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(54) Title: SYSTEM FOR A CRUSHING PLATE, AND A FASTENING PLATE AND A CRUSHING PROFILE FOR THE SYSTEM

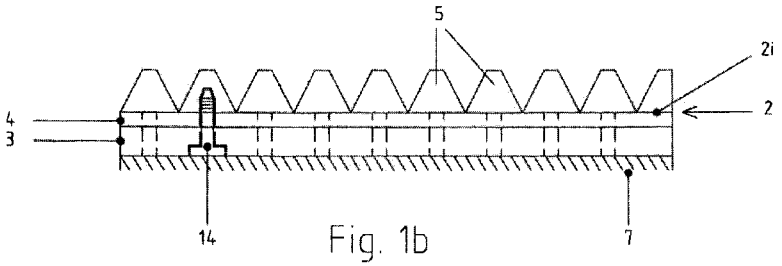

Fig. 1b

(57) Abstract: The invention concerns a system for a crushing plate 1 comprising a bottom plate 2 and several crushing profiles 5 that are mounted at the bottom plate 2 in a manner that allows them to be removed, where the bottom plate comprises a foundation plate 3 of sheet steel. The invention concerns also a fastening plate 4 for the system, where the fastening plate is manufactured from hardened boron steel, and a crushing profile 5 for the system, where the crushing profile is manufactured from hardened boron steel.

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System for a crushing plate, and a fastening plate and a crushing profile for the system

The invention concerns a system for a crushing plate, in particular a crushing plate intended to be used in what is known as a "jaw crusher" or similar.

Several different types of crusher are available for the crushing of material. One type of crusher that has been known for a long time is a jaw crusher, which has a jaw with a displaceable crushing surface and a stationary crushing surface, between which crushing surfaces the material to be crushed is placed and crushed when the displaceable crushing surface is pressed against the stationary crushing surface.

The crushing surfaces are provided with several crushing plates that are mounted onto a frame arranged at the crushing surfaces. It is normal to use 2-4 crushing plates on each crushing surface.

The previously known crushing plates are castings that have been cast in a single piece. Each crushing plate is provided with a backing piece that is mounted in the frame, and teeth that are directed towards the material that is to be crushed. The backing piece corresponds to approximately 70% of the material of the casting, and only approximately 30% of the material is a part of the crushing ridges that are worn down by the material to be crushed. A common type of crushing plate weighs approximately 1000 kg.

When the teeth of the crushing plate have been worn down by the material to be crushed, the crushing plate is exchanged and is replaced by a new crushing plate.

This means that the complete backing piece of the crushing plate is discarded after the exchange, which leads to large loss of material. While it is true that the discarded crushing plate can be recycled, this requires considerable consumption of energy in the form of transport and melting down, which also has a negative impact on the environment. In addition to this, the cost of each crushing plate is high since raw material prices today are considerably higher than previously.

The invention has as its purpose to achieve a system for a crushing plate that in a simple manner reduces the consumption of material and reduces the costs for the users of crushing plates.

This is achieved with a system for a crushing plate according to the invention that has the distinctive features specified in claim 1, a fastening plate for the system for a crushing plate according to the invention with the distinctive features specified in claim 14, and a crushing profile for the system for a crushing plate according to the invention with the distinctive features specified in claim 15.

Advantageous embodiments of the invention are made clear by the dependent claims.

One advantage of the system for a crushing plate according to the invention is that the manufacturing cost of the crushing plate is reduced through the use of a foundation plate of sheet steel.
Since the foundation plate does not come into contact with the material to be crushed when it is in use, the sheet steel is not worn down and can therefore be reused as foundation plate.

This means that the cost is considerably reduced since it is necessary to exchange only the worn crushing profiles, and the wear plates when necessary, instead of exchanging the complete crushing plate, as is currently the most common solution.

The solution according to the invention thus results in a considerable saving of material.

Furthermore, the material of the foundation plate may be of a cheaper type than that of the wear plates and crushing profiles, and this is also a reduction in cost. It is advantageous also from the point of view of the environment that it is not necessary to discard a complete crushing plate every time that the crushing ridges become worn, as is the case today.

The invention is described in more detail below with reference to several embodiments that are shown in the attached drawings, where:

Figure 1a shows a view of the upper surface of an embodiment of the system for a crushing plate according to the invention.

Figure 1b shows a cross-sectional view of the embodiment shown in Figure 1a.

Figure 1c shows a cross-sectional view of a crushing profile with penetrating holes.

Figure 1d shows a perspective view of the embodiment shown in Figures 1a-1c.

Figures 2a-e show several embodiments of crushing profiles.

Figures 3a-3b show other embodiments of the fastening plate for a system according to the invention.

Figure 4 shows another embodiment of a crushing profile.

Figures 1a-1d show a system for a crushing plate 1 according to the invention that comprises a bottom plate 2 consisting of a foundation plate 3 and a fastening plate 4. Several crushing profiles 5 are mounted on the upper surface 2i of the bottom plate in a manner that allows them to be removed.

The foundation plate 3 shown in Figure 1b has a lower surface 6 that is fastened against a frame 7 in a crushing machine (not shown in the drawings), and an upper surface 8 that is in contact with the lower surface 9 of the fastening plate. In another embodiment, the foundation plate may make contact directly with the lower surface of the removable crushing profiles (not shown in the drawings).

The foundation plate 3 consists of a sheet of steel of conventional type, for example a rolled steel sheet of, for example, the common steel quality 355. In an alternative embodiment the foundation plate is of hardened boron steel.

Hardened boron steel has the advantageous mechanical properties that it has an extremely high resistance to wear and is particularly useful in high-durability structural applications, which gives a longer lifetime for the structures and lower costs with respect to wear and the environment.

The foundation plate 3 is manufactured through an unhardened steel sheet being cut to a predetermined size and shape. The foundation plate is provided with penetrating holes 10 and with depressions 11 in order to receive bolted connections intended to mount at least one of the fastening plate 4 and the crushing profiles 5 at the foundation plate in a manner that allows them to be removed. The number and locations of the holes 10 on the plate are adapted to the locations of the crushing profiles and the forces that influence the crushing profiles during operation.

It is advantageous that the foundation plate 3 is manufactured from steel of conventional type, which is softer than hardened boron steel, absorbs the forces from the crushing operation, and has a damping function, which ensures good contact with the frame 7 of the crushing machine.

The fastening plate 4 is designed as a wear plate, and is designed to be placed between the foundation plate 3 and the crushing profiles 5. The fastening plate 4 comprises a sheet of hardened boron steel. The fastening plate is manufactured by a sheet of unhardened boron steel being cut to a predetermined size and shape, and provided with penetrating holes 12. The fastening plate is subsequently hardened to a predetermined hardness. The locations of the penetrating holes correspond to the penetrating holes in the foundation plate 3. The fastening plate shown in Figure 1 has a plane fastening surface 13 that faces the crushing profiles 5.

The fastening plate 4 is mounted at the foundation plate 3 by bolted connections 14 in a manner that allows it to be removed.
Both the fastening plate and the crushing profiles have been designed such that they can be exchanged while the foundation plate is retained and reused.

During the crushing operation, material to be crushed may come into contact with the fastening plate 4, which is in this way subject to wear, and this is the reason that the fastening plate has been designed such that it can be exchanged. The fastening plate, however, is exchanged considerably more seldom than the crushing profiles.

The bottom plate 2 is provided on its upper surface 2i with several crushing profiles 5.
The crushing profiles are manufactured through unhardened extended steel elements of boron steel with a predetermined cross-section being cut to the desired lengths.

The crushing profiles 5 are designed to extend from one outer edge 2' of the bottom plate to an opposite outer edge 2" of the bottom plate 2.

Each crushing profile 5 may be divided into two or more extended segments 5i, 5ii, 5iii with identical cross-sections, which are mounted one after the other in the longitudinal direction.

A crushing profile may, for example, be divided into three or four pieces such that the different segments can be moved to different positions on the bottom plate in order to achieve even wear.

The crushing profiles 5 may be designed also such that they can be rotated 180 degrees around an axis that lies perpendicular to the length, as shown in the drawings. This is advantageous since it is possible to compensate for uneven wear.

In an alternative embodiment, the crushing profile has a cross-section that varies along its length, as shown in Figure 4.

The crushing profiles are provided with holes for the reception of bolted connections. The holes may be penetrating holes that pass from the lower surface to the upper surface, or they may be designed as blind holes.
The crushing profiles are subsequently hardened to a predetermined hardness.

It is advantageous that the fastening plate, the wear plate, and the crushing profiles have the same hardness, since the material will in this case be worn in the same manner. It is normal that the wear plate and crushing profiles are hardened to a hardness corresponding to at least 500 Brinell or higher. It is preferable that it lies in the interval 500-550 Brinell. The hardness may, however, be adapted to the material that is to be crushed. It is, of course, conceivable that the hardness is lower, such as, for example, 450-500 Brinell.

In an alternative embodiment, the fastening plate is hardened to a higher hardness than the crushing profiles.

The cross-sectional form of the crushing profiles is selected and adapted to the material that is to be crushed.

Figures 2a-e show several conceivable embodiments of the cross-sectional form 5a-e of the crushing profiles. The cross-sectional form may be triangular, arced, with several corners in various forms, or a combination of these forms. The cross-sectional forms with several corners may be rectangular or designed as an equilateral parallel-sided trapezoid, or similar. An embodiment of a cross-section 5d of a crushing profile is shown in Figure 2d that is intended to interact with a particular embodiment of the fastening plate, which is shown in Figure 3b.

The crushing profile 5 has a contact surface 16 that faces the bottom plate 2 and a crushing surface 17 that faces the material to be crushed. The crushing profile has two longitudinal side surfaces 18 that face the neighbouring crushing profiles. The side surfaces meet the contact surface along the lower edges 19.

The crushing profiles are mounted at the bottom plate with bolted connections, bolts 14, which are introduced into the penetrating holes in the bottom plate and into the corresponding holes in the crushing profile.

The bolted connections consist of bolts 14 that are adapted for the loads to which the crushing profiles are subject.

It is advantageous to select a type of bolt of such a material that the bolt is worn down together with the crushing profile, in particular in the case in which the crushing profile is provided with penetrating holes.

The crushing profiles are located on the bottom plate such that the lower edges of two neighbouring crushing profiles are very close to each other. This means that there is a play 20 between the lower edges of the neighbouring crushing profiles in order to facilitate the mounting.

In another embodiment, the crushing profiles are located on the bottom plate such that the lower edges of two neighbouring crushing profiles are essentially in contact with each other. This is advantageous in that shear forces on the crushing profiles or pressure forces from the material to be crushed are absorbed by several bolted connections.

Another embodiment of the fastening plate 21 is shown in Figure 3a. The fastening plate is here provided with indentations, grooves 22, for the reception of a crushing profile 5.
The groove 22 is intended to receive a crushing profile with a plane contact surface 16. The groove 22 is adapted according to the size and shape of the crushing profile. The groove 22 is designed with side surfaces 23 and a bottom surface 24. The groove is designed to come into contact with the contact surface 16 of the crushing profile and with the lower longitudinal edge 19 along the side of the crushing profile. The purpose of the groove is to reduce the influence of transverse forces on the crushing profiles during the crushing operation. The grooves facilitate also during the mounting of the crushing profiles at the fastening plate 21. The penetrating holes in the fastening plate are, of course, arranged in the grooves.

A further embodiment of the fastening plate 25 and the crushing profile 5d according to Figure 2d is shown in Figure 3b. In this case the contact surface 16' of the crushing profile is designed with a protrusion 26 on the contact surface 16'. The fastening plate 25 is designed with a corresponding groove 27 that receives the protrusion 26 and contributes to absorbing the transverse forces on the crushing profiles during the crushing operation.

The crushing plate is normally approximately 150 mm thick, where the foundation plate is, for example, approximately 50 mm thick, and the fastening plate is approximately 20 mm thick, while the crushing profiles are approximately 80 mm high.
The thicknesses of the foundation plate and the fastening plate may, of course, be varied, depending on, for example, the crushing machine in which the crushing plate is to be mounted and used.

The crushing profile and the fastening plate, the wear plate, are intended to be delivered together with the system for the crushing plate, but they are intended also to be delivered separately, in order to be able to replace worn crushing profiles and fastening plates.

The embodiments of the system according to the invention for a crushing plate described above can be freely combined within the framework of the attached claims.

Claims

1. A system for a crushing plate 1 comprising a bottom plate 2 and several crushing profiles 5 that are mounted at the bottom plate 2 in a manner that allows them to be removed
characterised in that
the bottom plate 2 comprises a foundation plate 3 of sheet steel.

2. The system for a crushing plate according to claim 1, in which the bottom plate 2 comprises a fastening plate 4 located between the foundation plate 3 and the crushing profiles 5.

3. The system for a crushing plate according to claim 1 or 2, in which the fastening plate 4 is mounted at the foundation plate 3 in a manner that allows it to be removed.

4. The system for a crushing plate according to any one of the preceding claims, in which the fastening plate 3 is manufactured from a sheet of hardened boron steel.

5. The system for a crushing plate according to any one of the preceding claims, in which the crushing profiles 5 are manufactured from hardened boron steel.

6. The system for a crushing plate according to any one of the preceding claims, in which the fastening plate 4 and the crushing profiles 5 have the same hardness.

7. The system for a crushing plate according to any one of the preceding claims, in which the fastening plate 4 and the crushing profiles 5 are mounted with bolted connections at the foundation plate in a manner that allows them to be removed.

8. The system for a crushing plate according to any one of the preceding claims, in which the bolted connections comprise material that is worn down together with the material in the crushing profiles.

9. The system for a crushing plate according to any one of the preceding claims, in which a crushing profile comprises at least one extended element with a cross-sectional profile that is constant along the complete length.

10. The system for a crushing plate according to any one of the preceding claims, in which a crushing profile comprises two or more extended elements that are mounted one after the other in the longitudinal direction.

11. The system for a crushing plate according to either claim 9 or 10, in which the cross-section of the crushing profile has a triangular form, an arced form, a form with several corners, or a combination of these forms.

12. The system for a crushing plate according to any one of claim 11, in which the form with several corners is a rectangular form or has the form of an equilateral parallel-sided trapezoid.

13. The system for a crushing plate according to any one of the preceding claims, in which the fastening plate is provided with a groove intended for the reception of the crushing profiles.

14. A fastening plate for a system for a crushing plate according to any one of the preceding claims, **characterised in that** the fastening plate is manufactured from hardened boron steel.

15. A crushing profile for a system according to any one of the preceding claims, **characterised in that** the crushing profile is manufactured from hardened boron steel.

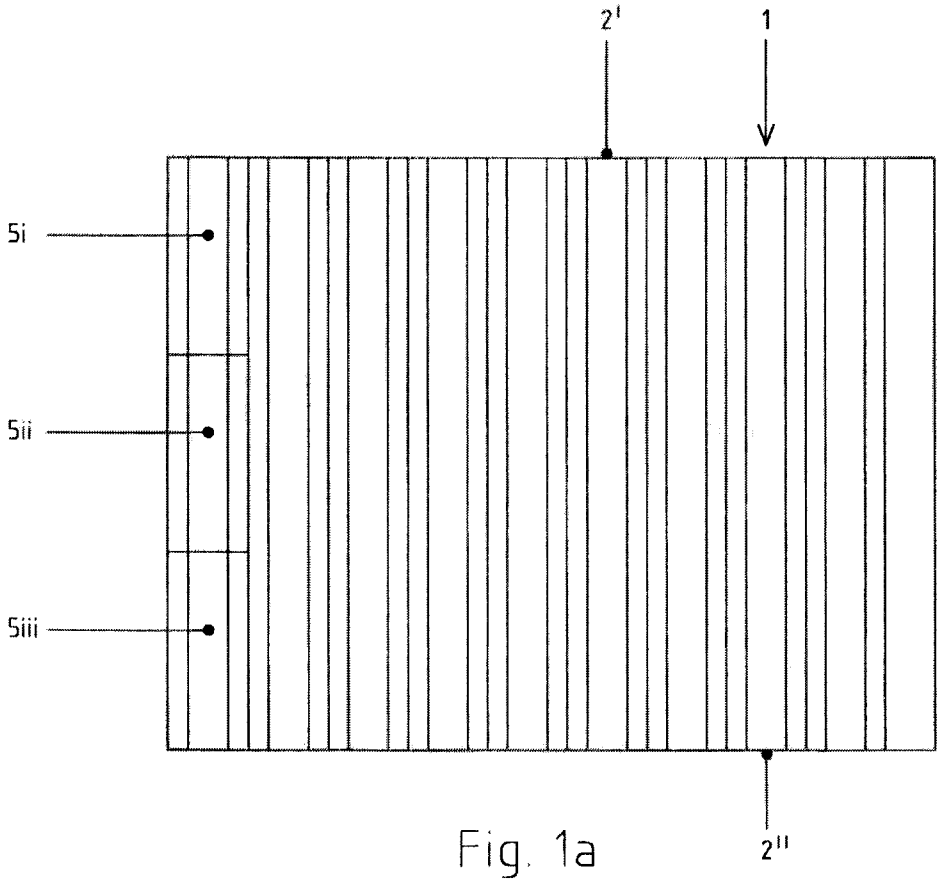


Fig. 1a

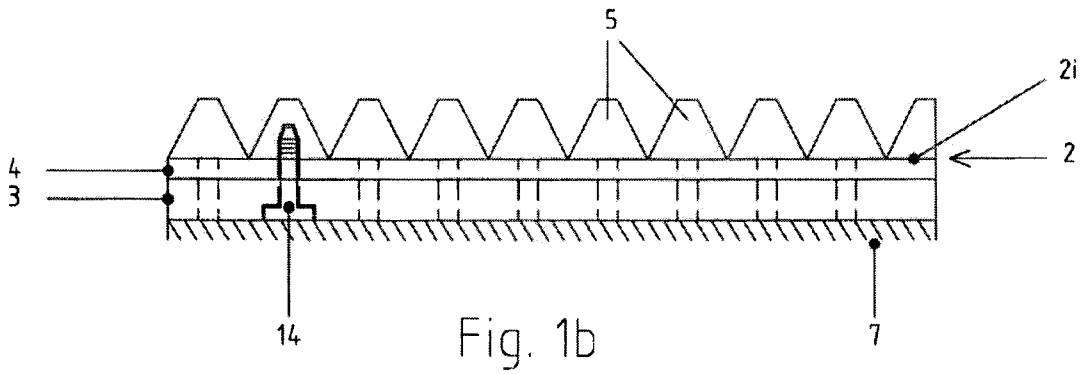


Fig. 1b

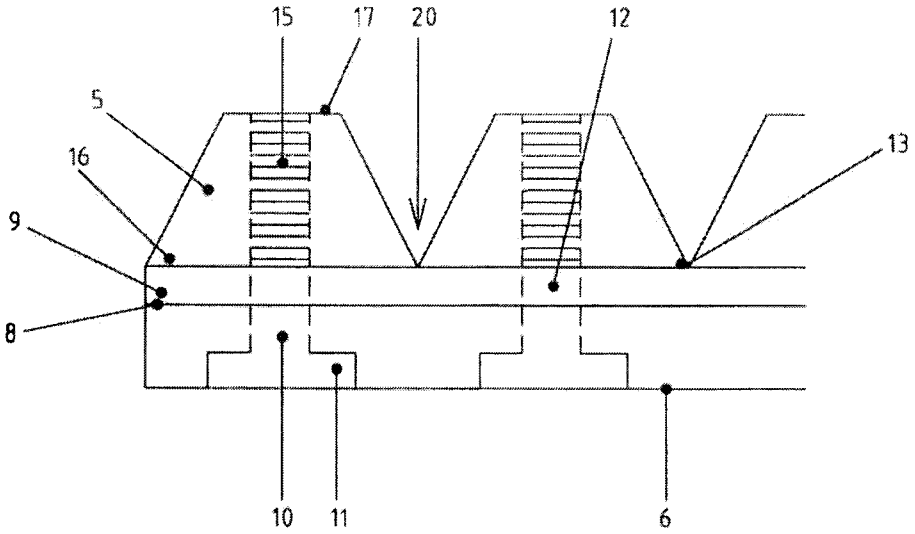
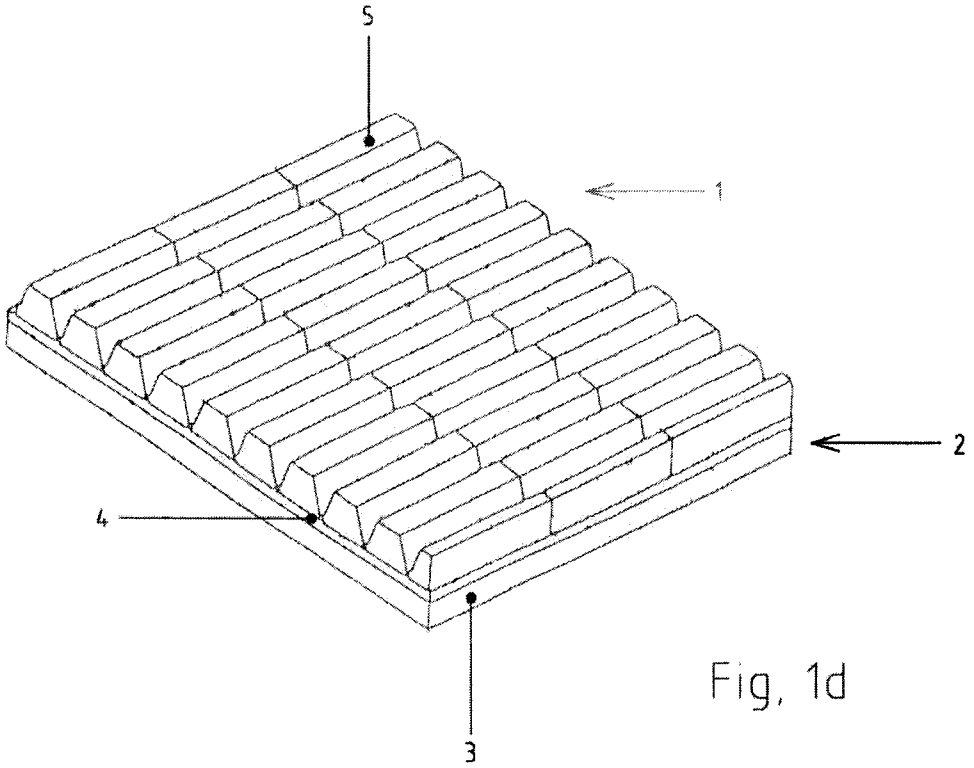


Fig. 1c



Fig, 1d

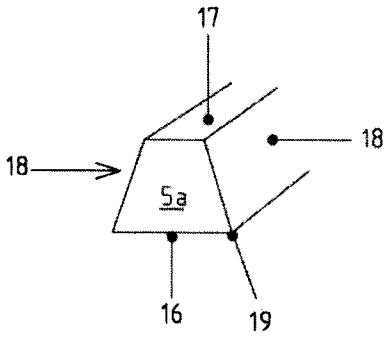


Fig 2a

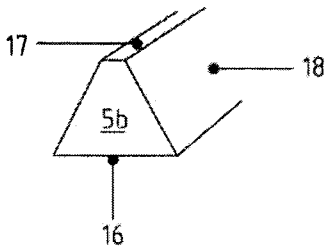


Fig 2b

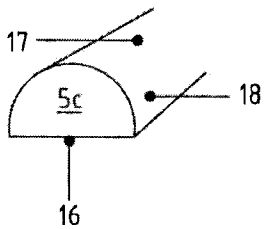


Fig 2c

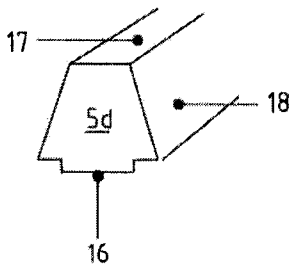


Fig 2d

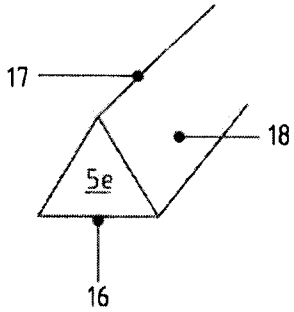


Fig 2e

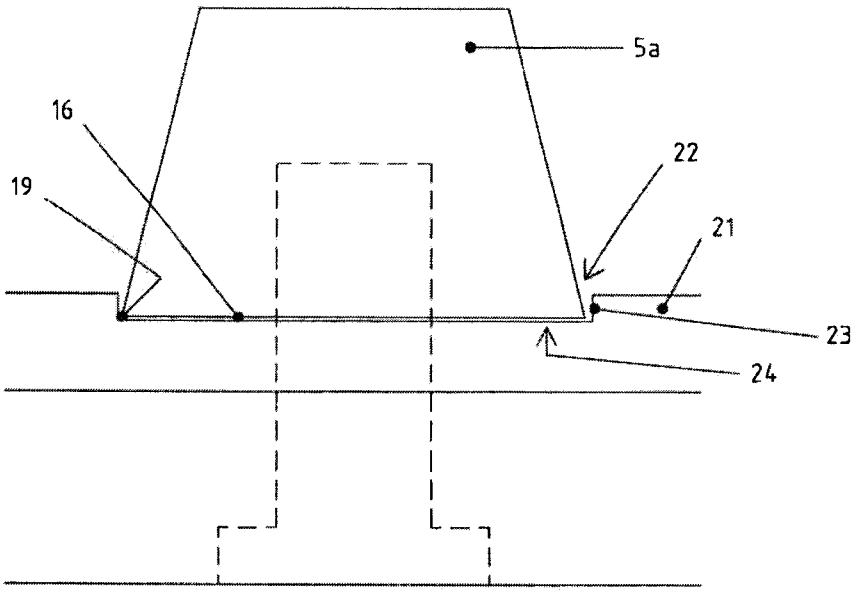


Fig. 3a

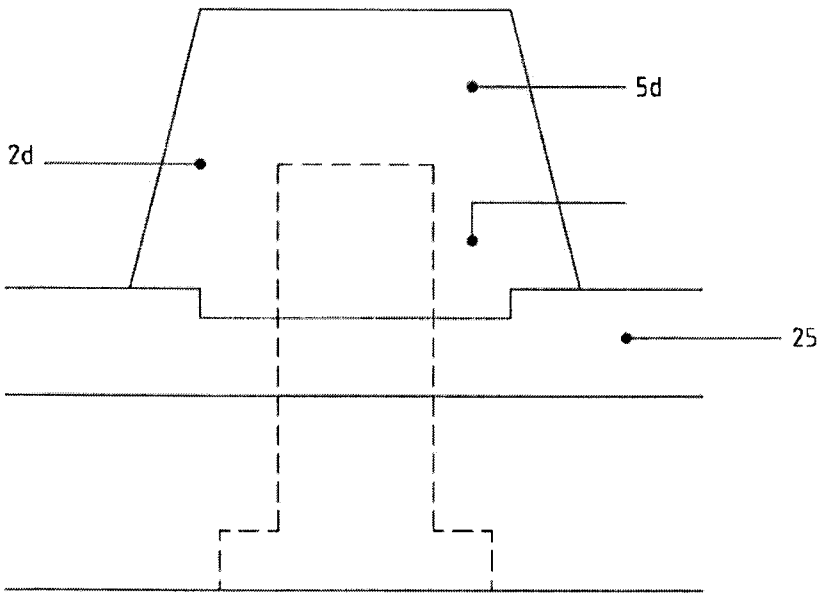


Fig. 3b

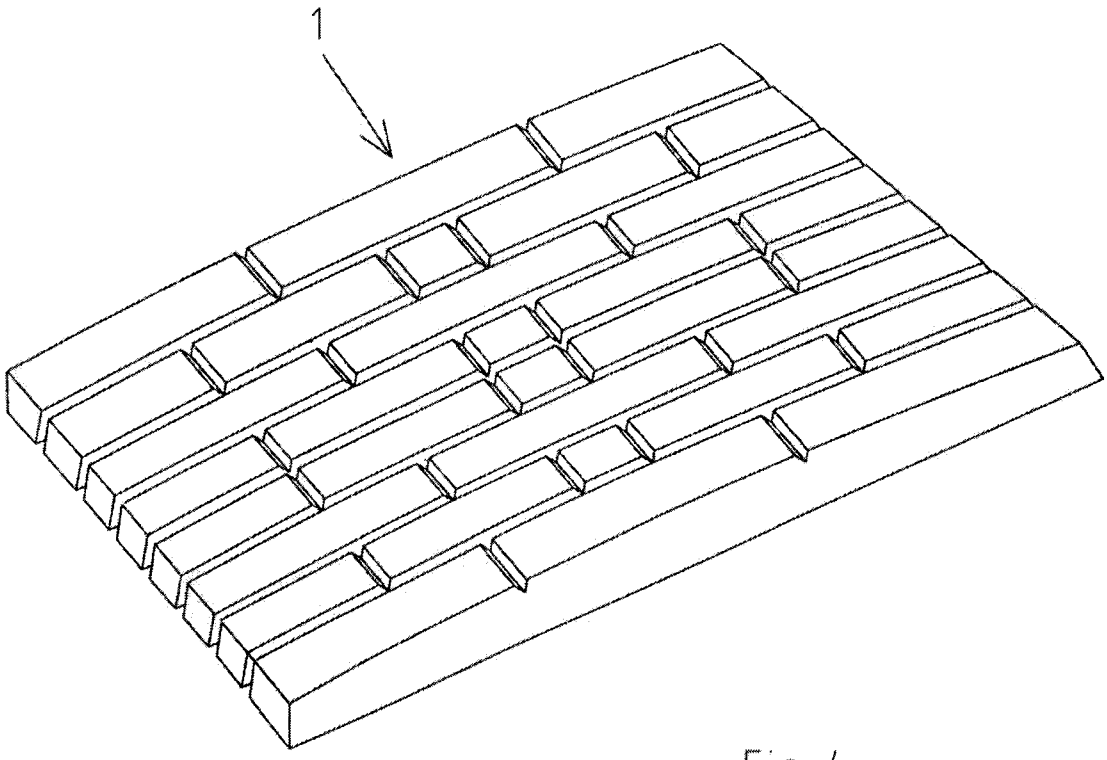


Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/050509

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B02C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012092427 A1 (SMIDTH AS F L ET AL), 5 July 2012 (2012-07-05); abstract; page 1, line 2 - page 1, line 9; page 4, line 5 - page 5, line 16; page 13, line 5 - page 13, line 16; page 14, line 11 - page 14, line 15; page 15, line 20 - page 17, line 21; page 20, line 18 - page 21, line 7; page 22, line 4 - page 24, line 23; figures 1-9 --	1-15
A	GB 578292 A (ELEK SKA SVETSNINGSAKTIEBOLAGE), 21 June 1946 (1946-06-21); page 1, line 45 - page 1, line 68; figures 1-4 --	1-15
X	DE 377438 C1 (ELEKTROSCHMELZE G M B H), 19 June 1923 (1923-06-19); whole document --	1-15

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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Date of the actual completion of the international search	Date of mailing of the international search report
28-01-2014	28-01-2014
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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2013/050509

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2441205 A (PETERSON EDWARD T), 11 May 1948 (1948-05-11); column 2, line 53; figures 1,2	1-15
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A	US 3241777 A (KUNTZ ROBERT S), 22 March 1966 (1966-03-22); whole document	1-15
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International application No.
PCT/SE2013/050509

Continuation of: second sheet

International Patent Classification (IPC)

B02C 1/10 (2006.01)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2013/050509

WO	2012092427	A1	05/07/2012	AU	2011352071	A1	18/07/2013
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				US	20130299618	A1	14/11/2013
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