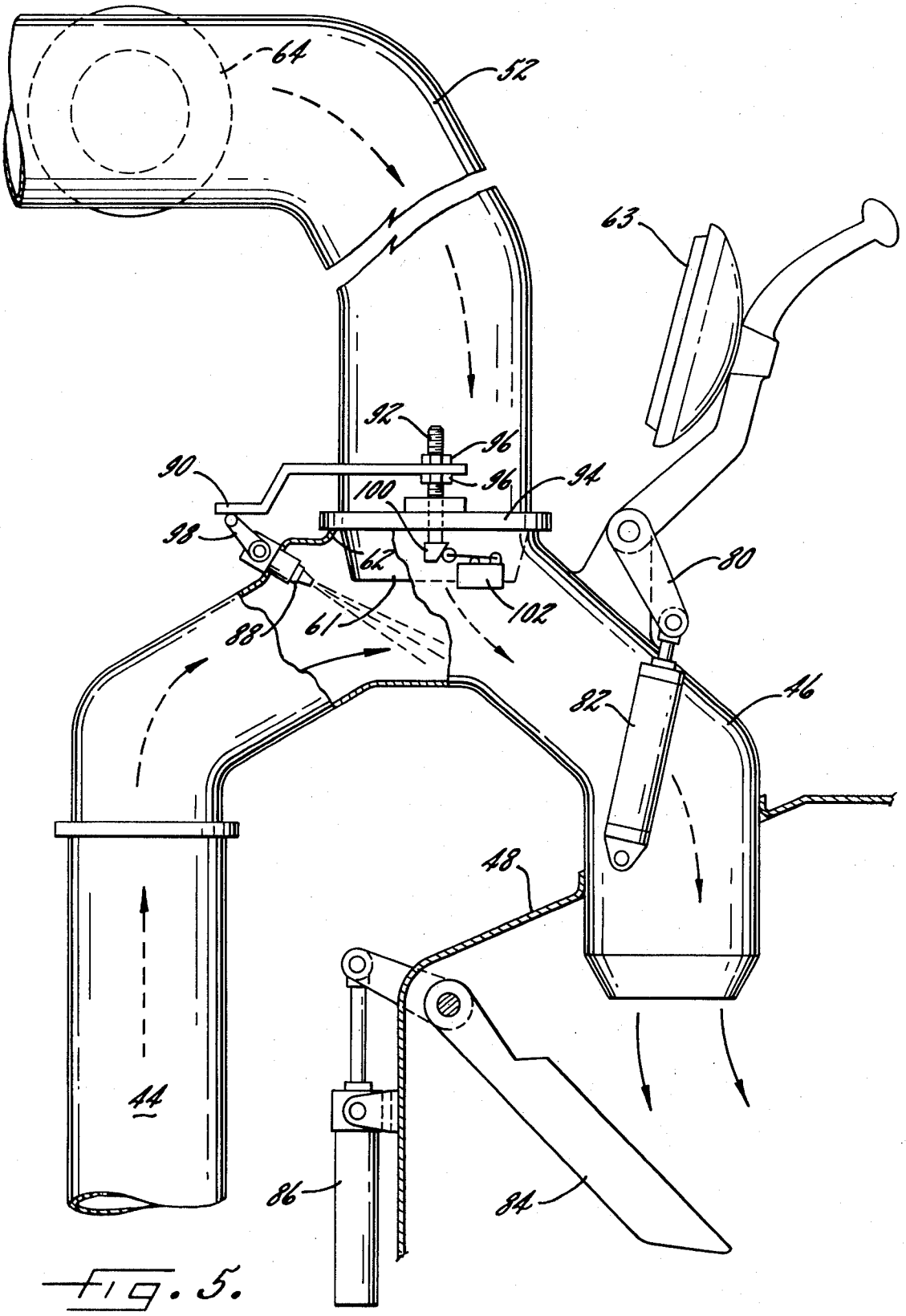



Fig. 5.

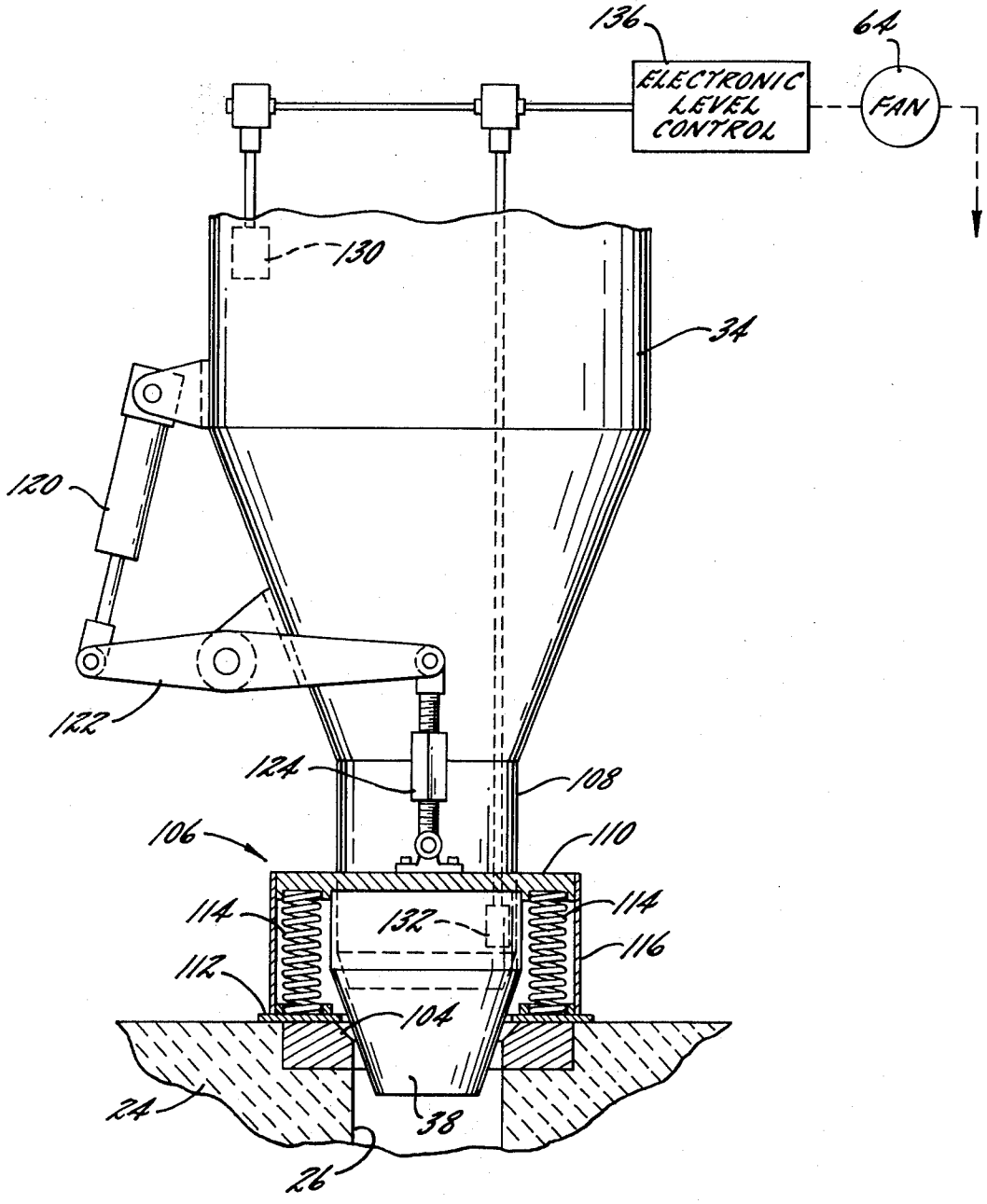

136
64
ELECTRONIC LEVEL CONTROL
FAN
130
34
120
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Fig. 6.

# METHOD AND APPARATUS FOR EMISSION FREE OPERATION OF BY-PRODUCT COKE OVENS

## DISCLOSURE OF INVENTION

The present invention relates generally to by-product coke ovens and more particulary, to methods and apparatus for effectively controlling atmospheric pollution emissions from by-product coke ovens during the coal charging cycle.

## BACKGROUNND AND OBJECTS

The steel industry in the United States today for the most part utilizes by-product ovens for manufacturing metallurgical coke that is used in the operation of blast furnaces to make the steel. The coke itself is a residue from the destructive distillation of coal and in the by-product oven method of manufacturing coke volatile products liberated during coking are recovered as gas and coal chemicals and percentage of the gas produced is returned to the ovens for heating purposes.

Generally, a plurality of ovens constituting a battery having alternate coking and heating chambers lined with refractory material are operated continuously according to a cycle where first prepared coals blended and adjusted for proper bulk density, are transported as weighed individual charges from coal bunkers in wide gauge self propelled vehicles that run on tracks along the top of the battery. The vehicles commonly referred to as larry cars, include individual hoppers and specially designed tapered discharge chutes corresponding in number to the slot openings or charging ports at the top of the ovens.

When the larry car hoppers are filled with predetermined amounts of coal they are positioned over the charging ports, the lids are removed and coal is discharged into the ovens in a preselected sequence. Discharged coal in the ovens form peaks that are leveled by bars oscillated back and forth across the top of the oven chamber.

After charging and leveling the coal, all ports are sealed and the coking cycle is begun.

During the coking cycle volatile matter is permitted to escape from the ovens through outlets at the top of the oven fitted with a refractory-line stand pipe or "ascension pipe" that in turn is connected to the collecting main spanning the battery. The collecting main is coupled to a by-product plant system that further processes the recovered products to form various gases and chemicals. For details of some of the types of by-product coke ovens and auxiliary equipment cross reference is made to "The Making, Shaping and Treating of Steel" United States Steel Corporation, 8th Ed., 1964, Chapter 4, Pages 102–121.

Heretofore, one of the greatest sources of air pollution from conventional slot-type coke ovens is the production of atmospheric pollution emissions during the coal charging cycle. The emissions which accompany the charging of coke ovens from the larry cars are primarily due to factors encountered with the relatively cold coal entering the slot or charging opening of the extremely hot coke oven chambers. The free space in the oven, leaves through the charging ports, and the residual moisture in the coal itself immediately starts to break down due to the thermal chemical reactions resulting in tar vapors, steam, gas, fumes, and particulate. The by-product plant itself will recover from 95 to 99 percent of the volatile matter evolved during the coking operations, but the small remaining percentage of emissions is produced during the charging cycle. Of this percentage of emissions is produced during the charging cycle, a substantial percentage goes directly to the atmosphere and does not enter the by-product plant.



Because of the seriousness of the emission problems during charging, various attempts have been made to minimize or prevent the escape of gases while charging the oven with coals. One practice that has been followed is known as the American Iron and Steel Institute (AISI) system of charging the oven on the main. The AISI system uses the concept of a steam-jet aspiration that puts the oven under suction during the charging and leveling period to direct gases produced into the collection main. A specially designed, sealed larry car is provided to minimize openings through which gases may escape. This approach has not proven to be very satisfactory for numerous reasons. Due to difficiencies in the equipment there still is some discharge into the atmosphere and there is a great deal of criticality involved in preventing over cooling of the ovens which could result in a costly shut-down requiring a rebuilding of the refractory linings of the ovens.

Moreover, the high pressure steam in the ascension pipe used to create a suction and draw off the gases will also pull coal particles along with the gases into the main. Peaks and valleys of charged coal in the oven tend to block off a free passageway for large volumes of gases displaced. Since the ports are sealed by the coal in the hopper back pressure results which can cause an explosion that relieves such a back pressure buildup. Steam failure of the ejectors has occured which causes a buildup of gases in the oven chambers. This too, may result in an explosion. Finally, the AISI larry car in most instances cannot be adapted to the older existing batteries which cannot support such additional weight structurally.

Another approach followed in European countries, primarily, although introduced to a limited extent in the United States involves larry cars fitted with a hood around the coal charging sleeve that is connected by a duct to a gas cleaning device and suction fan. Several different arrangements with wet mechanical disintegrators, or Venturi scrubbers have been tried with such equipment being provided for each charging hole or a single unit with manifolds. This approach has not been altogether satisfactory in its application in the United States due to the numerous different characteristics of the coals and environmental conditions. Higher moisture content, for example, produces a greater amount of steam that has to be discharged and it carries volatiles along with it into the atmosphere. A build-up of back pressure has been known to cause inspection port covers to be hurled hundreds of feet into the air and even more seriously to derail and topple larry cars from the top of an oven battery. Other problems encountered with this approach are:

1. Combustion of the gas before entering the scrubbers is not always complete due to ignition failures. Explosions result.
2. Venturi scrubbers require large volumes of water carried in containers on the larry car. The dirty water passes through the gravity separator to be discharged in a sewer, thus creating a water pollution problem.

3. The larry car must take on water with each charge and discharge dirty water after a return. In winter freeze-ups occur.
4. Maintenance and control monitoring is extreme often resulting in from 50-60% down time.

For details of the foregoing arrangements, reference is made to "Control of Coke Oven Emissions" by T. E. Dancy, prepared for presentation at the 78th General Meeting of the American Iron and Steel Institute May 27, 1970.

Accordingly, it is a primary object of the present invention to provide methods and apparatus for charging by-product coke oven batteries which overcome the foregoing disadvantages and will eliminate air pollution emissions on charging by directing the gaseous emissions to the collecting main of the by-product plant instead of discharging to the atmosphere. In this connection, it is an object of the present invention to provide the aforementioned methods and apparatus which may be readily applied at relatively low cost to conventional existing by-product coke ovens and larry cars as well as to be incorporated in new equipment constructions.

In one of its aspects, it is an object of the present invention to provide a system for controlling air pollution emissions from by-product coke ovens which seals off the charging coal ports and other auxiliary conveyors to minimize the leakage of air into the coke oven whereby maximum safety factors are met and safe levels of oxygen in the collecting main are not exceeded.

In another of its important aspects, it is an object of the invention to provide apparatus for use in conjunction with larry car hoppers which seals the coal charging ports and the hoppers as well as the ascension or stand pipes and provides means for manifolding and directing emissions the collecting main during the coal charging operation. In this connection, it is yet another object of the invention to provide apparatus for fully automatically operating the system which collects and directs emissions formed during charging to the collection main.

Other objects and advantages of the invention will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary elevation view, partly in section, showing a by-product coking oven with larry car flling of the oven chamber and embodying the features of the present invention;

FIG. **2** is an enlarged perspective view of exemplary larry car hoppers employing a manifold arrangement for directing emissions to the ascension pipe of the main according to the present invention;

FIG. **2***a* is a fragmentary perspective view of an alternative flexible conduit for the manifold of the present invention.

FIG. **3** is a view taken substantially along the line **3—3** in FIG. **1,** illustrating the hopper manifold in a closed position.

FIG. **4** is a side elevation of the larry car hopper of FIG. **3,** but here illustrating the manifold in the retracted or open position;

FIG. **5** is an enlarged fragmentary side view of the manifold of the present invention coupled with an ascension pipe and elbow connected to a main, here illustrating the automatic control available with the invention; and

FIG. **6** is an enlarged side view of a larry car hopper arrangement for discharging into an oven slot incorporating yet another aspect of the present invention.

While the invention is susceptible of various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed, but, on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as expressed in the appended claims.

## GENERAL ARRANGEMENT

Referring now to the drawings, there is diagrammatically illustrated in FIG. **1** an exemplary section of a typical by-product coke oven, indicated generally at **20,** which is particularly suitable for atmospheric emission free charging with coal in accordance with the present invention. While the particular type of oven to be charged is not critical to the present invention, it will be appreciated as the ensuing description proceeds, that the exemplary arrangement for controlling the emissions during charging will find particularly advantageous but, by no means exclusive, use in conventional slot-type, by-product oven batteries which are widely in use currently by the coke producing industry.

As illustrated in FIG. **1,** the oven **20** which has refractory lined side walls **22** and top wall **24** is charged with coal **25** through slot openings **26** in the top wall of the oven from individual hoppers of the larry car **28.** The larry car **28** having wheels **30** moves along tracks **32** mounted along the top of the furnace wall **24.** The larry car **28,** which may be fully mechanized and self-propelled so as to be handled by a single operator working in an environmentally controlled cab (not shown), includes a plurality of hoppers **34** equal in number to the openings **26** of the furnace disposed in a transverse line with respect to the track **32.** The hoppers **34** are funnel-shaped and have an axially shiftable sleeve member **38** surrounding the lower opening thereof which moves into the slot opening **26** during the charging operation for a close coupling that prevents leakage of gases to the atmosphere. The sleeve **38** carries a valve **40** which is operable to discharge the coal from the hopper once the sleeve has been positioned within the opening **26.**

As is well known to those skilled in the art, the larry car ordinarily carries automatically operated magnetic lid lifters or the like (not shown) which remove lids normally in place over the slot openings **26.**

As further illustrated in FIG. **1,** the oven **20** includes an opening **42** adjacent one side to which is coupled an ascension pipe **44** and elbow **46,** the latter being directed into the main **48** that runs along side the oven and carries the volatile products produced during coking to the by-product plant.

A. Hopper Manifold System

In accordance with one of the important aspects of the present invention, provision is made for sealing the larry car hoppers to conduct emissions produced during the charging operation up through the hopper and then through a closed manifold system directly into the ascension pipe elbow for discharge into the main from

whence such emissions may flow to the processing recovery plant system.

In carrying out this aspect of the invention, referring to FIGS. 1 and 2, conjointly, the larry car hoppers 34 are transversely spanned by a pivotally mounted manifold assembly 50, which includes a transverse main conduit 52 and a plurality of shroud conduits 54 that intersect the main conduit 50 and are adapted to sealingly cover top openings 56 provided in the larry car hoppers 34.

The manifold assembly 50 may be constructed of sheet material such as stainless steel shaped and welded or otherwise secured to form the manifold-like structure. Alternatively, the manifold may be integrally formed or molded from a otherwise suitable heat resistant and non-reactive material which would be uneffected by the volatile materials produced by such coking ovens. It should be appreciated that the tops of the hoppers 34 may be made or fitted with specially designed cover members 58 having openings 56 which are tapered to conform with a taper 60 provided at the extremity of the shroud 54. Such an arrangement provides for good sealing between the shroud and the hopper opening when the shroud is moved into the closed position. Of course, the shrouds 54 may take any number of shapes which may be necessary to enable them to conform with the hopper top openings to achieve a sealing engagement therebetween.

In order to conduct gaseous emissions received in the manifold to the ascension pipe elbow 46, the end of the transverse conduit 52 adjacent the ascension pipe elbow is adapted to be sealingly received into the inspection clean-out port 62 conventionally provided in the ascension pipe elbow 46. As best seen in FIG. 1, the inspection port opening 62 is typically provided with a pivotally hinged cover 63 that enables the port to be sealingly closed when not in use. The end 61 of the manifold conduit 52 is provided with a tapered portion adapted to sealingly engage the inspection port opening 62 when the manifold is in its closed position as viewed in FIG. 1.

Disposed within the main conduit 52 of manifold 50 and adjacent the ascension pipe entry end thereof is an induced draft fan 64 (FIGS. 1 and 2) which places the shrouds of the manifold on the suction side to pull gases out of the larry car hoppers and blow them through the conduit 52 into the ascension pipe elbow leading to the main. The fan 64 need only be of sufficient capacity to create a slight pressure differential that will cause the gases to flow. Indeed, the fan should not be of too high a cfm rating that would pull coal particles from the hopper and blow them into the ascension pipe.

In order to engage and disengage the manifold 50 with respect to the hoppers 34 and the ascension pipe inspection port 46, provision is made for mechanically rotating the manifold assembly in a manner which may be fully automatic and remotely controlled. To this end, referring to FIGS. 2, 3 and 4, the manifold is mounted on a generally L-shaped link member 66 having one leg attached to the manifold assembly and the fulcrum point of the link, being hingedly pinned to a pair of projecting trunions 68 attaching by a hopper 34. The other upstanding leg end of the link is connected to a rod 70 which in turn is coupled to the piston of a fluid operated servo mechanism 72 attached to the hopper side wall.

The arrangement is such that fluid actuation of the servo mechanism 72 driving the rod 70 in the upward direction rotates link 66 counterclockwise as viewed in FIG. 3 thereby bringing the manifold into the closed position where the shrouds 54 sealingly engage the openings 56 at the top of the hoppers 34. It will be appreciated, that at this point when such operation is carried out the larry car hoppers are intended to be situated such that the hoppers are positioned over the slot openings of the oven to be charged and the same rotatable movement of the manifold which seals off the hoppers causes the end 61 of the manifold conduit to enter the inspection port opening 62 of the ascension pipe elbow, as viewed in FIG. 1.

Conversely, actuation of the fluid operated servo mechanism 72 such that the rod 70 is moved downward as viewed in FIG. 4 rotates the manifold in the clockwise direction of this figure and brings the manifold to the open out-of-the-way position that disengages the conduit end 61 from the ascension pipe inspection port opening. This permits the larry car to be moved freely along the track to the next slot opening to be charged or returned back to the hopper filling station at one end of the battery.

In accordance with yet another aspect of the present invention, provision is made at the ascension pipe elbow inspection port opening entry portion of the manifold conduit 52 to permit adjustments to be made for differences that occur in the relative heights of the ascension pipes of coke oven batteries. In existing oven batteries it is not uncommon to find that for one reason or another over the years of use the tops of the ascension pipe elbows adjacent the oven slots are not in planer alignment.

To this end, referring to FIG. 2 the end 61 of main conduit 52 is provided with a separate, interfitting, relatively shiftable portion 74 which is coupled to the conduit 52 by means of a fluid operated servo 76 or the like. The actuation of the servo 76 causes the advancement or retraction of the fitting 74 to lengthen or shorten the reach of the conduit end 61 depending upon the particular height of the ascension pipe elbow opening it must couple with.

Referring to FIG. 2*a*, there is shown yet another feature of this invention that may be incorporated in the end portion of the manifold main conduit 52, this time to permit the end 61 to be moved over and used with an out of line ascension pipe elbow 46' in the event that the ascension pipe 44 associated with its respective oven slot is clogged with pitch and tar as may sometimes occur. To accomplish this, a flexible or articulated portion 78 is provided in the main conduit 52 which permits the end to be repositioned to the adjacent desired location.

B. Automatic Control of Ascension Pipe Component Functions

In carrying out a coking cycle the various components of the ascension pipe which include the damper valve, cap valve or "elbow cover" and steam jet spray are all operated in a predetermined sequential manner. These operations may be manually controlled or as provided for in the aforementioned AISI system may be operated by means of mechanical actuators on the coal charging car. In the present arrangement, referring to FIG. 5, provision is made for automatic control of the various ascension pipe components in a manner more

particularly suited for use with the emission control apparatus of the present invention.

Thus, the elbow cover lid **64** is arranged to be pivotally opened and closed through a linkage **80** and a suitable servo drive **82** which may be operated manually or automatically through actuators operated from the larry car. The liquor seal damper **84** is likewise coupled to a servo drive **86** which may be actuated in any number of known ways manually or automatically.

In order to initiate the aspirating steam spray jet **88** and to turn on the induced draft fan **64** of the manifold **50,** suitable actuators are provided operable in conjunction with the sealing of the main conduit end **61** in the inspection port opening **62.** The illustrative actuator takes the form of a striker plate **90** carried by a threaded lug **92** that is attached to a flange **94** surrounding the conduit end **61.**

Nuts **96** carried by the threaded member **92** permit adjustment of the plate **90** to set the plate position required for actuation of control lever arm **98** that operates steam ejection **88.** The lower end of threaded member **92** includes a cam striker head **100** adapted to actuate limit switch **102** that is connected to the induced fan **64.**

C. Hopper Feed Outlet and Charging Port Sealing Arrangement

In accordance with another important aspect of the present invention, provision is made for effecting a more positive seal between the coal hopper feed outlets and charging ports of the ovens than has heretofore been provided. In carrying out this aspect of the invention, reference is made to FIG. **6** which shows a larry car hopper **34** with its lower opening shiftable sleeve **38** engaging the charging port opening **26** in oven upper wall **24.** Surrounding the charging port opening **26** is a ring **104** that typically carries the charging port lid (not shown). In existing coke ovens the rings are often slightly askew resulting from the long periods of usage and the hopper sleeve **38** though tapered may not form a tight seal to prevent atmospheric emissions from occurring during the charging operation.

To this end, there is provided an auxillary shield assembly, indicated generally at **106,** that surrounds the hopper discharge conduit **108** and is coupled to the sliding sleeve **38** so as to be shiftable along therewith. The shield **106** includes a top plate **110** and a space annular bottom plate **112** that is supported and biased away from the top plate **110** by springs **114.** An outer cover of flexible heat resistant material **116** seals the space between the top plate **110** and the bottom plate **112.** It will be appreciated, however, that instead of separate springs **114,** an individual coil spring may be used or alternatively, the flexible cover material may contain such a coil spring integrally formed therewith.

In order to move the shield assembly **106** toward and away from the charging port in the furnace top wall, there is provided a servo drive **120** secured to the hopper side wall; the servo operates linkage **122** which in turn is coupled through an adjustable toggle **124** to the top plate **110** of the shield assembly. The arrangement is such that actuation of the servo drive **120** such that when the linkage **122** rotates clockwise as viewed in FIG. **6,** the top plate **110** is driven downwardly so that the bottom plate **112** is urged into contact with the charging port ring **104.** Due to the spring biasing of the bottom plate **112,** the latter can assume a skewed position to conform with the position of the charging port ring even though the latter may not be perpendicular to the axis of the hopper. After the coal is discharged from the hopper, the servo **120** is actuated so that the linkage **122** rotates counterclockwise as viewed in FIG. **6,** to lift the shield assembly and sleeve **38** away from the charging port and the larry car may then advance to the next row of charging ports or back to the coal filling station without interference.

In addition to the shield assembly, there is illustrated in FIG. **6,** a system to sense preselected maximum and minimum levels of coal in the hopper **34** for controlling operations such as the induced draft fan **64** in hopper manifold **50.** In this regard, a center probe **130** is mounted at a selected distance from the top of the hopper and a second probe **132** is mounted adjacent the discharge opening at the bottom of the hopper. These sensors may be electronic electromechanical and are connected to an electronic level control, **136** that may operate a number of the pieces of equipment of the coke oven battery in addition to the induced draft fan **64.**

For example, the sensor **130** may be located at a point in the hopper which would indicate that a substantial portion of the coal from the hopper has been discharged and it is necessary to activate the levelers to smooth out the peaks that have been formed within the oven. Other functions of level sensing equipment in the larry car hoppers will be apparent to those skilled in the art.

One further function that merits brief mentioning, is to operate vibrators (not shown) located on the hoppers to regulate the discharge rate in conjunction with the butterfly valves **40** at the discharge ends of the hoppers. The vibrators are usually adjustable from zero to maximum output and are controlled either manually or automatically to vary the output as required to obtain efficient and regulated movement of the coal from the hopper into the oven.

D. Typical Cycle of Operation

In order to more fully understand the methods and apparatus of the present invention, a step wise description of a typical cycle of operation is presented herein below. The operating procedures for essentially all of the various types of by-product coke ovens are substantially the same starting with the filling of larry car charging hoppers with a predetermined mixed and blended volume of coal as required for the particular coking cycle. The larry car, after the hoppers are filled, is moved to the charging position on the oven either manually or automatically and sensing controls such as a gamma ray interlock enables a positioning and stopping of the larry car within plus or minus one third of an inch of the oven slots to be charged. At the same time, pusher equipment and leveling bar equipment may be manipulated to be brought into their respective new positions for use. Manually or automatically operated lid lifters then remove the charging port lids and the tapered feed hopper drop sleeves **38** are lowered into their respective ports. The cycle then proceeds thusly:

1. Approximately at the same time that the hoppers are coupled to the oven charging slots, the ascension pipe inspection elbow cover **63** is acutated into the open position as illustrated in FIG. **1** and the damper valve **84** is acutuated into a closed position on the collector main **48.** the manifold **50** is then brought into the closed position covering and sealing the hopper tops

and inserting the end **61** of conduit **52** into the inspection port opening **62.**

2. The coal charging from the hoppers is now begun by opening of valve **40,** assisted by vibrators or other mechanical bin activators to empty the hoppers at a predetermined rate. Damper valve **84** is opened and the steam ejectors and the induced draft fan are turned on to transport smoke and gases rising up through the hoppers through the manifold into the main. The leveling functions are carried out at the appropriate times as may be determined by the sensing probes detecting an amount of discharge where such leveling is necessary.

3. When the coal bin hoppers have been fully discharged and the emissions which evolve are drawn off and directed into the main through the manifold system, the hopper discharge sleeves are retracted and the lids are replaced over the charging ports. At this stage the induced draft fan **64** may be turned off, and the hopper manifold **50** may be pivoted to the open position thus permitting the elbow cover **63** to be immediately closed. At the same time that the foregoing takes place, the steam ejector valve is also actuated to the closed position. The damper valve **84** remains opened to accomodate the coking cycle volatiles generated within the coke oven slot. The larry car may be moved on for refilling and carrying out of another cycle.

I claim as my invention:

**1.** The method of eliminating atmopsheric emissions during charging of by-product coke ovens of the type having charging ports for filling the oven chambers from coal hoppers carried by said oven and said hoppers having top openings for filling the hoppers and bottom discharge openings adapted to be discharged into said ports and a gas collection main having an ascension pipe and elbow including an elbow port opening and cap therefor adjacent said ports comprising the steps of,

a. automatically actuating manifold means including shroud conduits and a closed conduit traversing the tops of the hoppers and intersecting said shroud conduits so that said shroud conduits sealingly cover the tops of the hoppers, said conduit having an induced draft fan disposed therein,

b. connecting the end of the closed conduit from said sealed hoppers to said ascension pipe elbow port opening of said gas collection main,

c. actuating said fan to create an induced draft in said closed conduit directed toward the collection main,

d. positively conducting emissions produced during the charging of the oven chamber up through the hoppers and through said conduit means into said gas collecting main.

**2.** In a by-product coke oven having charging ports for filling the coke oven chamber, an ascension pipe and elbow including an elbow port opening and cap therefor, the ascension pipe elbow being coupled to a gas collecting main along side said oven, and a larry car having coal charging hoppers with top openings for filling the hoppers and bottom openings including means for introducing the coal to said charging ports, the improvement for preventing atmospheric emissions during the charging operation, comprising, in combination, manifold means pivotally carried by said larry car adapted to sealingly cover said hopper top openings, said manifold including conduit means for sealingly coupling the larry car hoppers to said ascension pipe elbow port opening whereby charging emissions are conducted through said hoppers and manifold to the main, means including an induced draft fan connected to said manifold conduit means for positively moving said charging emissions therthrough, said manifold means comprising a transverse main conduit and a plurality of shroud conduits that intersect the main conduit, the shroud conduits being adapted to sealingly cover the top openings in the larry car hoppers, said main conduit having an end adapted to sealingly engage the elbow cap opening of the oven ascension pipe associated with the chamber being charged, actuating means for automatically operating said manifold means to move said manifold to a first out-of-the-way position and a second sealing position with respect to the hoppers.

**3.** Apparatus as claimed in claim **2** wherein said main conduit elbow cap opening engaging end includes an articulated flexible portion.

**4.** Apparatus as claimed in claim **2** wherein said main conduit elbow cap engaging end includes an extensible interfitting end portion and means for automatically extending and retracting said end portion.

**5.** Apparatus as claimed in claim **2** wherein each of said hoppers include shiftable shield means surrounding its discharge opening, said shield means comprising an upper plate, a lower annular plate spaced from said upper plate and spring biased away from said upper plate and flexible cover means surrounding said spaced plates.

**6.** Apparatus as claimed in claim **5** wherein said shield means includes automatic means for extending and retracting said shield means axially with respect to the hopper discharge opening.

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# UNITED STATES PATENT OFFICE
# CERTIFICATE OF CORRECTION

Patent No. 3,857,758 Dated December 31, 1974

Inventor(s) Phillip Mole

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 33, "occured" should be --occurred--;

Column 3, line 50, "flling" should be --filling--;

Column 8, line 17, after "electronic" insert --or--; and

Column 9, line 29, "atmopsheric" should be --atmospheric--.

Signed and sealed this 4th day of March 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks