Sept. 5, 1972 L. G. TUCKER 3,689,369

CHARGING HOLE LID AND MAGNETIC LID LIFTER APPARATUS

Filed April 5, 1971 2 Sheets-Sheet 1

Fig. 1.

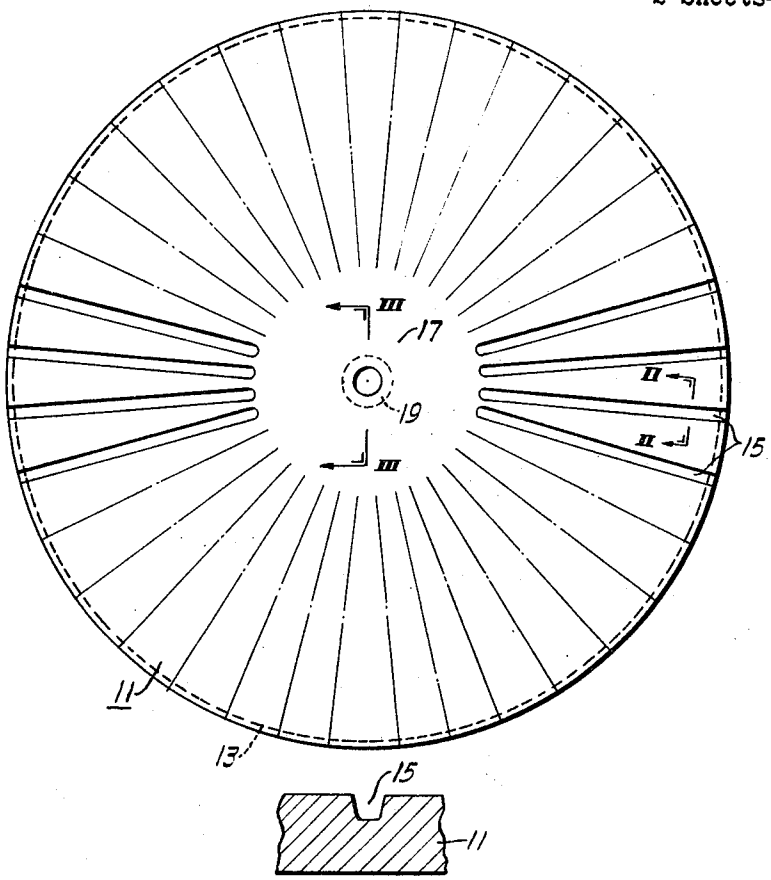


Fig. 2.

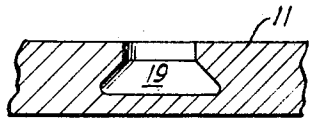


Fig. 3.

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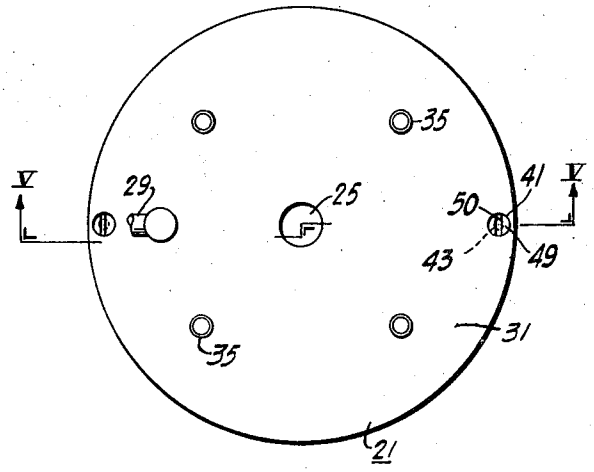


Fig. 4.

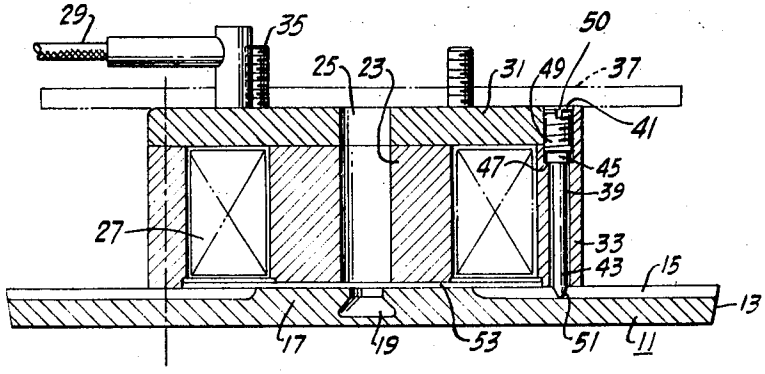


Fig. 5.

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3,689,369

CHARGING HOLE LID AND MAGNETIC LID LIFTER APPARATUS

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Int. Cl. C10b 25/24, 31/00
U.S. Cl. 202—251 6 Claims

ABSTRACT OF THE DISCLOSURE

A coal charging hole lid for a coke oven chamber has a plurality of radially arranged grooves in its top surface. A magnet for lifting and seating the lid has a plurality of resiliently biased pins around its periphery that coact with respective grooves in the lid and effect positive rotative action of the lid when it has been reseated in the charging hole.

BACKGROUND OF THE INVENTION

The present invention relates to coke ovens and, more particularly, to a lid for a coal charging hole in a coke oven chamber and a lid handling mechanism for lifting and seating such lid.

One of the problems in regard to operating a lid lifting mechanism on a larry car is the reseating of the lid in the charging hole. It is necessary to provide apparatus that will effect positive oscillation of the lid after it has been reseated in order to minimize leakage of gases around the lid.

Usually charging hole lids do not, after some usage, have a planar top surface due to warpage because of heat. The top surface becomes slightly convex. In those installations where magnetic lid lifters are used, the slightly convex surface contour of the lid does not appreciably affect the magnetic attraction between the lid and the magnet, but it does affect and greatly reduce the torque that the magnet exerts on the lid during the seating-in oscillation. One reason why the torque is reduced is that the effective area of contact between the magnet and the convex surface of the lid is reduced. Even though the attraction force of the magnet is constant, the requisite amount of torque to accomplish effective seating-in oscillation of the lid is not available because of the small surface area in contact with the magnet.

Several attempts have been made, knowledge of which is available from the prior art, to effect positive torque on a warped charging hole lid. One such attempt includes the application of a circular, high-speed-steel cutting band saw blade to the lower surface of the magnet. It was reasoned that the sharp teeth of the saw blade should dig into the lid and provide a positive torque for seating-in. However, such a saw blade soon becomes dull and, after a short service life, the blade is no longer effective. The teeth break or are quickly worn down and have no effect on the lid.

Other apparatus known from the prior art also have not proved to be entirely satisfactory, with the result that charging hole lids are usually improperly seated and leakage of gases by the lids is not an uncommon occurrence.

SUMMARY OF THE INVENTION

A charging hole lid has a plurality of radially arranged grooves in its surface which coact respectively with a plurality of resiliently biased pins in a lid lifting electromagnet; wherefore, the pins provide torque for oscillating a lid even though it may be convexly warped.

For a further understanding of the invention and for features and advantages thereof reference may be made to the following description and the drawings which illustrate a preferred embodiment of equipment in accordance with the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a plan view of a charging hole lid in accordance with the invention;

FIG. 2 is a view along line II—II of FIG. 1;

FIG. 3 is a view along lines III—III of FIG. 1;

FIG. 4 is a plan view of a lifting magnet in accordance with the invention; and

FIG. 5 is a view along line V—V of FIG. 4.

DETAILED DESCRIPTION

FIG. 1 illustrates in plan view a coal charging hole lid **11** which comprises a circular plate that has a slightly chamfered periphery as at **13**, and that has a plurality of radial grooves **15** in the top surface of the lid **11**. The central portion **17** of the top surface is not grooved, as may be noticed from FIG. 5, but this central portion **17** has a cavity **19** therein that is shaped in cross section about as shown in FIG. 3. This cavity **19** is so shaped that it cooperates with a manually applied tool when it is desirable or necessary to remove and replace the charging hole lid **11** in a coke oven coal charging hole.

It is desirable to have a number of grooves **15** in a charging hole lid for a purpose that will be explained hereinafter. Some number such as **36** would be provided in a preferred embodiment of the lid, though more or less grooves may be used as preferred.

FIGS. 4 and 5 illustrate an electromagnet **21** which is in accordance with the invention and which includes a central core **23** having an axial hole **25** therethrough, and a surrounding coil **27** of electrical wire which is connected to an electrical conduit **29**. A cover **31** is fastened to the central core **23** in a conventional manner and a cylindrical tubular side **33** is secured to the cover in a conventional manner.

The cover **31** is provided with a plurality of studs **35** that are used to secure the electromagnet to a conventional mounting plate **37** on a larry car. The cover **31** and the cylindrical tubular side **33** are perforated by a plurality of holes **39**; there being two such holes **39** disposed on a diameter of the cover **31**.

Each hole **39** has a reentrant threaded bore upper portion **41**, and a pin **43** having a head **45** is disposed in each hole **39** with the head **45** engaging a shoulder **47**. A threaded plug **49** is screwed into the threaded upper portion **41** and into engagement with the head **45** of the pin **43**. The plug has a slot **50** in it for easy removal by means of a tool such as a screwdriver.

From FIG. 5 it is seen that the lower or bottom end **51** of the pin **43** is generally conical in shape with a slightly rounded apex. Such conical shape is complementary to the shape of the grooves **15** of FIG. 2.

It will be noted from FIG. 5 that the cylindrical tubular side **33** extends slightly below the bottom of the coil **27** and central core **23** and that there is a narrow air gap **53** between the bottom of the coil **27** and core **23** and the charging hole lid **11**.

After a coke oven chamber has been charged with coal, the lid lifter magnet contacts a lid and places it back in its respective coal charging hole. The lid magnet then oscillates the lid in order to seat the lid and to prevent the escape of gases from the oven chamber.

However, as mentioned previously, if a conventional lid has become convexly warped due to heat, the magnet will not grip the lid with enough force to oscillate the lid and seat it properly. However, the magnet of the present invention turns about its vertical axis until one of the pins, acting under the influence of its associated spring, drops into a groove. Further turning of the magnet makes it

possible for another, or more than one, pin to drop into a slot or slots. Thereafter, the magnet and pins exert torque on the lid and it oscillates about its vertical axis until it is properly seated.

Those skilled in the art will note from FIG. 5 that, even though the lid becomes warped convexly upward, the pins will continue to coact with their respective grooves and exert sufficient torque to the warped lid to oscillate it and seat it in the charging hole.

Those skilled in the art will recognize that the lid lifting magnet of the present invention is simple and effective and that it provides a positive torque to seat-in the charging hole lid of the invention.

Although the invention has been described herein with a certain degree of particularity, it is understood that the present disclosure has been made only as an example and the scope of the invention is defined by what is hereinafter claimed.

I claim:

1. A lid for a charging hole in a coke oven chamber and a lid lifting mechanism comprising:

(a) a planar lid having in one surface thereof a plurality of grooves extending from the center of the surface toward the periphery thereof;

(b) a magnet mounted to an oscillateable mechanism and having a plurality of protrusions on a surface that contact said lid; and

(c) means for oscillating said mechanism and bringing said protrusions into engagement with respective grooves whereby said lid is oscillateable about an axis and is seatable in said charging hole.

2. The apparatus of claim **1** wherein:

(a) said protrusions include pins having one end projecting below the face of said magnet.

3. The apparatus of claim **2** wherein:

(a) said pins are removably secured in said magnet.

4. The apparatus of claim **1** wherein:

(a) said lid includes a cavity adapted to receive a tool for manipulating said lid.

5. The apparatus of claim **1** wherein:

(a) said lid has a chamfered peripheral surface.

6. In a coke oven battery having a coal charging hole, the improved lid for such hole and lid lifting mechanism comprising:

(a) a planar lid having a chamfered peripheral surface and a plurality of grooves extending from a central zone of a planar surface portion of said lid toward the peripheral surface;

(b) a magnet mounted to an oscillateable mechanism for movement about a vertical axis;

(c) a plurality of pins removably disposed in cavities in said magnet with the ends of said pins protruding below the bottom surface of said magnet; and

(d) means for bringing said magnet into contact with said lid and oscillating said magnet mechanism with said pins engaging said grooves in said lid and thereby oscillating said lid to effect seating-in of said lid.

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U.S. Cl. X.R.

202—262; 212—4; 214—18 PH; 294—65.5