United States Patent [19]

Saller et al.

[11] **3,721,608**

[45] **March 20, 1973**

[54] **FLUIDIZING DEVICES FOR FLUID BEDS, WITH IN-PROCESS CLEANING**

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[73] Assignee: **FMC Corporation,** New York, N.Y.

[22] Filed: **July 12, 1971**

[21] Appl. No.: **161,649**

[52] **U.S. Cl.** .....**202/241,** 202/121, 201/2, 201/32, 134/22 C, 134/37, 134/166 C, 34/57 A

[51] **Int. Cl.** **C10b 43/00**

[58] **Field of Search** .....201/2, 31; 202/241, 121; 134/25 R, 37, 39, 2, 166 C, 196 C, 22 C; 34/57 A, 57

[56] **References Cited**

UNITED STATES PATENTS

3,480,512	11/1969	Vorum	202/121 X
3,332,853	7/1967	Urquhart	201/31
3,016,624	1/1962	Bliss	34/57 A
2,876,079	3/1959	Upchurch et al.	34/57 A
2,813,352	11/1957	Payne et al.	34/57 A
263,349	8/1882	Opper et al.	134/22 C

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[57] **ABSTRACT**

A device for feeding fluidized gas into a fluidized-bed vessel, particularly useful in the charring of coal at elevated temperatures, which comprises a series of relatively large pipes disposed near the bottom of the vessel, each affixed to the vessel at only one point to permit ready expansion and contraction, and having a plurality of holes therein to pass fluidizing gas into the vessel, a second smaller pipe in each of the large pipes through most of its length and open at the inner end, one pipe of each pair being connected to a source of fluidizing gas, and the other being connected through a valve to the outside. On start-up, or when finely-divided combustibles begin to accumulate in the large pipes during operation, the valves may be opened so that the fluidizing gas pressure blows out the particulate material, to minimize the occurrence of fires in the pipes with consequent damage.

3 Claims, 5 Drawing Figures

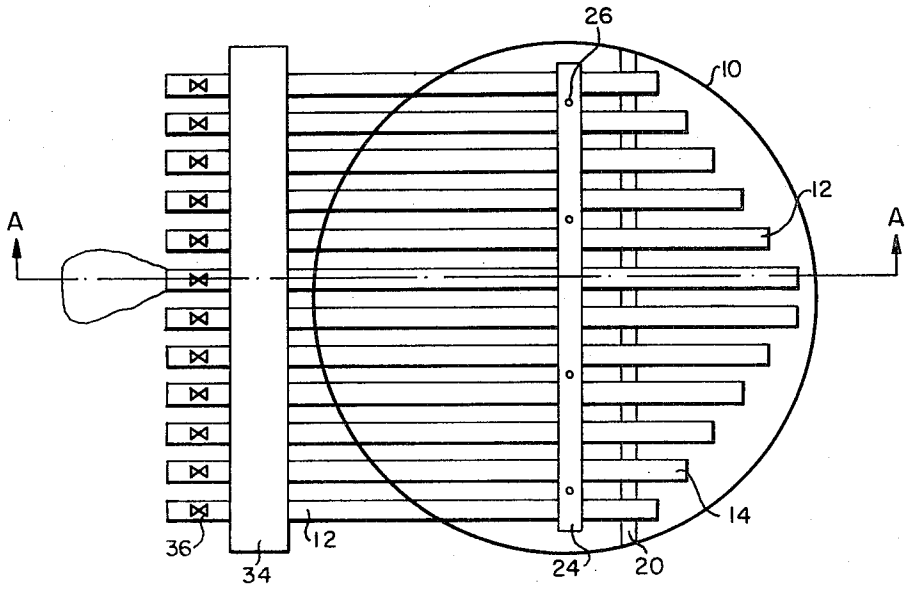
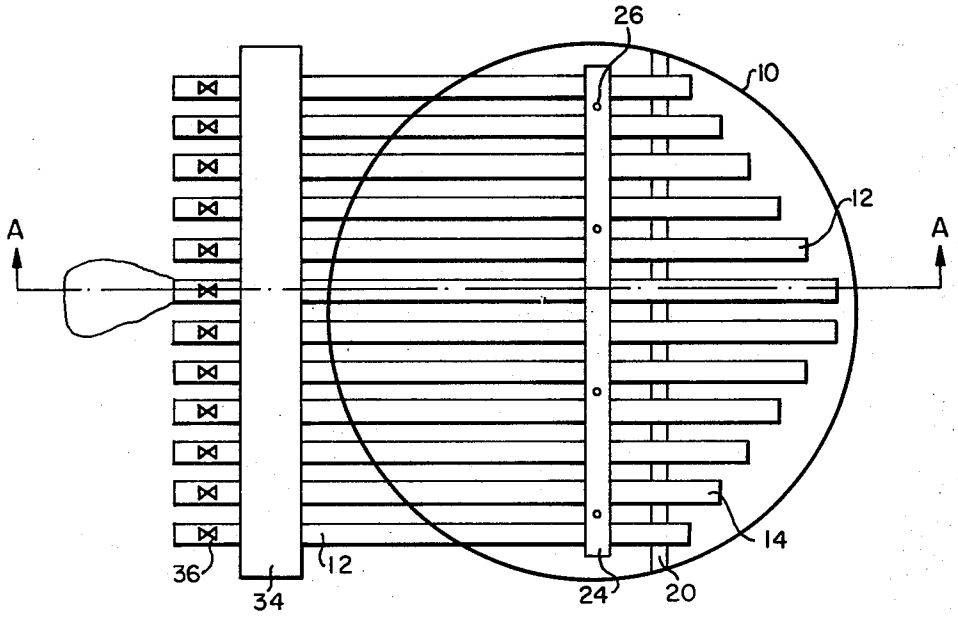


FIG. 1



SECTION A-A

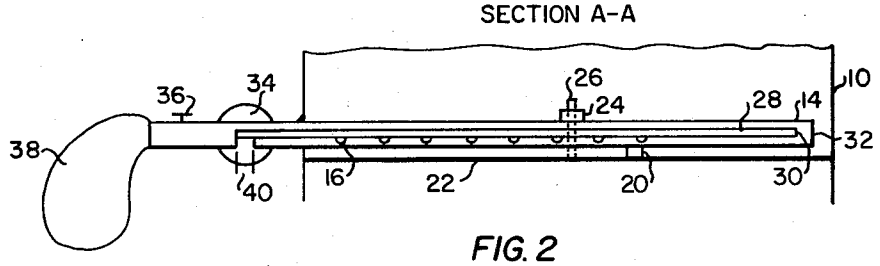


FIG. 2

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FIG. 3

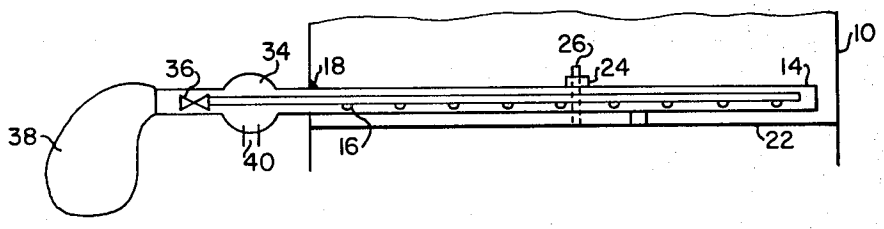


FIG. 4

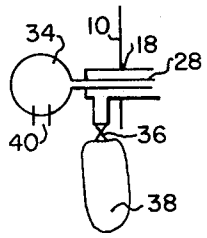
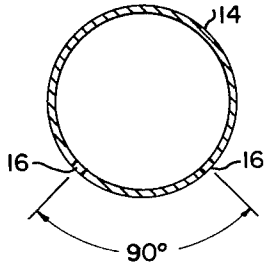


FIG. 5



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FLUIDIZING DEVICES FOR FLUID BEDS, WITH IN-PROCESS CLEANING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to fluidized beds for treating solid particles, especially coal and coal chars, at elevated temperatures, and particularly to apparatus and methods for cleaning the grids used to supply fluidizing gas to the beds.

2. Prior Art

The fluidization of solids by suspending them in dense phase in a stream of gas is a widely used technique in the petroleum and other industries; it has found extensive acceptance in the carbonization of coal. For example, in the processes for making reactive form coke described and claimed in the Work et al. U.S. Pat. Nos. 3,140,241 and 3,140,242, issued July 7, 1964, fluidized beds are used in a series of four or more vessels in which dried coal is first heated in a fluidized-bed catalyzation stage at a temperature above 250°F and below tar-forming temperatures, then shock-heated to tar-forming temperatures (typically 600° to 900°F) by feeding directly to a second fluidized bed to remove tars (which may require more than one bed), then heated in at least a third fluidized bed to a higher temperature to reduce volatiles to below 3 percent, but not below 1% of hydrogen, and finally cooled in still another fluidized bed or beds.

Naturally, in such a process, if one fluidized bed is shut down, production stops. Since the process involves using ground coal, which may be further reduced in size during processing, good distribution of gas across the bed is essential. Otherwise, reaction will not be uniform and hot spots will occur, with clinker formation and at times damage to the grid.

The design of fluidizing grids for high temperature operations is complicated by the problem of grid expansion and contraction with shift in temperatures. In operating a demonstration plant for producing about 150 tons per day of form coke in accordance with U.S. Pat. Nos. 3,140,241 and 3,140,24, it was found that this problem of grid expansion can be overcome by using a grid consisting of a series of evenly distributed pipes near the bottom of the vessel each having sets of holes drilled therein for distribution of the fluidizing gas, the pipes being welded to the fluidizing vessel only at their entrance into the vessel, so that the pipes are free to contract and expand. By using two sets of holes on the underside of each pipe each at 45° from the vertical, backsifting of solids into the pipes is minimized.

However, substantial backsifting always occurs when the fluidizing gas is turned off for any reason, and some backsifting occurs during operation. This is a serious problem because the fluidizing gases are oxidizing in most of the vessels, and the finely-divided solids in the pipes can catch fire and damage the equipment. Hence, cleaning of the grid is desirable at regular intervals during operation, and is essential after any shutdown.

OBJECT OF THE INVENTION

This invention aims to provide a grid design for fluidized beds in which feeder lines can be cleaned out readily before start-up, or during operation of the bed, without shutdown.

STATEMENT OF THE INVENTION

In accordance with this invention, a fluidized grid is provided which consists of a series of relatively large hollow pipes distributed uniformly adjacent the bottom of the fluidizing vessel, each pipe being rigidly affixed to the vessel only at its entrance therein to permit ready expansion and contraction. Each of the pipes has at least one series of uniformly spaced holes in its bottom half to permit a substantially uniform flow of fluidizing gas along the length of the feed pipe. In each pipe is a smaller pipe extending close to the end of the larger pipe. One of each set of pipes is connected to a source of fluidizing gas, preferably through a manifold; the other is connected through a valve outside of the vessel. When a feed pipe shows evidence of plugging, it is only necessary to open the valve to the outside, and the internal gas pressure will sweep out both pipes and clean them.

THE DRAWINGS

In the drawings,

FIG. 1 is a plan view of the bottom of a fluidized-bed reactor with the fluidizing-gas grid in place.

FIG. 2 is a section through the line 2—2 of FIG. 1.

FIG. 3 is a section similar to FIG. 2, showing another arrangement of the piping.

FIG. 4 is a fragmentary view of another piping arrangement.

FIG. 5 is a section across a feed pipe, without the cleaning pipe in place, to show a preferred disposition of the fluidizing-gas feed holes.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, a typical fluidized-bed vessel comprises a hollow cylinder **10** which may be of any desired height, may be insulated or not, and has a variety of arrangements not shown on the drawing for admitting and removing solids. The fluidizing grid **12** is placed at the point in the vessel **10** where the bottom of the fluidized bed of solids is wanted, and may be supported in any convenient fashion; the space below the grid **12** should be maintained at a minimum. In the treatment of coal as described in U.S. Pat. Nos. 3,140,241 and 3,140,242, the grid **12** is placed as shown in FIG. **2**, near the bottom of the vessel **10**.

The grid **12** consists of a series of feed pipes **14** each having at least one series of holes **16** drilled therein. Preferably, there are two series of holes **16** in each pipe, each drilled on the underside of the pipe **14** at 45° from the vertical. However, any desired arrangement of holes may be used.

Each pipe passes through the wall of the vessel **10** and is preferably welded to it **18**; the pipes **14** all rest on a saddle **20** which in turn is attached to the bottom **22** of the vessel **10**; this bottom may be of metal or of refractory. A hold-down bar **24** is used to prevent upward floating of the pipes; it is secured to the bottom by bolts **24**. This construction leaves the pipes **14** free to expand and contract without strain, since they are rigidly attached to the vessel only at their entrance into the vessel.

In each pipe **14** is a smaller pipe **28** extending through most of the length of the larger pipe **14** and with its open inner end **30** near the closed inner end **32**

of the pipe 14. One of the pipes of each set is connected to a manifold 34 through which fluidizing gas is fed into the system. The other pipe in the set is connected through a valve 36 to the atmosphere, preferably through a filter bag 38.

In the operation of the device as shown in FIG. 2, fluidizing gas passes through a riser 40 into the manifold 34, thence into the small pipe 28 and through the opening 30 into the large pipe 14 and through the holes 16 to fluidized the vessel 10. The pipe 14 is connected to the atmosphere outside of the vessel 10 through a valve 36; a filter bag 38 is mounted on the pipe 14 beyond the valve 36.

An alternate construction is shown in FIG. 3. Here, the large pipes 14 open directly into the manifold 34 and the small pipes 28 are connected to the atmosphere through the valves 36.

FIG. 4 shows still another variation; in this variation, the pipe 14 is not connected through the manifold.

If desired, the pipes through which the back-filtered fines are flushed out can be connected to a manifold (or manifolds), equipped with a valve, so that all of the pipes (or those connected to each manifold) can be cleaned out as a group.

In all of the constructions, in the event it is desired to remove fines which have backsifted into the pipes 14, opening of the valve 36 causes the fluidizing gas to push the fines through the valve 36 and into the filter bag 38 and flush out the pipes 14 and 28.

Obviously, this self-cleaning system is useful in any fluidizing grid in which fluidizing gas is fed out of a series of feed pipes with small holes therein, and the specific system disclosed herein can be modified, without departing from the invention as disclosed in the claims. However, the system is particularly useful in the carbonization of coal, where backsifting induces combustion and consequent clinkering and equipment damage, and where thermal expansion of a more conventional grid design would be troublesome.

We claim:

1. In a fluidizing grid which supplies gas for fluidizing solids in a fluidizing vessel, which grid consists of a series of fluidizing-gas feed pipes distributed to substantially cover the cross section of the vessel near its lower end, each feed pipe being attached to the vessel to permit ready expansion and contraction, and also attached to a source of fluidizing gas, being closed at its inner end, and having at least one series of feed holes drilled therein, whereby the fluidizing gas is uniformly fed over the bottom of the fluidizing vessel, the improvement which permits in-process cleaning in which each feed pipe contains therein a second smaller pipe open at its inner end, one of the pipes being connected at its outer end of the source of fluidizing gas and the other pipe being connected at its outer end to the atmosphere through a valve, whereby on opening of the valve during operating the fluidizing gas will sweep solid matter out of the feed pipe through the valve.

2. The device of claim 1, in which the feed pipe is connected directly to the fluidizing-gas source, and the smaller pipe is connected to the atmosphere through a valve.

3. The device of claim 1, in which the feed pipe is connected to the atmosphere through a valve, and the smaller pipe is connected directly to the fluidizing-gas source.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,721,608 Dated 3/20/73

Inventor(s) Erik Saller & Jack Trechock

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

Column 1, line 43 "3,140,24," should read --3,140,242--.

Signed and sealed this 29th day of October 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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