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(54) POLYCRYSTALLINE DIAMOND COMPACT

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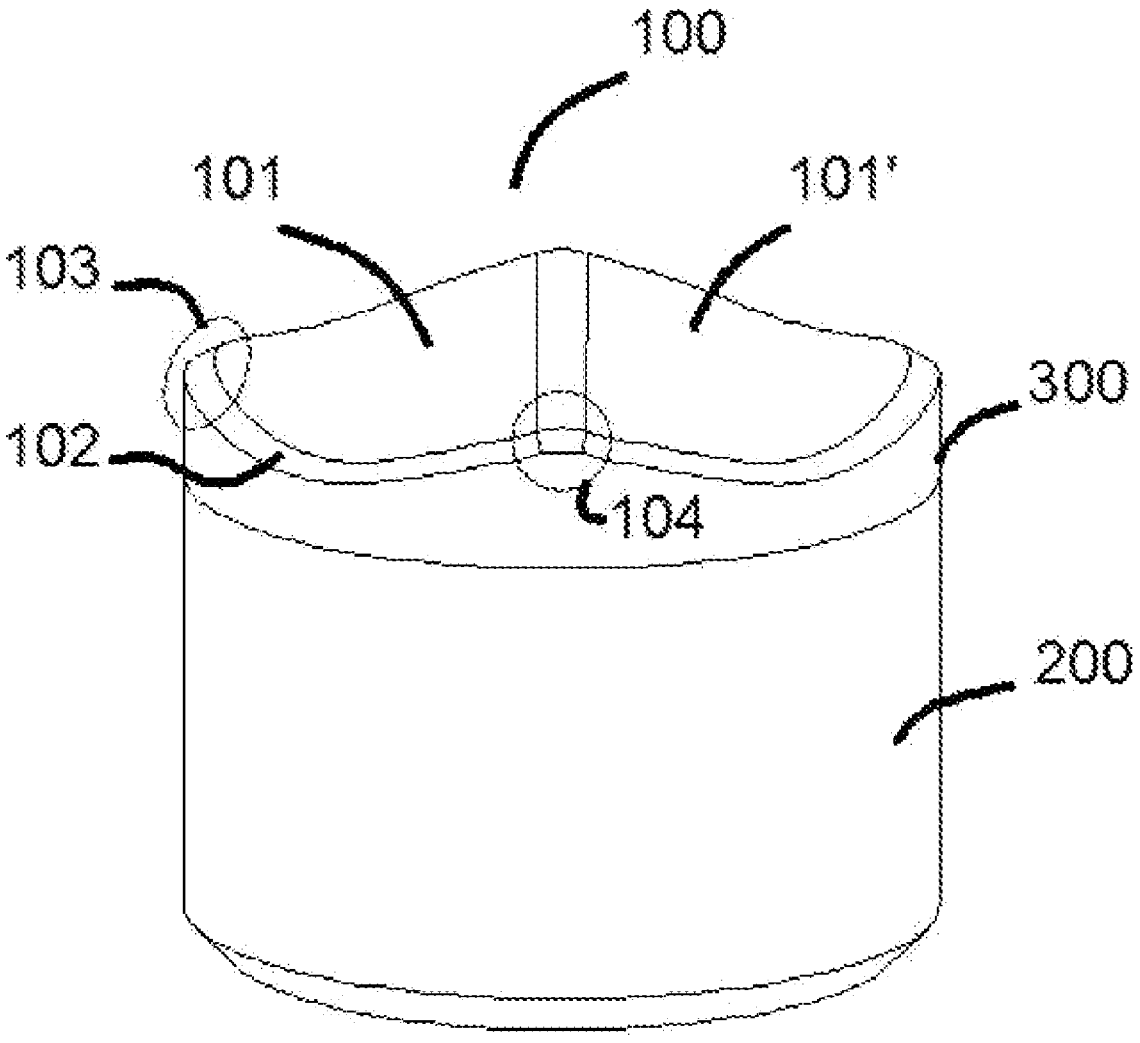
(57) **ABSTRACT**

A polycrystalline diamond compact including a cemented carbide substrate and a polycrystalline diamond layer disposed on the cemented carbide substrate. The polycrystalline diamond layer is nonplanar and includes a first curved surface, a second curved surface, and a side surface directly connected to the cemented carbide substrate. The first curved surface is connected to the second curved surface. The joint of the first curved surface and the second curved surface protrudes to form a first cutting edge. The joints of the first curved surface and the second curved surface and the side surface protrudes to form a plurality of second cutting edges.



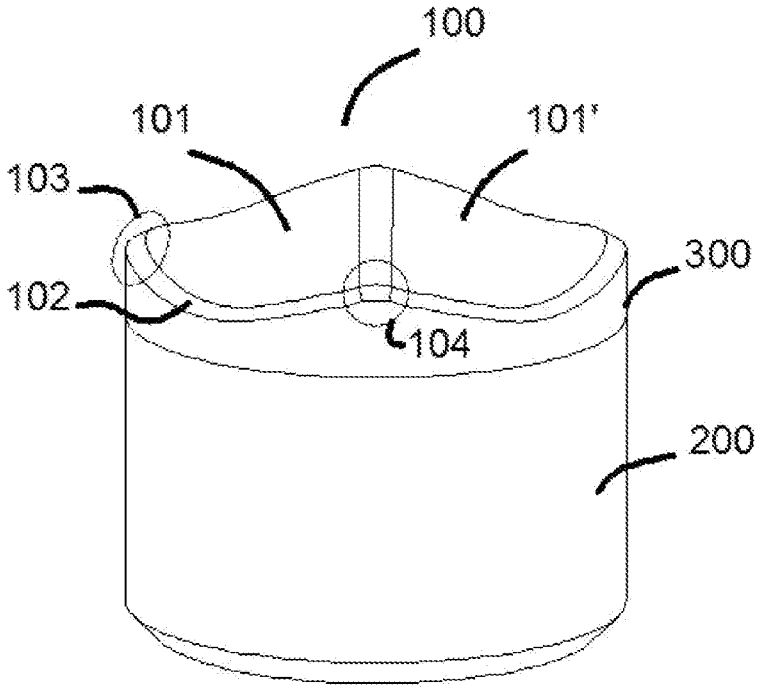


FIG. 1

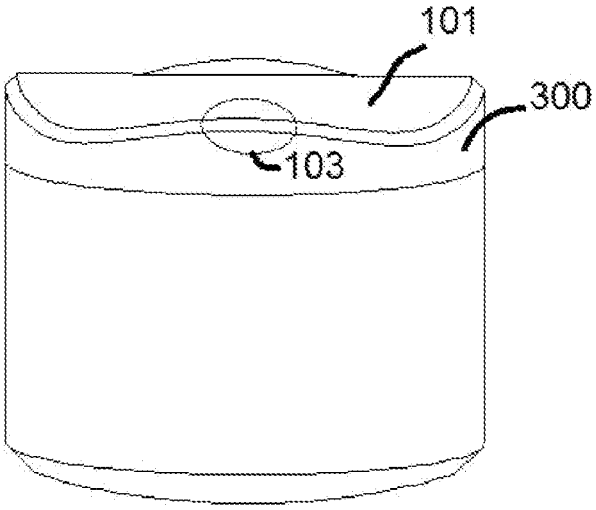


FIG. 2

POLYCRYSTALLINE DIAMOND COMPACT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of International Patent Application No. PCT/CN2017/118761 with an international filing date of Dec. 26, 2017, designating the United States, now pending, and further claims foreign priority benefits to Chinese Patent Application No. 201721327355.7 filed Oct. 16, 2017. The contents of all of the aforementioned applications, including any intervening amendments thereto, are incorporated herein by reference. Inquiries from the public to applicants or assignees concerning this document or the related applications should be directed to: Matthias Scholl P.C., Attn.: Dr. Matthias Scholl Esq., 245 First Street, 18th Floor, Cambridge, Mass. 02142.

BACKGROUND

[0002] This disclosure relates to the field of composite materials, and more particularly, to a polycrystalline diamond compact (PDC).

[0003] Polycrystalline diamond compacts (PDCs) are composed of diamond and a cemented carbide substrate and are widely used in manufacturing of drill bits. However, conventional PDCs have a flat surface, exhibit relatively low working efficiency, and the cutting edges of the PDCs tend to break down.

SUMMARY

[0004] Disclosed is a polycrystalline diamond compact that has dual cutting edges.

[0005] Disclosed is a polycrystalline diamond compact comprising a cemented carbide substrate and a polycrystalline diamond layer disposed on the cemented carbide substrate. The polycrystalline diamond layer is nonplanar and comprises a first curved surface, a second curved surface, and a side surface directly connected to the cemented carbide substrate. The first curved surface is connected to the second curved surface. The joint of the first curved surface and the second curved surface protrudes to form a first cutting edge. The joints of the first curved surface and the second curved surface and the side surface protrudes to form a plurality of second cutting edges.

[0006] The first cutting edge has an included angle formed by an edge of the first curved surface and an edge of the second curved surface, and the included angle is between 10 and 179°.

[0007] The second cutting edges each have an included angle formed by the first curved surface and the side surface or the second curved surface and the side surface, and the included angle is between 10 and 179°.

[0008] The polycrystalline diamond layer comprises a chamfer.

[0009] The nonplanar polycrystalline diamond layer is formed by contact or non-contact processing or a combination thereof, such as electrical discharge machining, laser processing and so on.

[0010] Advantages of the polycrystalline diamond compact in the disclosure are summarized as below. The design of the non-planar polycrystalline diamond layer improves the impact resistance of the polycrystalline diamond compact. The arrangement of the first and second cutting edges functioning as cutter teeth reduces the cutting resistance of the polycrystalline diamond compact. The polycrystalline diamond compact exhibits relatively high drilling efficiency, and no failure such as teeth collapse occurs.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a schematic diagram of a polycrystalline diamond compact according to one embodiment of the disclosure; and

[0012] FIG. **2** is a left view of the polycrystalline diamond compact in FIG. **1**.

DETAILED DESCRIPTION

[0013] To further illustrate, examples detailing a polycrystalline diamond compact are described below. It should be noted that the following examples are intended to describe and not to limit the description.

[0014] FIGS. **1-2** shows a polycrystalline diamond compact comprising a cemented carbide substrate **200** and a polycrystalline diamond layer **100** disposed on the cemented carbide substrate. The polycrystalline diamond layer **100** is nonplanar and comprises a first curved surface **101**, a second curved surface **101'**, and a side surface **300** connected to the cemented carbide substrate **200**. The first curved surface **101** is connected to the second curved surface **101'**. A joint of the first curved surface **101** and the second curved surface **101'** protrudes to form a first cutting edge **104**. Joints of the first curved surface **101** or the second curved surface **101'** and the side surface **300** protrudes to form a plurality of second cutting edges **103**. The polycrystalline diamond layer **100** comprises a chamfer **102** disposed between the first curved surface and the side surface, and between the second curved surface and the side surface.

[0015] Specifically, the polycrystalline diamond compact has a diameter of 15.88 mm and a height of 13.2 mm. The polycrystalline diamond compact is prepared by high temperature and high-pressure sintering combined with laser processing. The first cutting edge formed by an edge of the first curved surface and an edge of the second curved surface has an included angle of 148.5°. The second cutting edges formed by the first curved surface and the side surface or the second curved surface and the side surface is 169.3°. The chamber of the polycrystalline diamond layer has a width of 0.56 mm. The minimum thickness of the polycrystalline diamond layer is 2.0 mm.

[0016] Cutting experiments are carried out using the polycrystalline diamond compact of the disclosure and a conventional polycrystalline diamond compact. The results show, in contrast to conventional polycrystalline diamond compacts, when using the first cutting edge of the polycrystalline diamond compact to grind a rock with a Rockwell hardness of 8-9 grade, the cutting resistance decreases by 38%, the removal efficiency of the rock increases by 56%, and no failure such as teeth collapse occurs.

[0017] The results also show, in contrast to conventional polycrystalline diamond compacts, when using the second cutting edges of the polycrystalline diamond compact to grind a rock with a Rockwell hardness of 6 grade, the rock removal efficiency increases by 83% under the same grinding load, and no failure such as teeth collapse occurs.

[0018] It will be obvious to those skilled in the art that changes and modifications may be made, and therefore, the aim in the appended claims is to cover all such changes and modifications.

What is claimed is:

1. A polycrystalline diamond compact, comprising a cemented carbide substrate and a polycrystalline diamond layer disposed on the cemented carbide substrate;

wherein:

the polycrystalline diamond layer is nonplanar and comprises a first curved surface, a second curved surface, and a side surface directly connected to the cemented carbide substrate;

the first curved surface is connected to the second curved surface;

a joint of the first curved surface and the second curved surface protrudes to form a first cutting edge; and

joints of the first curved surface and the second curved surface and the side surface protrudes to form a plurality of second cutting edges.

2. The polycrystalline diamond compact of claim **1**, wherein the first cutting edge has an included angle formed by an edge of the first curved surface and an edge of the second curved surface, and the included angle is between 10 and 179°.

3. The polycrystalline diamond compact of claim **1**, wherein the plurality of second cutting edges each have an included angle formed by the first curved surface and the side surface, or formed by the second curved surface and the side surface, and the included angle is between 10 and 179°.

4. The polycrystalline diamond compact of claim **1**, wherein the polycrystalline diamond layer comprises a chamfer disposed between the first curved surface and the side surface, and between the second curved surface and the side surface.

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