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**Declarations under Rule 4.17:**

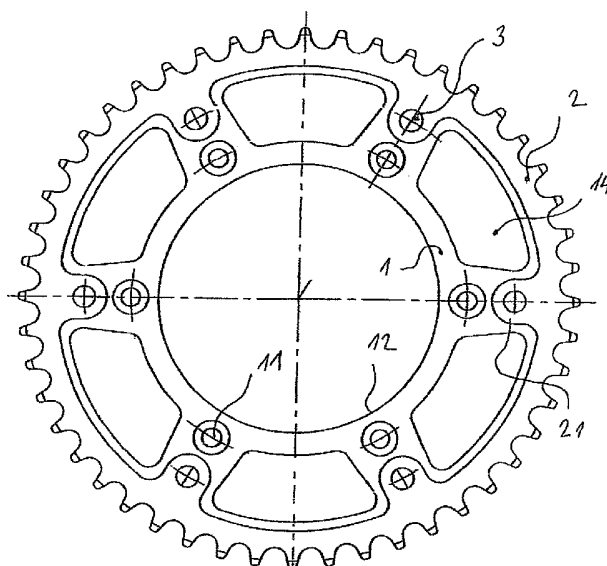
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AU, BR, BY, CA, CN, HR, ID, IN, JP, KR, LK, LT, LV, MX, NO, NZ, PL, RU, SG, SK, UA, ZA, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
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(54) Title: LIGHTWEIGHT SPROCKET



(57) Abstract: The present invention relates to lightweight sprocket, consisting of a central portion (1) made from light metal alloy, to which a peripheral toothed portion (2) made from ferrous alloy is joined, using rivets (3) for joining said portions (1,2), where said joining is created between radial beams (21) of the peripheral toothed portion (2) and pocket-like recess (13) in the central portion (1), radial beams (21) being overlapped across bottoms of pocket-like recesses (13), and where a thickness of radial beams (21), at least over the joining area, is decreased by 10 to 60%, in relation to full thickness of said toothed peripheral portion (2), and a thickness of a bottom of the pocket-like recess (13) in the central portion (1) is decreased by 20 to 70%, in relation to full thickness of the central portion (1) of the sprocket.

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

Lightweight SprocketTechnical Field

The invention relates to gears, especially to sprocket wheels, intended for outside use in power transmission of motor vehicles.

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Background Art

Outside-mounted chain power transmissions are usually used for driving wheels of cycles and motorcycles. The same type of transmission was used for driving accessories in agricultural machines or in road maintenance vehicles, or in similar machines, too, but recently hydrostatic transmissions are more frequently used here. In bicycles, chain power transmission is used for a possibility to change gears in a wide range simply by guiding a chain over different diameter sprockets. In motorcycles, chain power transmission is used for its capability for transferring a relative high torque, when a weight of such a sort of gear is relative low. When comparing with toothed gear without a chain or similar transmission member, another advantage is apparent in use of chain power transmissions, too. In such a sort of gear there is not so high need for driving and driven wheels to be fully in-line, and also the driving and the driven sprockets can slightly change their axis spacing. In a motorcycle, a weight of a driven road wheel, including a driven sprocket and other accessories, is substantive for ability of a tire to follow the road surface profile and so for having the best contact with said road surface. This is needed especially when a driving speed is high and/or the road profile is rough. This is the reason for making a rear driving wheel as lightweight as possible, especially for road going motorcycles and for off road motorcycles. And for making a lightweight rear wheel it is substantive to make a lightweight rear wheel sprocket. Usually, these sorts of lightweight sprockets are made from light alloys. Light alloy sprockets have not so hard surface, they are not so wear resistant as steel sprockets, so their life is shorter. In some areas of machinery engineering it is known to create more resistant surfaces by welding more

resistant materials over those surfaces, or by joining, for example, basic parts of cutting tools with more resistant cutting edges, blades or bits. For heavy duty gears it is known to join the teeth made from more resistant material with a central part of the gear, using bolts. But, unfortunately, those solutions are not convenient for sprockets of motorcycles. The constructions described above are too complicated from a technological point of view, and they are rather expensive, too. In the area of bicycles, it is known using sprockets which are composed of two parts – a central part and a peripheral part with teeth, both parts joined together by bolts, where a possibility of changing a peripheral part for another, having different number of teeth, or having new teeth instead of old and worn teeth, is reached this way. For sprockets in usual bicycle use it is not so substantive to have especially low weight and especially precise centring, because a driving speed of a bicycle and a rotation speed of its sprocket are relative low. In the area of motorcycles the situation is different. Here the rotation speed of sprockets is higher, so the demand for better centring of said sprockets is higher, too. The transmission of a considerably higher power and the influence of vibrations result in demand for more resistant sprocket, with lower own weight.

## Disclosure of Invention

The present invention provides a lightweight sprocket, consisting of a central portion made from light metal alloy, to which a peripheral toothed portion made from ferrous alloy is joined, using rivets for joining said portions, where said joining is created between radial beams of the peripheral toothed portion and pocket-like recess in the central portion, radial beams being overlapped across bottoms of pocket-like recesses, and where a thickness of radial beams, at least over the joining area, is decreased by 10 to 60%, in relation to full thickness of said toothed peripheral portion, and a thickness of a bottom of the pocket-like recess in the central portion is decreased by 20 to 70%, in relation to full

thickness of the central portion of the sprocket. An object of the invention is to provide an improved sprocket which is both lightweight and economical in construction and operation and which provides an increased service life for the drive system in which it is installed. Another object of the invention is to provide  
5 said sort of sprocket, where a centring of the peripheral toothed portion in relation to the central portion acts over an outer circumference of the central portion of said sprocket. The centring constructed this way is sufficiently precise. A further object of the invention is to provide said sprocket, where the rivets for joining the central portion with the peripheral toothed portion are made of titanium alloy or  
10 stainless steel alloy. So high strength and high corrosion resistance of fasteners is achieved. A still further object of the invention is to provide said sprocket, where a side clearance between the radial beams of peripheral toothed portion and side walls of pocket-like recesses of the central portion is from 0,5 to 10% of the rivet shank diameter. A yet further object of the invention is to provide said  
15 sprocket, where lightening openings are created in the central portion of the sprocket. In this case it could be advantageous to create at least a circumferential strip between said lightening openings and the outer circumference of the central portion, where the thickness of said strip, in radial direction, is at least 50% of the full thickness of said central portion. In this case it could be advantageous, too, to  
20 create a wall between the lightening openings and the pocket-like recesses of the central portion, where a height of said wall is the same as the full thickness of said central portion and a width of said wall is at least 50% of the full thickness of said central portion of the sprocket.

So the lightweight and rigid sprocket is created, with long life toothed portion  
25 and with very precise centring. Because the peripheral toothed portion has a long service life it is not substantive that there is no possibility to change said portion separately, because of its being fastened to the central portion by riveting. The whole sprocket will be changed when needed, but after a relative long time.

Substantive objects of the invention will be evident from the following  
30 detailed description when read in conjunction with the accompanying drawings. It

is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings.

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#### Brief Description of the Drawings

Fig.1 is a plan view of the central portion of the sprocket, according to the present invention.

10 Fig.2 is a cross-section view of the central portion from Fig.1.

Fig.3 is a plan view of the peripheral toothed portion of the sprocket, according to the present invention.

Fig.4 is a cross-section view of the peripheral toothed portion from Fig.3.

15 Fig.5 is a plan view of the whole lightweight sprocket, according to the present invention.

Fig.6 is a cross-section view of the sprocket from Fig.5, when both portions are joined together by rivets.

#### 20 Best Mode for Carrying out the Invention

Lightweight sprocket consists of a central portion 1 and a peripheral toothed portion 2, which are joined together by titanium rivets 3 having a rivet shank diameter 6 mm. A centring of the peripheral toothed portion 2 in relation to the central portion 1 is provided over an outer circumference of the central portion 1, and a centring of the central portion 1, and this way a centring of the whole sprocket, in relation to a driving wheel of the motorcycle, acts over a centring opening 12, where as fastening members bolts are used, going through fastening openings 11 in the central portion 1. A thickness of both the central portion 1 and the peripheral toothed portion 2 is 6 mm, and both beams 21 of the peripheral

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toothed portion 2 and the central portion 1 in the area of pocket-like recess 13 have, over the joining area between said central portion 1 and the peripheral toothed portion 2, their thickness decreased to 50% of their full thickness. This joining is provided as an overlapped joining, where for said joining peripheral openings 211 are arranged in radial beams 21 of the peripheral toothed portion 2, and central openings 131 are arranged in the central portion 1, in the area of pocket-like recesses 13. The peripheral toothed portion 2 is created here with radial beams 21, the thickness of which is decreased, in the described manner, by 50%, all over their surface. Central portion 1 is created here with pocket-like recesses 13, a circumferential walls of which having a width of 4 mm, in circumferential direction, the direction related to the whole sprocket. The circumferential clearance between the circumferential wall of the pocket-like recess 13 and the side wall of the radial beam 21 is 0,4mm. This clearance decreases when the rivets 3 are clinched and the radial beams 21 are slightly spread out by pushing a head of the rivet 3 against a surface of the radial beam 21 and by upsetting the shank of the rivet 3, so that, finally, said clearance disappears partly or completely. Big shaped lightening openings 14 are created in the central portion 1, where a circumferential strip rests along the outer circumference of the central portion 1, which strip has a width of 4 mm and goes around the central portion 1 of the sprocket, in places along the lightening openings 14. Said shaped lightening openings 14 could be created also as a plurality of smaller circular holes, for example, but always it is advantageous to keep a minimal distance from said openings 14 to the outer circumference of the central portion 1 and to the side walls of pocket-like recesses 13, at the rate of 50% of the full thickness of the central portion 1. Then a rigidity and a shape stability of the central portion 1 will be still sufficient. For a similar reason it is recommended to keep the depth of pocket-like recesses 13 so that the thickness reduction here is at least 20% of the full thickness of the central portion 1. In case of lower thickness reduction over said area there appears a danger of too high pressure between side walls of pocket-like recesses 13 and a lateral part of the

radial beams 21 of the peripheral toothed portion 2, when high power is transmitted to said lightweight sprocket, which is a part of a motorcycle rear wheel. So this lightweight sprocket works like a part of a transmission system of a motorcycle, where as a transmission member a roller chain is used.

5        This sort of sprockets were produced and then the tests were done, while mounting said sprockets on plurality of high powered cross-type motorcycles. The results show the same service life of the sprockets according to the present invention as the life of usual sprockets made completely of the ferrous alloy. No damages or deformations were apparent both on a joining of the peripheral  
10      toothed portion 2 with the central portion 1 of the sprocket and on other parts or portions of all the sprockets tested.

#### Industrial Applicability

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      The lightweight sprocket according the present invention is applicable above all for use in high performance motorcycles, as sprocket for rear driven wheel of this sort of motorcycle. Another possibilities of use appear in machines or transmissions, where lightweight sprocket with ability of precise centring and long  
20      life service is needed.

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Claims

1. Lightweight sprocket, characterized in, that the sprocket consists of a central portion (1) made from light metal alloy, to which a peripheral toothed portion (2) made from ferrous alloy is joined, using rivets (3) for joining said portions (1,2), where said joining is created between radial beams (21) of the peripheral toothed portion (2) and pocket-like recess (13) in the central portion (1), radial beams (21) being overlapped across bottoms of pocket-like recesses (13), and where a thickness of radial beams (21), at least over the joining area, is decreased by 10 to 60%, in relation to full thickness of said toothed peripheral portion (2), and a thickness of a bottom of the pocket-like recess (13) in the central portion (1) is decreased by 20 to 70%, in relation to full thickness of the central portion (1) of the sprocket.
2. Lightweight sprocket, according to claim 1, characterized in, that a centring of the peripheral toothed portion (2) in relation to the central portion (1) acts over an outer circumference of the central portion (1) of said sprocket.
3. Lightweight sprocket, according to claims 1 and 2, characterized in, that rivets (3) for joining the central portion (1) with the peripheral toothed portion (2) are made of titanium alloy or stainless steel alloy.
4. Lightweight sprocket, according to claims 1 to 3, characterized in, that a side clearance between the radial beams (21) of the peripheral toothed portion (2) and side walls of the pocket-like recesses (13) of the central portion (1) is from 0,5 to 10% of the rivet (3) shank diameter.
5. Lightweight sprocket, according to claims 1 to 4, characterized in, that lightening openings (14) are created in the central portion (1) of the sprocket.

6. Lightweight sprocket, according to claim 5, characterized in, that at least a circumferential strip is created between said lightening openings (14) and the outer circumference of the central portion (1), where the thickness of said strip, in radial direction, is at least 50% of the full thickness of said central portion (1).

7. Lightweight sprocket, according to claims 5 and 6, characterized in, that a wall is created between the lightening openings (14) and the pocket-like recesses (13) of the central portion (1), where a height of said wall is the same as the full thickness of said central portion (1) and a width of said wall is at least 50% of the full thickness of said central portion (1) of the sprocket.

Fig. 1

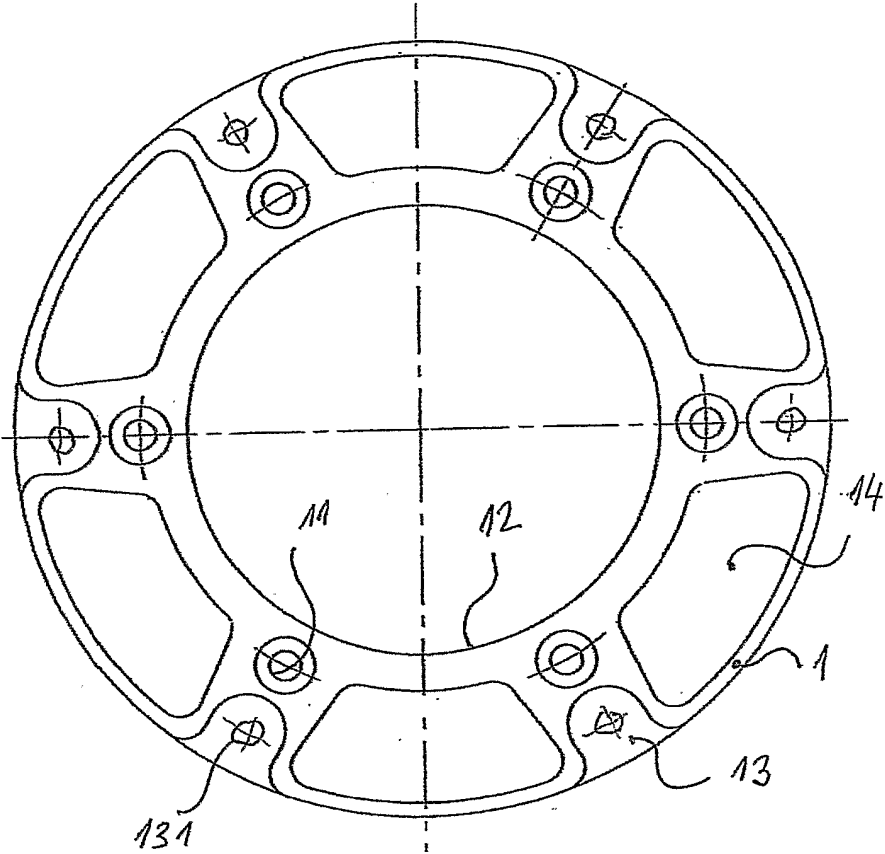


Fig. 2

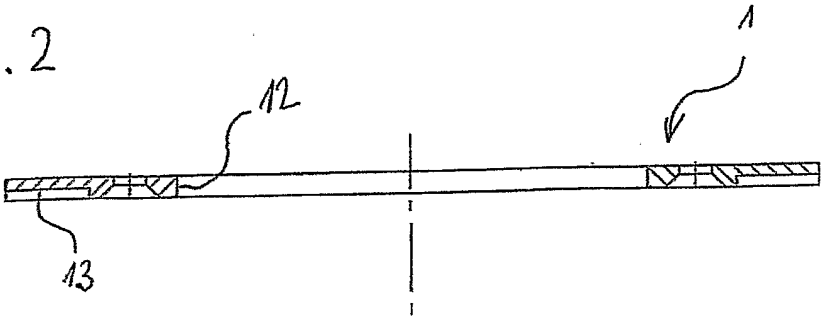


Fig. 3

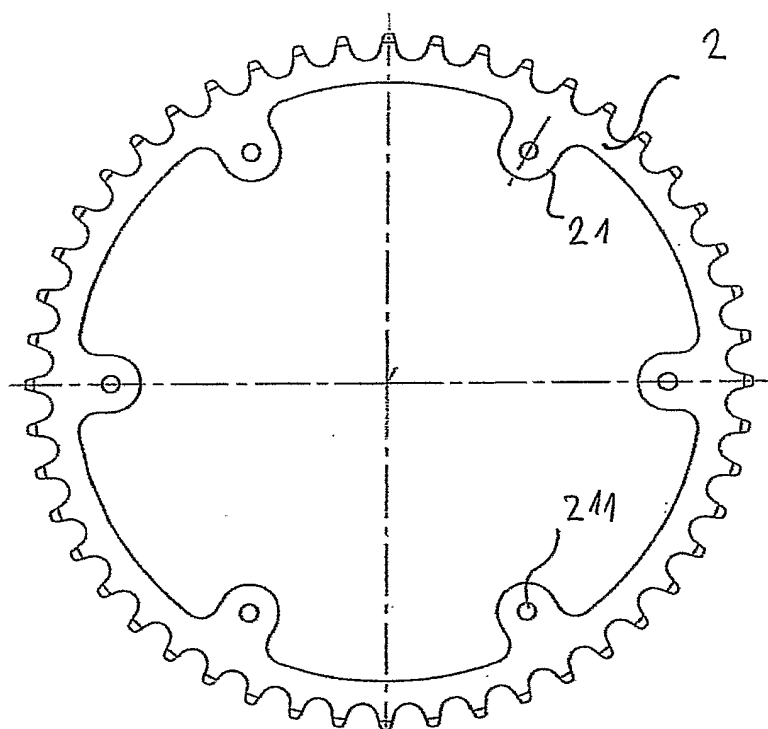


Fig 4

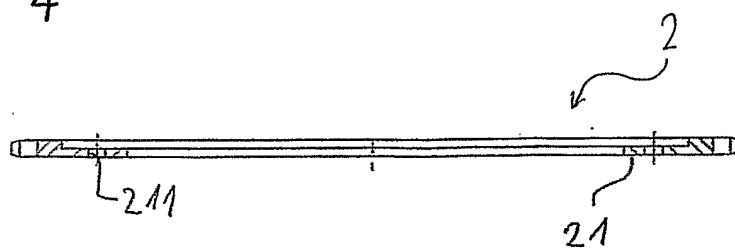


Fig. 5

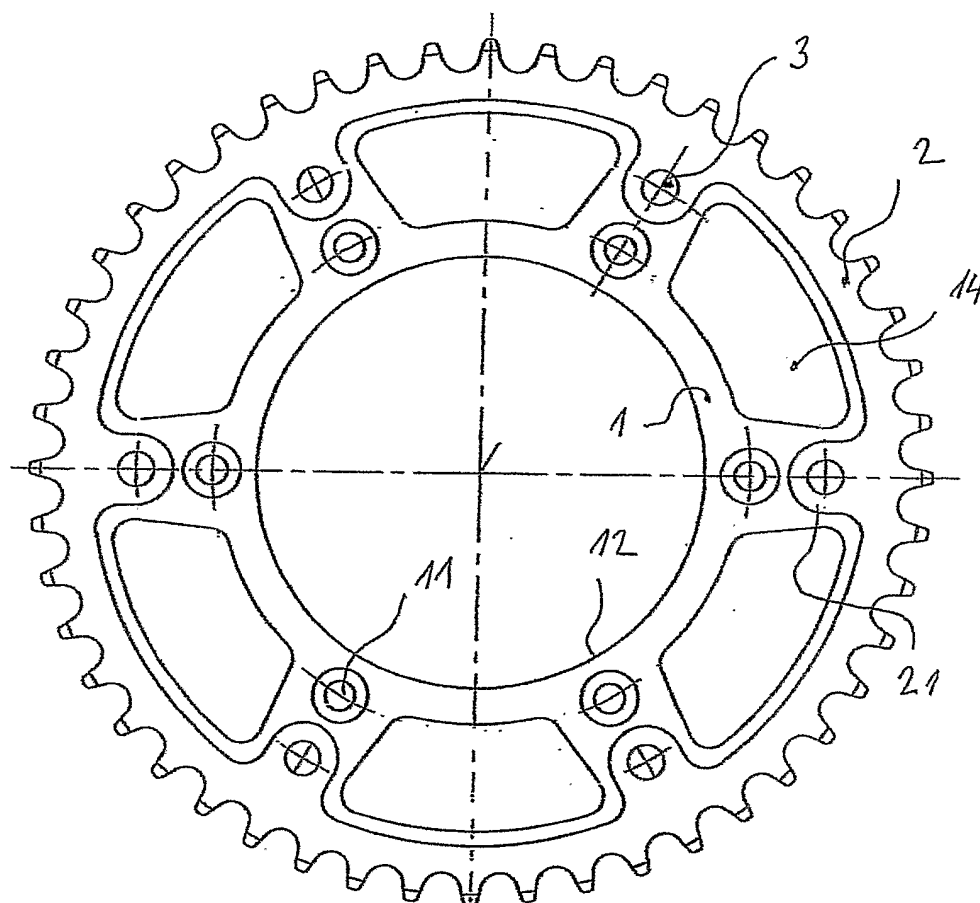
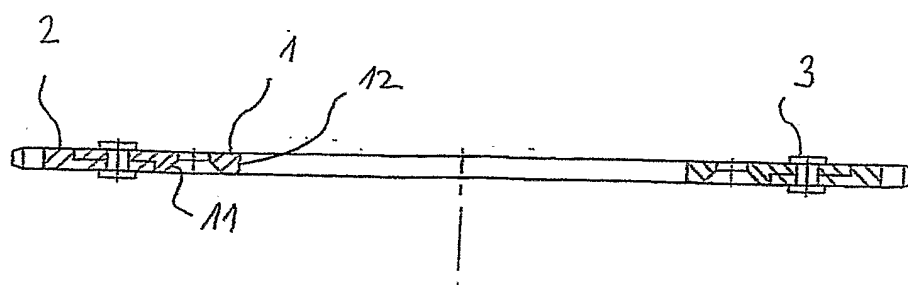


Fig. 6



# INTERNATIONAL SEARCH REPORT

|                 |            |
|-----------------|------------|
| Internal        | ication No |
| PCT/CZ 03/00048 |            |

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 F16H55/06

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 7 F16H

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

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

EPO-Internal, WPI Data, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category * | Citation of document, with indication, where appropriate, of the relevant passages                                                           | Relevant to claim No. |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A          | DE 892 561 C (NAVET GEORGES)<br>8 October 1953 (1953-10-08)<br>page 2, line 53 - line 78<br>page 3, line 39 - line 70<br>figures 9,10<br>--- | 1-7                   |
| A          | US 6 024 662 A (FUJIMOTO TADAO)<br>15 February 2000 (2000-02-15)<br>column 4, line 54 - line 62<br>figure 3<br>---                           | 1-7                   |
| A          | US 1 378 156 A (RALPH WATTS JAMES)<br>17 May 1921 (1921-05-17)<br>figures 1-3<br>---<br>-/-                                                  | 1-7                   |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents :

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- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*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

24 November 2003

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication, where appropriate, of the relevant passages                                                                                   | Relevant to claim No. |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A          | <p>DE 30 01 782 A (FMC CORP)<br/> 24 July 1980 (1980-07-24)<br/> page 6, paragraph 2<br/> page 8, paragraph 2 -page 9, paragraph 1<br/> figures 4-7</p> <p>-----</p> | 1-7                   |

# INTERNATIONAL SEARCH REPORT

Intern: cation No  
PCT/CZ 03/00048

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
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