



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.06.2011 Bulletin 2011/25

(51) Int Cl.:
B02C 1/10 (2006.01)

(21) Application number: **09179972.6**

(22) Date of filing: **18.12.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

- **Teeri, Tuomas**
33300 Tampere (FI)
- **Hellman, Jussi**
00930 Helsinki (FI)
- **Siitonen, Pekka**
33880 Lempäälä (FI)

(71) Applicant: **Metso Minerals, Inc.**
00101 Helsinki (FI)

(74) Representative: **Milanov, Nina Vendela Maria**
Awapatent AB
P.O. Box 5117
200 71 Malmö (SE)

(72) Inventors:
• **Liimatainen, Jari**
33240 Tampere (FI)

(54) **Insert arrangement, wear surface structure for a jaw of a jaw crusher, jaw crusher and use of wear surface structure**

(57) The invention relates to a wear insert (1) for a jaw of a jaw crusher or the like. The wear insert comprises a body (2) and a core (3) inserted in the body, whereby the body has a Vickers hardness value of at least 500 HV and the core has a Vickers hardness value of at least

800 HV, the core having a higher Vickers hardness value than the body. The invention relates also to a wear surface structure comprising matrix material, comprising one or several recesses, and one or several wear insert (s) according to the invention, as well as a jaw crusher comprising said wear surface structure.

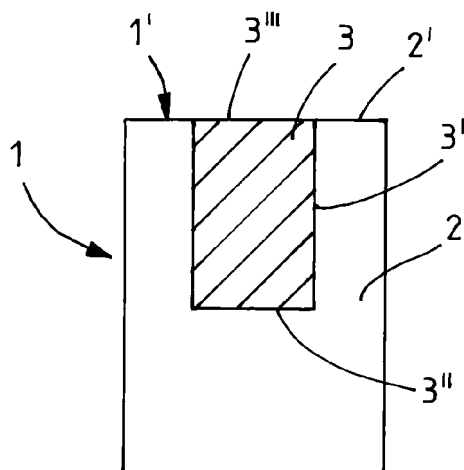


FIG. 1A

Description

[0001] The invention relates to an insert arrangement, wear surface structure for a jaw of a jaw crusher, a jaw crusher and use of a wear surface structure according to the preambles of the enclosed claims.

RELATED ART

[0002] Jaw crushers are used for reducing the size of solid material, such as mineral material for example in mining industry. Usually jaw crushers comprise two vertical jaws, where the first jaw is fixedly mounted and the second jaw is arranged movable to and fro relative to the first jaw. The material to be crushed is fed between the jaws and subjected to the pressing and relieving actions of the moving jaw. The jaws are arranged in tapered manner so that they are farther apart at the top than at the bottom, and the material, which is crushed travels at the same time downwards towards the discharge opening.

[0003] The crushing occurs between the two jaws, whereby the surface of the jaws is subjected to heavy wear and abrasion. The wear surfaces of the jaws are usually made of wear resistant material, such as manganese steel. However, when very abrasive minerals are crushed, the wear surfaces are rapidly eroded and they must be replaced. Replacement of the wear surface requires that the operation of the jaw crusher must be interrupted, which leads to process downtime and losses in operational efficiency. Naturally, the process costs are also increased.

[0004] There have been attempts to improve the wear resistance and function of the wear surface of the jaws. WO 99/15275 discloses a jaw crusher having hardened tapered inserts in the manganese or other wear liner. The inserts extend outwardly from the crushing surface so as to act as pick axes that shatter the rock primarily by impact rather than pulverising the rock by compression. The outwardly extending inserts are, however, very susceptible to fracture.

[0005] US 2008/142272 discloses a wear resistant assembly comprising at least one hard insert disposed within a recess formed within a surface. The hard insert is surrounded by a hard material disposed within the surface. The hard insert and hard material are separated by an intermediate material softer than both the insert and the hard material. However, crushing of very abrasive minerals still wears the wear surface too rapidly, inducing unnecessary costs.

OBJECT AND SHORT SUMMARY OF THE INVENTION

[0006] An object of this invention is to minimise or even eliminate the disadvantages existing in the prior art.

[0007] An object of this invention is to provide an insert arrangement which shows an improved wear resistance.

[0008] An another object of this invention is to provide a wear surface structure for a jaw of jaw crusher which

is durable and enables the crushing of very abrasive materials.

[0009] A further object of this invention is to provide a wear surface structure, which has a prolonged lifetime and enables long continuous work cycles.

[0010] These objects are attained with a method and an arrangement having the characteristics presented below in the characterising parts of the independent claims.

[0011] Typical wear insert according to the present invention for a jaw of a jaw crusher or the like, comprises

- a body and
- a core inserted in the body, whereby the body has a Vickers hardness value of at least 500 HV and the core has a Vickers hardness value of at least 800 HV, the core having a higher Vickers hardness value than the body.

Typical wear surface structure according to the present invention for a jaw of a jaw crusher or the like, comprises

- matrix material, comprising one or several recesses,
- one or several wear insert(s), inserted into recess or recesses of the matrix material and having a body (bodies), the body(bodies) of the wear insert(s) having an abrasion strength value that is higher than the abrasion strength value of the matrix material, whereby
- at least one core is arranged into the body, the core having an abrasion strength value that is higher than the abrasion strength value of the body.

Typical jaw crusher according to the present invention comprises

- a first and a second vertical jaw, at least one of the jaws being movable in relation to the another, arranged in tapered manner,
- the jaws having a wear surface facing each other, whereby one or both of the jaws comprises a wear surface structure according to the present invention.

[0012] Typical use of the wear surface structure according to the present invention is for crushing of abrasive or very abrasive mineral material.

DETAILED DESCRIPTION OF THE INVENTION

[0013] Now it has been surprisingly found out that the lifetime of the wear surface structures of the jaw of a jaw crusher and their resistance to surface wear and severe loads can be significantly improved when the wear inserts comprising a hard core and a ductile impact resistant body are attached to the wear surface structure of the jaw. When wear inserts comprising a body and a core are arranged into the wear surface structure of the jaw crusher, the wear resistance of the wear surface structure is significantly improved. The wear inserts according to the invention can increase the lifetime of the wear surface structure. The hard cores achieve an unexpected synergistic effect when they are inserted to the body of the

wear insert. This makes possible to crush abrasive and very abrasive materials, and to minimise the down time in the crushing process, which improves the overall throughput and productivity. It is also possible to optimise the wear resistance of the wear surface structure according to the material, which is crushed.

[0014] Furthermore, an uneven wear of the wear surface structure has been a problem in the known solutions. In earlier solutions the matrix material of the jaw surface structure has been rapidly and unevenly worn out and caused various problems. Now it has been observed that the wear inserts according to the present invention level out the wear differences, and more even wear profile for the surface structure is obtained.

[0015] According to one embodiment of the invention the body of the wear insert has a Vickers hardness value in the range of 500 - 900 HV, preferably 600 - 900 HV, more preferably 750 - 850 HV, the hardness of the body being at the same time higher than Vickers hardness of the matrix material and lower than Vickers hardness of the core material. The body may be made of white cast iron, tool steel or wear resistant steel. Tool steel is here understood as iron based material, which comprises a carbide, such as chromium carbide, vanadium carbide, niobium carbide, tungsten carbide or any combination thereof. Examples of tool steel types are carburizing steel, tempering steel, high speed steel and spray-formed steel. The amount of carbide in the tool steel is at least 5 volume-%, typically over 10 volume-%, preferably over 20 volume-%. The carbon content in tool steel is typically 0.5 %, preferably > 1.0 %. The chromium content in tool steel is typically 0 - 30 %, vanadium content 0 - 18 % and the total combined chromium and vanadium content is in tool steel typically > 5 %, preferably 10 - 25 %.

[0016] Wear insert body is usually prepared separately by casting, electroslag melting, vacuum arc remelting or spray deposition. It is also possible to forge or roll the wear insert body to its final shape. The length of the body is typically in the range of 50 - 200 mm, preferably 60 - 140 mm. The width of the body is typically in the range 40 - 100 mm, preferably 50 - 80 mm. The depth of the body is typically in the range 100 - 150 mm, preferably 110 - 140 mm. At least one recess is arranged into the wear insert body by machining for inserting a core. The recess for the core is typically arranged into that side face of the body, which is defined by the length and the width of the body.

[0017] According to one embodiment of the invention the core of the wear insert has a Vickers hardness value in the range of 800 - 1800 HV, preferably 1000 - 1800 HV, more preferably 1200 - 1400 HV, the hardness of the core being at the same time higher than Vickers hardness of the matrix material and the body material. The core may be made of ceramic material or hard metal. Suitable hard metals are, for example, tungsten carbide-cobalt (WC-Co), titanium carbide-iron (TiC-Fe) or titanium carbide-nickel-molybdenum (TiC-Ni-Mb). Suitable ceramic materials are, for example, aluminium oxide,

partly stabilised zirconium oxide, silicon oxide or a metal nitride or a metal boride. The core may also be a composite of metal and ceramic, so called Cermet, where the metal functions as a binder. Typical binder may be, for example, cobalt, and the binder content may be 0 - 20 weight-%. Other metals that may be used as binder are cobalt based alloys, nickel and nickel based alloys, titanium and titanium based alloys, iron based alloys as well as molybdenum and molybdenum based alloys. The ceramic in the Cermet may be any suitable carbide material, such as tungsten carbide (WC), titanium carbide (TiC), vanadium carbide (VC), chromium carbide (CrC) or mixture of several carbides.

[0018] According to a preferred embodiment of the present invention the body of the wear insert is made of tool steel, while the core is made of Cermet or hard metal.

[0019] The core comprises typically a generally elongated or cylindrical body, having a length in the range 50 — 100 mm, preferably 60 - 90 mm, more preferably 70 - 80 mm. The largest diameter of the core is typically 15 — 50 mm, preferably 20 - 40 mm, more preferably 20 - 30 mm. Typically the core is mainly embedded into the wear insert body. This means that the sides of the core are covered by the material of the body. In this manner the core, which has lower fracture toughness, but high hardness and wear resistance is protected by the more ductile material of the body. The core may be visible at the end(s) of the wear insert or the core may be totally covered by the material of the wear insert body, even at the end(s) of the wear insert. The core may extend substantially from the first end of the wear insert body to the second end of wear insert body, or it may extend only part of total depth of the body, for example 40 %, 50 %, 60 %, 70 %, 80 % or 90 % of the total depth of the body.

[0020] It is also possible that the body has a shape of a hollow tube, torus or ring. The core, preferably a plurality of cores, may be arranged in the tube, torus or ring wall, or the core may form a core layer on the inner wall of the body. During the crushing, the hollow space inside the wear insert is filled with the material which is crushed, thus providing autogenous protection.

[0021] Usually the cross sectional form of the core is symmetrical. The cross sectional form of the core may be circular, elongated, triangular, quadrangular, parallelogram, polygon or irregular. The cross sectional form and area of the core is normally constant over the whole core length. In certain embodiments, however, it is possible that the diameter and the cross sectional area decrease from the first end towards the second end of the core, whereby the core has a shape of a truncated cone. It is also possible that the core is T-shaped.

[0022] The core may also be made of a plurality of individual parts. For example, the core may comprise a number of cylindrical core parts, which have been arranged into the wear insert body one after another. In this manner, the core is not continuous, but the core comprises a number of discontinuities where the one core part ends and the second core part starts. The ends of

the individual core parts may be in contact with each other, or there may be material, such as the material of the body, between them. The discontinuity points of the core make the core more resistant for fracture, but it still retains its wear improving properties. The core may comprise 2 — 4 individual core parts.

[0023] According to one embodiment the invention the cross section of the wear insert may be circular, elongated, triangular, quadrangular, parallelogram, polygon or irregular. It is possible to improve the crushing results by employing wear inserts with different cross sectional forms at different locations of the wear surface structure of the jaw of a jaw crusher.

[0024] According to one embodiment of the invention the wear insert comprises further a surface layer or coating, which envelopes at least part of the outer surface of the wear insert body. The surface layer or coating may be of different material than the wear insert body or the outer surface of the wear insert body may have been treated or processed in a manner that provides it with different characteristics and/or properties than the bulk material of the body. For example, the outer surface of the wear insert body may be carburized. The surface layer or coating may improve the wear resistance of the wear insert or it may improve its bonding to the matrix material of the wear surface structure. It is also possible that the core comprises a corresponding surface layer or coating, improving the mechanical properties of the core or its bonding to the body. In case a surface layer or coating is arranged on the outer surface of the core before its insertion into the body, the layer or coating will become an intermediate layer between the core and the body.

[0025] In one embodiment of the invention it is possible to arrange one or several intermediate layers between the core and the body. The intermediate layer may be material, which is chemically different from materials of both the core and the body. The intermediate layer may also be chemically similar material than the material of the core and/or the body, but in that case it differs from them by its physical properties. The intermediate layers may be arranged one at a time on the surface of the core before it is inserted and attached to the body.

[0026] According to one preferred embodiment of the invention the outer end surfaces of the core, body and matrix material are arranged in the same level. This means that the wear insert is not protruding from the main level of the matrix of the wear surface structure and the core is not protruding from the main level of the matrix of the wear surface structure or the main surface level of the body. Thus the end surface of the wear insert and the main surface of the wear surface structure form a uniform, plain and flat surface of the jaw of a jaw crusher.

[0027] According to one embodiment of the invention it is possible to insert several cores into one wear insert body, typically 2 — 5 cores, preferably 2 — 3 cores per one body. Thus the wear insert may comprise a plurality of parallel cores. When one wear insert has a plurality of parallel cores, its mechanical reliability is improved, even

if the individual cores are thinner than cores used in wear insert body comprising only a single core. Plurality of cores provides the advantage that even if one of the cores would be broken or damaged, the strength of the wear insert is still maintained at acceptable level due to the other unbroken cores. Wear insert bodies, which have a plurality of cores, may be used for example for protection of most exposed areas of the wear surface of the jaw of the jaw crusher.

[0028] The wear insert bodies and cores are usually manufactured separately and attached together in order to form a wear insert arrangement. The core can be attached to the body with any suitable method which provides for sufficient strength for the attachment. Typically the core is attached to the body with a bonding adhesive, such as epoxy based adhesive, preferably two-component epoxy adhesive. Also brazing, shrink fitting, welding, press fitting, interference fitting or mechanical joint can be used for attaching the core to the body.

[0029] The wear insert according to the present invention is preferably intended to be used in connection with a wear surface structure of a jaw of a jaw crusher or the like. Jaw crusher comprises two vertical jaws, where the first jaw is fixedly mounted and the second jaw is arranged movable to and fro relative to the first jaw. The material to be crushed is fed between the jaws and subjected to the pressing and relieving actions of the moving jaw. The jaws are arranged in tapered manner so that they are farther apart at the top than at the bottom, and the material, which is crushed travels at the downwards towards the discharge opening between the jaw ends. The surface structures of the jaws, which face each other and which come into contact with the material to be crushed are denoted as the wear surface structures. The matrix material of the wear surface structure has usually a Vickers hardness value in the range of 180 - 600 HV, preferably 250 - 500 HV, more preferably 250 - 400 HV, and being at the same time lower than Vickers hardness of the body and the core. Typically the matrix material is made of wear resistant steel, such as manganese steel, comprising 0.9 - 1.6 percent carbon and 10 — 20 percent manganese. The matrix material is usually formed by casting, so that suitable recesses or cavities are formed, into which the wear inserts can then be inserted and attached.

[0030] The wear surface structure comprises at least one, preferably a plurality of recesses for the wear inserts comprising a core and a body surrounding the core. The wear insert arrangement may be attached to the recess of the wear surface structure with adhesive bonding, brazing, shrink fitting, welding, press fitting, interference fitting or mechanical joint. An adhesive that may be used for adhesive bonding is epoxy adhesives, especially two-component epoxy adhesives. In many embodiments the adhesive bonding provides a fast, inexpensive and simple way of bonding the insert arrangement to the wear surface structure. It also has lower requirements for the clearance of the insert arrangement and recess dimen-

sions. Adhesive bonding may also provide for changing the damaged and/or worn wear inserts.

[0031] The wear insert is normally arranged to the wear surface structure of the jaw in such a manner that the core of the wear insert is perpendicular or in angular relationship to the surface of the wear surface structure. The end of the core is normally in contact with the material to be crushed during the crushing process. Typically the core of the wear insert is perpendicular to the surface.

[0032] According to one embodiment of the invention the wear surface structure is arranged on wear surfaces of raised crushing teeth of a jaw frame. This means that the wear inserts are arranged in teeth of the jaw of a jaw crusher, so that the geometry of the jaw remains constant during the operation. The wear exposure is usually higher in the raised teeth area than in area between the teeth, and more wear resistance is needed in those areas, in order to maintain the jaw geometry.

[0033] According to one embodiment of the invention the wear surface structure comprises a plurality of wear inserts arranged in a pattern. The wear inserts may be arranged to form a desired pattern on the wear surface structure of the jaw crusher in order to optimise the throughput of crushed material. By proper arrangement and selection of different insert cross sectional forms and sizes and/or heights on different parts of the wear surface of the jaw it is also possible to optimise the wear protection. For example, it is possible to arrange higher number of inserts in the centre part of the wear surface structure. It is also possible to optimise the capacity and jaw wear in the crushing process by using wear surface structures with different insert patterns.

[0034] According to one embodiment of the invention one or both jaws of the jaw crusher has a wear surface structure comprising a plurality of wear inserts arranged in a pattern, so that the insert coverage area varies on wear surface or that different parts of wear surface structure have different inserts. Insert coverage area denotes here proportion of the additive cross-sectional area of the inserts on a defined surface area of the wear surface structure of the jaw to that defined surface area of the wear surface structure of the jaw, given in %. The insert coverage area is at least 20 %, typically at least 30 %, and it does not exceed 100 %, and is typically less than 90 %. The insert coverage area of may vary on or along the jaw surface. The insert coverage area is may also be chosen so that an even wear of the jaw surface is obtained.

[0035] A jaw crusher comprising insert arrangements according to the present invention is especially suitable for crushing of abrasive and/or very abrasive mineral material. Abrasive mineral materials are hard and they induce a high wear rate in jaw crusher wear surface structures. Examples of abrasive mineral materials are quartz, granite, tonalite, gold ores and copper ores. In this context abrasive mineral material is mineral material having abrasive index 1200 - 1700 g/t, and very abrasive mineral material has an abrasive index > 1700 g/t. The abrasion

index is determined by rounding stone material of 1600 g (4 x 400 g) in abrasion mill for one hour. The fractions used for determination is 12 - 1 mm (50%) and 16 - 19 mm (50 %). In abrasion mill the stones hit the standard metal plate and the abrasion index is the loss of metal plate's weight after rounding it for one hour.

[0036] The invention is described in more detail with the aid of the following exemplary and schematical figures, in which

Figures 1A — 1 F show sectional views of different embodiments of the wear insert according to the present invention, seen from the side, perpendicularly to the depth direction of the wear insert,

Figures 2A - 2G show different embodiments of the wear insert according to the present invention, seen in the depth direction of the wear insert,

Figure 3 shows a wear insert according to one embodiment of the present invention, seen from the side, perpendicularly to the depth direction of the wear insert arrangement,

Figures 4A - 4B show schematically wear inserts according to some embodiments of the present invention, and

Figure 5 shows schematically a wear surface structure according to one embodiment of the invention.

[0037] Figures 1A - 1F show sectional views of different embodiments of the wear insert according to the present invention, seen from the side, perpendicularly to the depth direction of the insert.

[0038] In Figure 1A is shown a wear insert 1 comprising a body 2 and a core 3. The core 3 is inserted to the body 2 in such a manner that the body 2 envelopes the circumference 3' and the first end 3" of the core 3. Thus, the core 3 does not extend through the whole wear insert body 2. The second end 3''' of the core 3 and the second end 2' of body 2 having a recess for the core 3 form a flat even end surface 1' of the wear insert 1. Usually this end surface 1' is facing outwards from the wear surface structure, once the insert arrangement is attached to the wear surface structure of the jaw of a jaw crusher or the like. The core 3 does not extend through the whole wear insert body 2.

[0039] In Figure 1B is shown a wear insert 1 comprising a body 2 and a core 3, which extends through the whole wear insert body 2. Thus the body 2 envelopes the circumference 3' of the core 3. The first end 3" of the core 3 and the first end 2' of body 2 form a flat even first end

surface 1' of the wear insert 1. Correspondingly the second end 3''' of the core 3 and the second end 2'' of body 2 form a flat even second end surface 1'' of the wear insert arrangement 1. The core 3 and body 2 have a constant cross sectional area and form, whereby the wear insert 1 is totally symmetrical.

[0040] In Figure 1C is shown a wear insert 1 comprising a body 2 and a core, which comprises a first and second core part 4, 4'. A discontinuity 5 is located between the first core part 4 and the second core part 4'. The core parts do not have to be of same size, for example, they can be of different length. The diameter of the core parts is usually the same. It is observed that the cores may be some times fractionated during the crushing process. When the core comprises two or several core parts, the discontinuity makes the core more flexible, still retaining its strength. The length of the different core parts may be chosen so that the discontinuity/discontinuities are located at points where the core receives the strongest fractionating forces.

[0041] In Figure 1D is shown a wear insert 1 comprising a body 2 and a core 3. The cross sectional area of the core is decreasing towards the first end 3' of the core 3, whereby the core 3 has an overall form of a truncated cone.

[0042] In Figure 1E is shown a wear insert 1 comprising a body 2 and a first core 3 and a second core 6. The first and second cores 3, 6 are parallel and they extend through the whole wear insert body 2. Thus, the wear insert body 2 envelopes the circumferences 3', 6' of the first and second cores 3, 6. It is clear that when the wear insert comprises a plurality of cores, they do not necessarily extend through the whole wear insert. The cores may extend only part of total wear insert length, for example 40 %, 50 %, 60 %, 70 %, 80 % or 90 % of the total length of the wear insert body. The parallel cores may also comprise a number of core parts, arranged one after another to form an individual core.

[0043] In Figure 1F is shown a wear insert 1 comprising a body 2 and a T-shaped core 3. In this case the end surface 1' of the wear insert arrangement 1 is largely covered by the material of the core.

[0044] In Figures 2A - 2G is shown different embodiments of the insert arrangement according to the present invention, seen in the depth direction of the wear insert.

[0045] In Figure 2A is shown a wear insert 1 with circular cross section. A circular core 3 is inserted into the centre of a circular body 2 so that the longitudinal axis of the core 3 and the depth axis of the body 2 are parallel and overlapping each other.

[0046] Figure 2B shows a wear insert 1 with square or quadrangular cross section. A circular core 3 is inserted into the centre of the square wear insert body 2, but still the longitudinal axis of the core 3 and the depth axis of the body 2 are parallel and overlapping each other. Usually the wear insert according to the present invention has a core and a body with the same cross sectional form, but it is not necessary. In certain embodiments the

cross sectional form of the core may differ from the cross sectional form of the body, as shown in Fig. 2B.

[0047] Figure 2C shows a wear insert 1 having a body 2 in form of a hollow tube, having ring-like cross sectional form. In the centre of the body 1 is an empty and hollow space 7, which will be filled with the material to be ground in the crushing process. A plurality of circular cores 3, 3', 3'' are inserted into the ring-like body 2. The cores 3, 3', 3'' have parallel longitudinal axes.

[0048] Figure 2D shows a wear insert 1 having a body 2 in form of a hollow tube, having ring-like cross sectional form. A core 3 is arranged on the inner surface 8 of the body 2, and the core 3 is thus also in form of a hollow tube with a ring-like cross sectional form. In the centre of the wear insert arrangement 1 is an empty and hollow space 7, defined by the core 3 material.

[0049] Figure 2E shows a wear insert 1 with circular cross section with plurality of circular cores 3, 3', 3'', 3''' inserted into a circular body 2. The cores 3, 3', 3'', 3''' are parallel and they are of the same size, i.e. their cross sectional areas are the same. However, it is not necessary in the embodiments employing a plurality of cores in one single body that all the cores are of same size. They may differ from each other and have different lengths, cross sectional forms and/or cross sectional areas: This improves the possibility to tailor the insert arrangement properties for different materials to be crushed and/or for different locations on the wear surface structure of the jaw crusher.

[0050] Figure 2F shows a wear insert 1 with circular cross section. A circular core 3 is inserted into the centre of a circular body 2 so that the longitudinal axis of the core 3 and the depth axis of the body 2 are parallel and overlapping each other. The wear insert arrangement 1 comprises also an intermediate layer 20 arranged between the core 3 and the body 2. The intermediate layer 20 may improve the mechanical properties of the wear insert 1 or it may improve the attachment of the core 3 to the wear insert body 2. The wear insert 1 comprises also a coating 21 on the outer surface of the wear insert body 2. The coating may also improve the mechanical properties of the wear insert 1 or the attachment of the wear insert 1 to the wear surface structure of a jaw crusher. The intermediate layer and the coating may be of the same or different material.

[0051] Figure 2G shows a wear insert 1 with quadrangular cross section. A quadrangular core 3 is inserted into the centre of a quadrangular body 2 so that the longitudinal axis of the core 3 and the depth axis of the body 2 are parallel and overlapping each other.

[0052] Figure 3 shows a wear insert according to one embodiment of the present invention, seen from the side, perpendicularly to the depth direction of the wear insert arrangement. The wear insert 1 comprises a body 2 and a core 3 inserted into the body 2. The whole wear insert body 2 is covered with a surface layer or coating 20. The surface layer or the coating may be obtained by dipping the wear insert arrangement 1 into a liquid coating and

allowing it to dry on the wear insert surface or to react with the wear insert surface. The coating or surface layer may also be obtained by mechanical or physical processes, for example by deposition or carburizing.

[0053] Figures 4A and 4B show schematically wear inserts according to some embodiments of the present invention. Angular wear inserts 1, 1' comprise plurality of parallel cores 3, 3', 3" that have been inserted and attached to the bodies 2, 2'. A xyz-coordinate system is indicated in Fig. 4A. The body 2 has a length A in the x-direction, a width B in the z-direction and a depth C in y-direction. The cores 3, 3', 3" extend in the depth direction y of the body 2. The ends of the cores 3, 3', 3" are visible on the surface 41, 41' of the wear insert 1, 1' and in contact with the material to be crushed during crushing process. The cores 3, 3', 3" do not extend through the whole wear insert body 2, 2'.

[0054] Figure 5 shows schematically a wear surface structure of a jaw of a jaw crusher according to one embodiment of the invention. A wear surface structure 61 comprises a plurality of wear inserts according to the invention arranged into different patterns on different locations of the wear surface structure 61. The arrow W indicates the feed of the abrasive mineral material to be crushed between the jaws of the jaw crusher.

[0055] The wear surface structure 61 comprises elongated quadrangular wear inserts 16, 16', 56, 56'. Some of the quadrangular wear inserts 16, 16' comprise a plurality of cores 101, 101', 101". Some of the quadrangular wear inserts 56, 56' comprise only one core, which may be an elongated core 102 or a circular core 102'. The wear surface structure 61 of the jaw comprises also circular inserts 17, 17', 18, 18'. Some of the circular wear inserts 17, 17' comprise only one core, while some of the circular wear inserts 18, 18' comprise a plurality of cores.

[0056] Some of the wear inserts 19, 18' comprise a plurality of cores that are different from each other. The cores in the inserts 19, 18' can be of different material, of different length, and/or have different cross-sectional areas and/or forms.

[0057] Some of the quadrangular inserts 66, 66' are arranged in an angle to the vertical, i.e. in an angle to the feed direction W. It is also possible to arrange the wear insert 16', 56' so that its length A coincides with the feed direction W, i.e. vertical direction. Some of the wear inserts 19, 56 are arranged so that their width B coincides with the feed direction W, i.e. vertical, and their length is perpendicular to the feed direction W.

[0058] Even if the invention was described with reference to what at present seems to be the most practical and preferred embodiments, it is appreciated that the invention shall not be limited to the embodiments described above, but the invention is intended to cover also different modifications and equivalent technical solutions within the scope of the enclosed claims.

Claims

1. A wear insert for a jaw of a jaw crusher or the like, the wear insert comprising
 - a body and
 - a core inserted in the body, whereby the body has a Vickers hardness value of at least 500 HV and the core has a Vickers hardness value of at least 800 HV, the core having a higher Vickers hardness value than the body.
2. Wear insert according to claim 1, **characterised in that** the body has a Vickers hardness value in the range of 500 - 900 HV.
3. Wear insert according to claim 1 or 2, **characterised in that** the core has a Vickers hardness value of at least 800 - 1800 HV.
4. A wear surface structure for a jaw of a jaw crusher or the like, the wear surface structure comprising
 - matrix material, comprising one or several recesses,
 - one or several wear insert(s), inserted into recess or recesses of the matrix material and having a body(bodies), the body(bodies) of the wear insert(s) having an abrasion strength value that is higher than the abrasion strength value of the matrix material, whereby
 - at least one core is arranged into the body, the core having an abrasion strength value that is higher than the abrasion strength value of the body.
5. Wear surface structure according to claim 4, **characterised in that** the core has a Vickers hardness value in the range of 800 - 1800 HV.
6. Wear surface structure according to claim 4 or 5, **characterised in that** the core is made of ceramic material or hard metal, such as WC-Co hard metal.
7. Wear surface structure according to any of claims 4 to 6, **characterised in that** the body has a Vickers hardness value in the range of 500 - 900 HV.
8. Wear surface structure according to any preceding claim, **characterised in that** the body is made of white cast iron, tool steel or wear resistant steel.
9. Wear surface structure according to claim 1, **characterised in that** the matrix material has a Vickers hardness value in the range of 180 - 600 HV.
10. Wear surface structure according to claim 9, **characterised in that** the matrix material is made of wear

resistant steel, such as manganese steel, comprising 0.9

- 1.6 percent carbon and 10 — 20 percent manganese. 5

11. Wear surface structure according to claim 1, **characterised in that** the core is attached to the body with a bonding adhesive, such as epoxy based adhesive. 10

12. Wear surface structure according to any of the preceding claims, **characterised in that** into one body is inserted several cores, typically 2 — 5 cores, preferably 2 - 3 cores. 15

13. A jaw crusher, comprising

- a first and a second vertical jaw, at least one of the jaws being movable in relation to the other, arranged in tapered manner, 20
- the jaws having a wear surface structure facing each other,
characterised in that one or both of the jaws comprises a wear surface structure according to any of the claims 4 — 12. 25

14. Jaw crusher according to claim 13, **characterised in that** one or both jaws has a wear surface structure comprising a plurality of wear inserts arranged in a pattern, so that the insert coverage area varies on wear surface or that different parts of wear surface structure have different inserts. 30

15. Jaw crusher according to claim 13 or 14, **characterised in that** the wear surface structure is arranged on wear surfaces of raised crushing teeth of a jaw frame. 35

16. Use of wear surface structure according to any of claims 4 - 12 for crushing of abrasive or very abrasive mineral material. 40

45

50

55

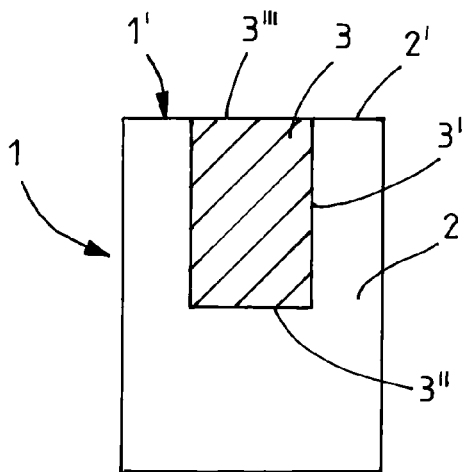


FIG. 1A

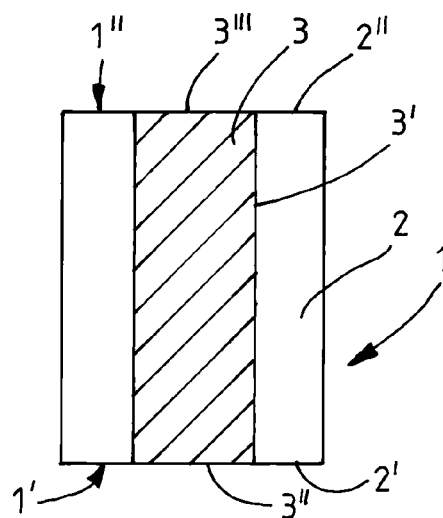


FIG. 1B

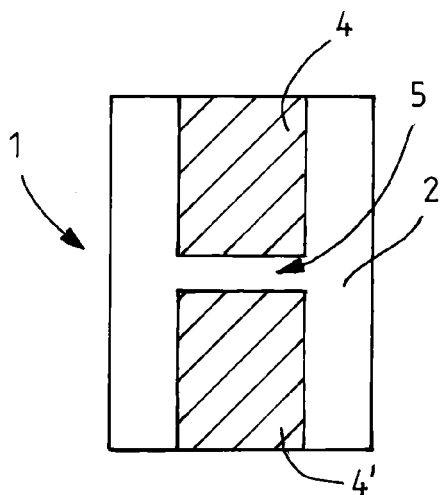


FIG. 1C

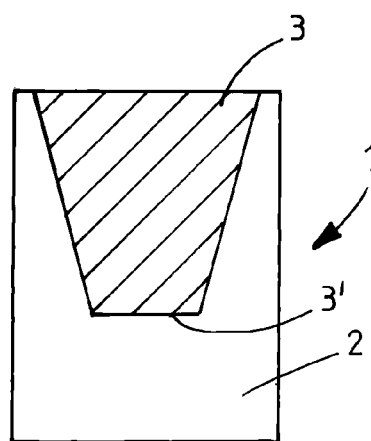


FIG. 1D

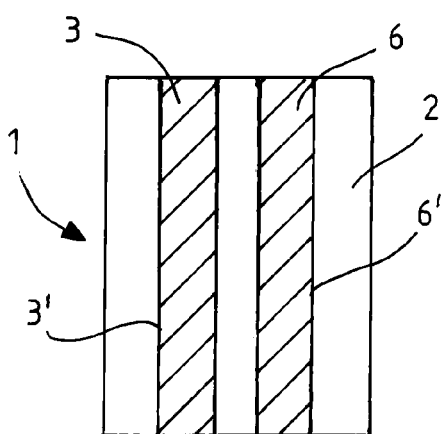


FIG. 1E

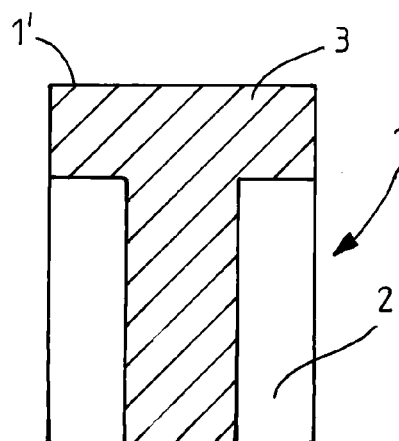


FIG. 1F

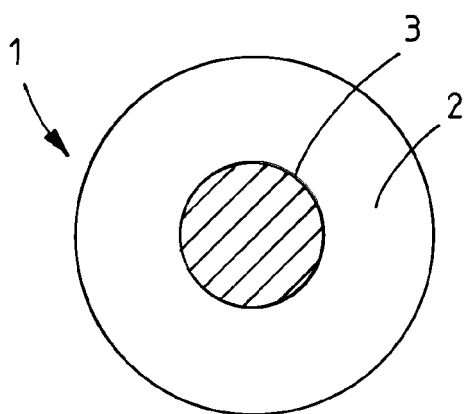


FIG. 2A

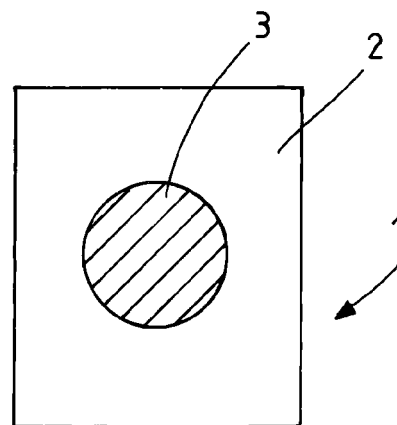


FIG. 2B

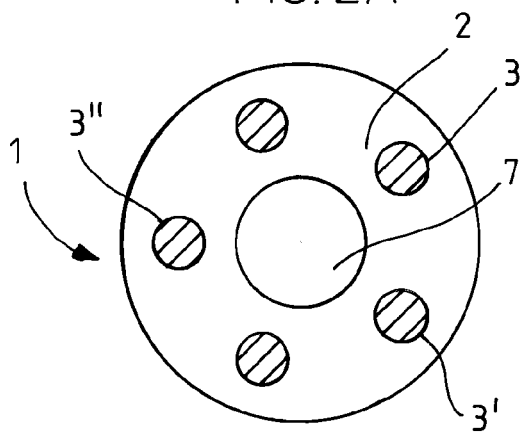


FIG. 2C

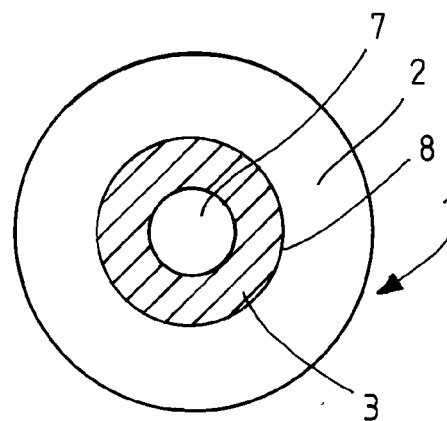


FIG. 2D

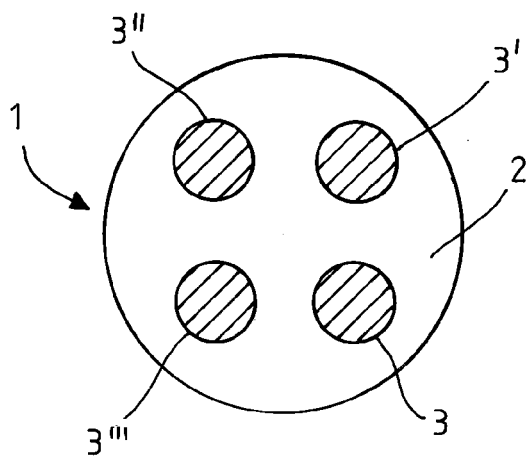


FIG. 2E

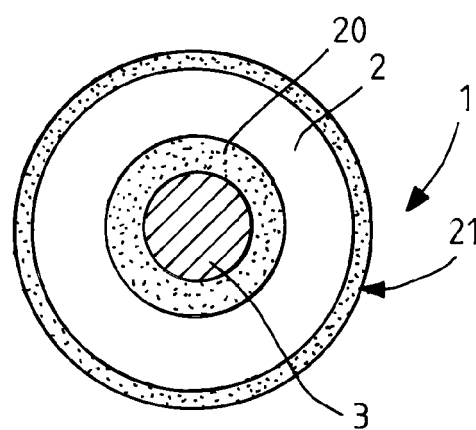


FIG. 2F

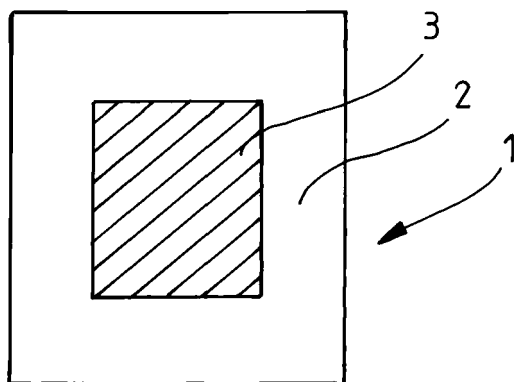


FIG. 2G

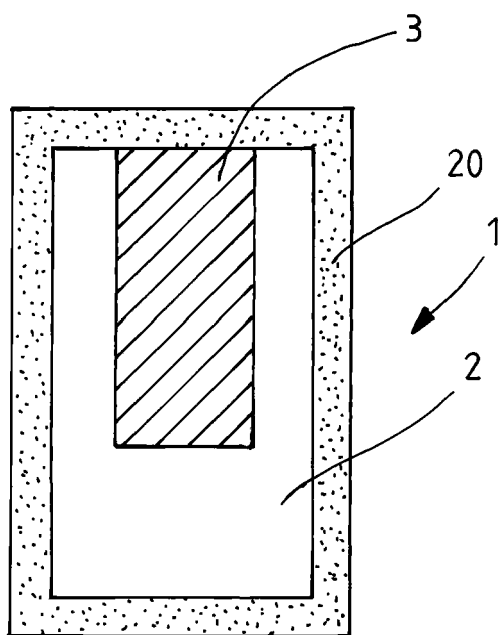


FIG. 3

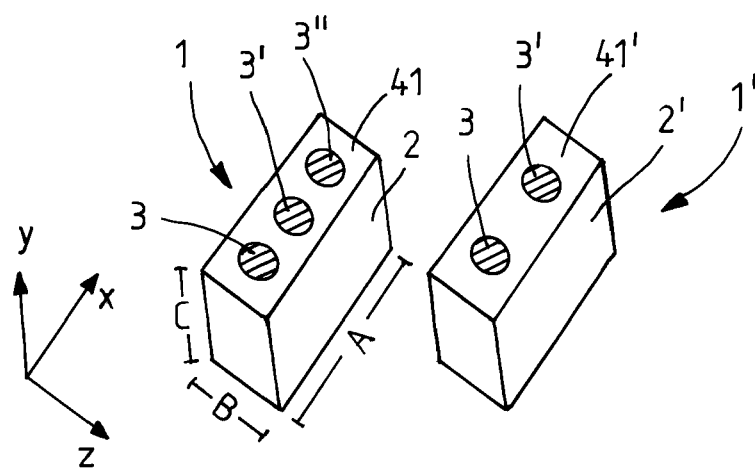


FIG. 4A

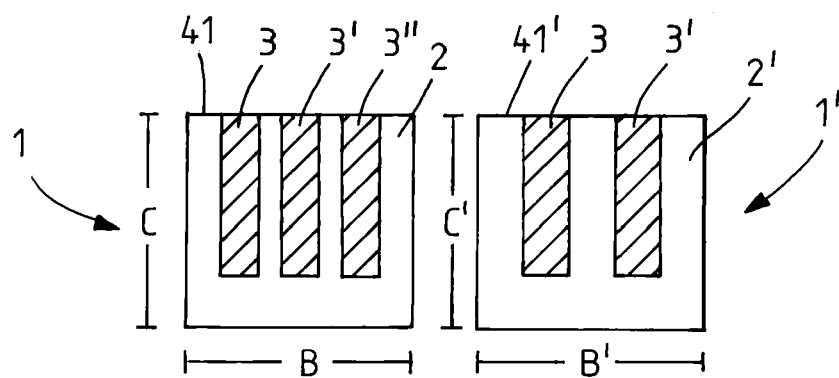


FIG. 4B

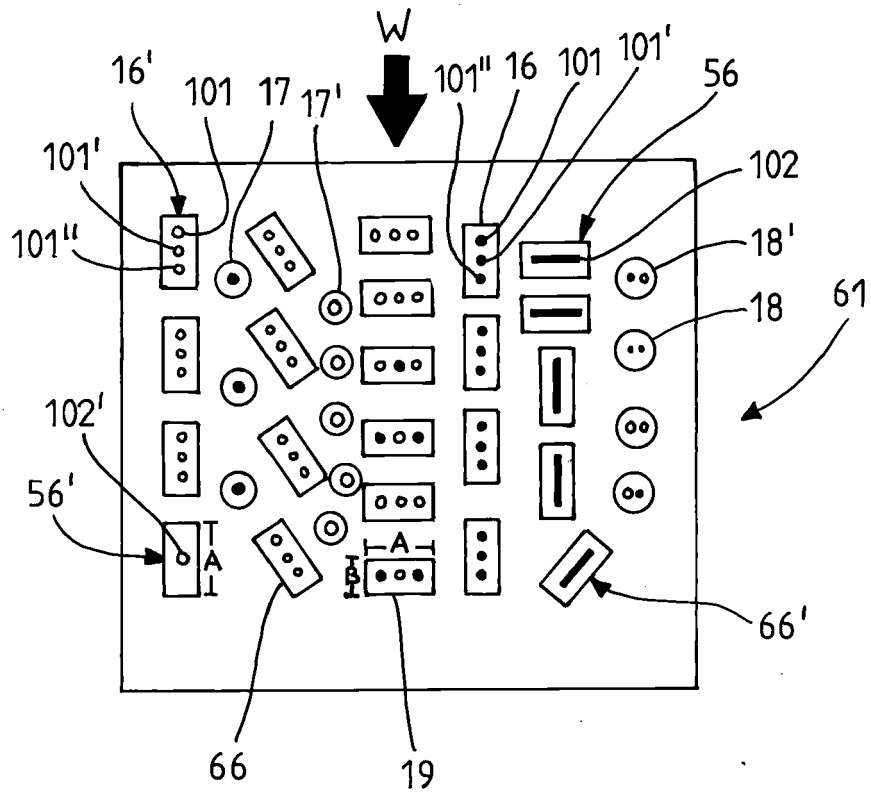


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 09 17 9972

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2008/142272 A1 (HALL DAVID R [US] ET AL) 19 June 2008 (2008-06-19) * page 1, paragraph 1 * * page 1, paragraph 6 - paragraph 9 * * page 2, paragraph 29 - page 4, paragraph 48 * * figures 1-18 *	1-9, 11-16 10	INV. B02C1/10
X	US 2008/041994 A1 (HALL DAVID R [US] ET AL) 21 February 2008 (2008-02-21) * page 1, paragraph 1 * * page 1, paragraph 4 - paragraph 7 * * page 2, paragraph 41 * * page 3, paragraph 43 * * page 3, paragraph 45 - paragraph 46 * * page 4 - page 49, paragraph 53 * * figures 6-10-12-33 *	1-16	
X Y	US 5 328 776 A (GARBER MICHAIL [US] ET AL) 12 July 1994 (1994-07-12) * column 1, line 7 - line 15 * * column 1, line 58 - column 2, line 43 * * column 2, line 61 - column 5, line 25 * * figures 1-4 *	1-10,12, 16 13-15	TECHNICAL FIELDS SEARCHED (IPC) B02C
X Y	US 2009/047543 A1 (GARBER MIKHAIL [US] ET AL) 19 February 2009 (2009-02-19) * page 1, paragraph 1 - paragraph 2 * * page 1, paragraph 4 * * page 1, paragraph 8 - paragraph 16 * * page 2, paragraph 23 - paragraph 28 * * page 2, paragraph 38 - paragraph 47 * * page 3, paragraph 50 - paragraph 65 * * figures 1-8k *	1-12,16 13-15	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 7 May 2010	Examiner Redelsperger, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

 1
EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 09 17 9972

DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)	
Y	US 3 946 955 A (BOND RICHARD S) 30 March 1976 (1976-03-30)	13-15		
A	* column 1, line 6 - line 45 * * column 2, line 20 - column 4, line 11 * * figures 1-11 *	1,4,16		
Y	FR 2 397 232 A1 (KAWASAKI HEAVY IND LTD [JP]) 9 February 1979 (1979-02-09)	13-15		
A	* page 1, line 1 - line 9 * * page 2, line 22 - line 33 * * page 3, line 5 - line 28 * * page 5, line 10 - page 6, line 23 * * figures 1-5 *	1,4,16		
A	US 273 477 A (M.B. DODGE) 6 March 1883 (1883-03-06) * the whole document *	1,4,13,16		
				TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims				
Place of search Munich		Date of completion of the search 7 May 2010	Examiner Redelsperger, C	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document				

1

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 17 9972

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-05-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008142272 A1	19-06-2008	NONE	
US 2008041994 A1	21-02-2008	US 2008041995 A1	21-02-2008
US 5328776 A	12-07-1994	NONE	
US 2009047543 A1	19-02-2009	NONE	
US 3946955 A	30-03-1976	NONE	
FR 2397232 A1	09-02-1979	AU 509363 B2	08-05-1980
		AU 3138377 A	14-06-1979
		BR 7708276 A	03-07-1979
		CA 1091207 A1	09-12-1980
		DE 2755426 A1	25-01-1979
		GB 1588249 A	23-04-1981
		JP 1129913 C	17-01-1983
		JP 54019256 A	13-02-1979
		JP 57023542 B	19-05-1982
US 273477 A		NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 9915275 A [0004]
- US 2008142272 A [0005]