

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) Publication number:

**0 438 599 A1**

(12)

**EUROPEAN PATENT APPLICATION**  
published in accordance with Art.  
158(3) EPC

(21) Application number: **90911712.9**

(51) Int. Cl.<sup>5</sup>: **B05B 1/08, F15C 1/22**

(22) Date of filing: **03.08.90**

(86) International application number:  
**PCT/JP90/00994**

(87) International publication number:  
**WO 91/02594 (07.03.91 91/06)**

(30) Priority: **15.08.89 JP 209615/89**

(43) Date of publication of application:  
**31.07.91 Bulletin 91/31**

(84) Designated Contracting States:  
**DE DK FR GB**

(71) Applicant: **CREO-UNI CO., LTD.**  
**4-26 Shinmachi 1-chome Nishi-Ku**  
**Osaka-shi, Osaka 550(JP)**

(72) Inventor: **NAKAYAMA, Yasuki**  
**56-2, Higashiohizumi 3-chome Nerima-ku**  
**Tokyo 178(JP)**  
Inventor: **OHKUBO, Masakane**  
**4-26, Shinmachi 1-chome Nishi-ku**  
**Osaka-shi Osaka 550(JP)**

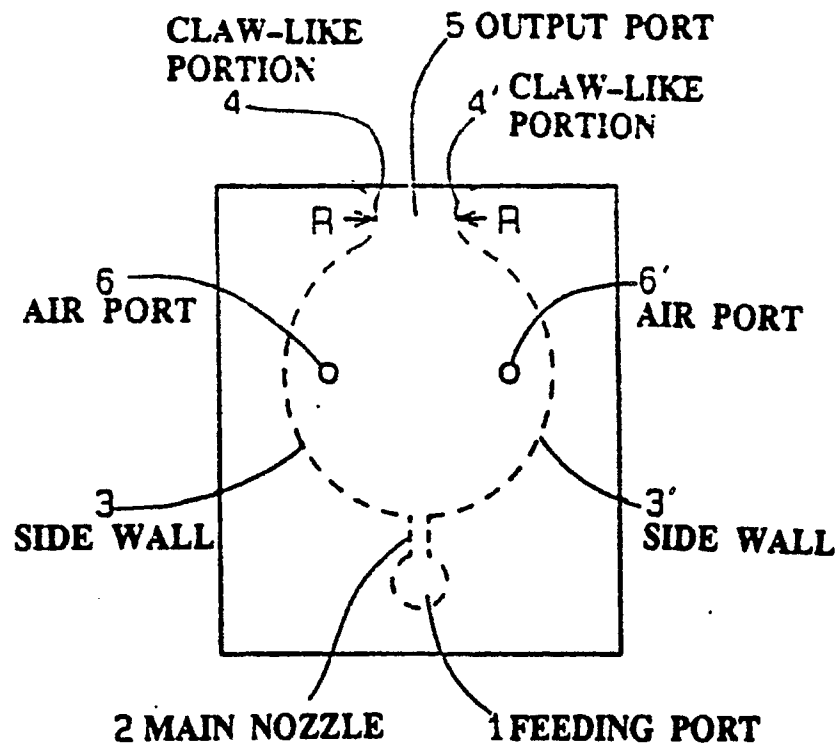
(74) Representative: **Patentanwälte Grünecker,**  
**Kinkeldey, Stockmair & Partner**  
**Maximilianstrasse 58**  
**W-8000 München 22(DE)**

(54) **NOZZLE FOR JETTING SELF-VIBRATORY FLUID STREAM EXHIBITING HIGH CLEANING EFFICIENCY BY VARYING THE SHAPE OF OUTPUT PORT.**

(57) A nozzle for jetting self-vibratory fluid stream, which comprises a main nozzle for forming a jet stream, side walls for producing eddies on the right and left sides of the jet stream while preventing the stream from sticking thereto, and claw-like portions contiguous to the side walls for dividing and dispersing the jet stream, so as to adapt the jet stream to curve to cause self-vibration by means of alternately generated eddies in the right of left space between the side wall and the jet stream and pressure difference caused by absorptive effect arising from wake, and to disperse the jet stream with the claw-like portions for spraying the fluid around widely, is very useful as a jet nozzle for the water spraying device and cleaning machine, Recognizing the importance of the claw-like portions at the outlet port of the self-vibratory fluid stream jetting nozzle as above, this invention provides a self-vibratory stream jetting nozzle usable for a long term, in which the claw-like portion is rounded or provided with a straight linear part rounded at the end thereof or the cross-section of the output port is curved inwardly so that flowing efficiency is raised with flowing loss reduced and variation in characteristics resulting from wear of the claw-like portion may be prevented.

**EP 0 438 599 A1**

**FIG.2**



## TECHNICAL FIELD

This invention relates to a nozzle for jetting a self-vibratory fluid stream, and more particularly to a nozzle for jetting without moving parts a self-vibratory fluid stream, provided with a rounded portion or a straight linear part rounded at an output port or provided with a output port with an inwardly curved cross-section so that flowing efficiency is raised.

5

## BACKGROUND ART

Conventional water spraying devices (including a jetting nozzle), include a device such as a watering can with a system for directly jetting water through a plurality of pores and a device such as a sprinkler or the like for spraying water with a system mechanically moving a jetting nozzle. Moreover, a water spraying device disclosed in Japanese Patent Publication No. 49-1916 and Japanese Patent Publication No. 50-6644 etc., has a system comprising a main nozzle for forming a jet stream in a jetting nozzle, side walls for producing eddies on the right and left sides of the jet stream, and claw-like portions contiguous to the side walls for dividing and dispersing the jet stream, so as to induce the jet stream to curve to create self-vibration by means of the difference in the right and left eddies generated between the side walls and the jet stream, and to disperse the jet stream with the claw-like portions for spraying the fluid over a wide range.

Of these conventional water spraying devices, the device such as a watering can with the system for directly jetting water through a plurality of pores, exhibits some defects that the pores are inclined to become plugged with dust and the trajectory of the jet stream is short because of a large flowing resistance or the like. In addition, the device such as a sprinkler with the system mechanically moving a jetting nozzle, shows some defects that mechanically moving parts are damaged and production costs are high because of the complicated structure or the like. Further, the water spraying device with a self-vibration system disclosed in Japanese Patent Publication No. 49-1916 and Japanese Patent Publication No. 50-6644 etc., exhibits some defects that an energy loss is largely produced by the impingement of the jet stream against the claw-like portions of the output port and the characteristics of the claw-like portion changed by wear or the like.

An object of the invention is to provide a jetting nozzle which can stably produce a high-frequency self-vibration by a jet stream from a main nozzle, and in which flowing loss is small and variation in characteristics resulting from wear is small.

## DISCLOSURE OF INVENTION

A first invention of a self-vibratory fluid stream jetting nozzle according to the present invention is characterized in that a output port is provided with a claw-like portion rounded or provided with a straight linear part rounded so that flowing efficiency is raised with flowing loss reduced and variation in characteristics resulting from wear is prevented, and regarding a second invention, is characterized in that a cross-section of a output port is curved inwardly so that flowing efficiency is raised with flowing loss reduced and variation in characteristics resulting from wear is prevented in the same way as in the first invention. Here, characteristics are defined as the angle of the water spraying, the distribution of water spraying and the flowing characteristics or the like.

Thus, the self-vibratory stream jetting nozzle is a output port provided with a claw-like portion rounded or provided with a straight linear part rounded at the end thereof so that exfoliation and contraction are restrained, flowing loss is reduced and adhesive action is increased to increase the angle of water spraying, as compared with the output port of the conventional self-vibratory stream jetting nozzle having an acute claw-like portion and a straight linear part contiguous thereto. Moreover, a stable vibration can continue over a long period because variations resulting from wear are prevented.

In addition, the self-vibratory stream jetting nozzle is provided with a output port having a portions ranging from a claw-like portion to a straight linear part curved inwardly in the cross-section thereof so that the flowing loss can also be similarly reduced to increase the volume of flow. Furthermore, the two systems above are combined to provide an output port with claw-like portions rounded or provided with straight linear parts rounded and curved inwardly in cross-section so that the above effects are intensified.

## BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is an exploded perspective view of an embodiment of the first invention according to a self-vibratory fluid stream jetting nozzle of the present invention, Fig. 2 is a front view of the assembled nozzle, Fig. 3 is an exploded perspective view of another embodiment of the first invention, Fig. 4 is a front view of the assembled nozzle, Fig. 5 (a), (b) are an assembled view and a sectional view taken along the line b-b' of the second invention.

#### BEST MODE FOR CARRYING OUT THE INVENTION

In order to describe the present invention in more detail, the embodiment will be described hereunder with reference to the accompanying drawings.

Fig. 1 is an exploded perspective view of an embodiment of the first invention, Fig. 2 is a front view of the assembled self-vibratory fluid stream jetting nozzle.

The device comprising, in combination; a plate C having a feeding port 1; a plate B comprising a main nozzle 2 for forming a jet stream connected to the feeding port 1, an air chamber defined by right and left walls 3, 3' and connected with the main nozzle 2, an output port 5 provided with right and left claw-like portions 4, 4' rounded on a radius R and leading to the walls 3, 3'; and a plate A with air ports 6, 6'.

In addition, Fig. 3 is an exploded perspective view of another embodiment of the first invention, Fig. 4 is a front view of the assembled nozzle, wherein right and left claw-like portions 4, 4' are rounded on a radius R and straight linear parts 7, 7' respectively lead to the claw-like portions 4, 4', and end parts leading to the straight linear parts 7, 7' are respectively rounded on a radius R.

The self-vibratory action of these self-vibratory fluid stream jetting nozzles is similar to that of the devices disclosed in Japanese Patent Publication No. 49-1916 etc., and the output port 5 is a little wider than the spreading width of the jet stream and fluid provided from the feeding port 1 becomes a jet stream through the main nozzle 2 and an eddy is generated between the jet stream and the wall 3 or 3' contacting the jet stream. Air between the jet stream and the wall on the opposite side is removed by the jet stream to produce a pressure difference between the right and left sides of the jet stream so that the jet stream is resultingly bent to the right or left. By repeating this action, a stable self-vibration is continued. In this case, the claw-like portions 4, 4' are not acute, but rounded on a radius R so that flowing efficiency is raised with flowing loss reduced. In addition, when the claw-like portions are acute, the characteristics as the spray angle, the distribution of the water spraying and the flowing characteristics or the like are largely changed resulting from wear, but when the claw-like portions are initially rounded, the claw-like portions do not appreciably change from wear, therefore these characteristics are not significantly changed.

Fig. 5(a) is an assembled view of an embodiment of the second invention, and Fig. 5(b) is a sectional view taken along line b-b' in Fig. 5(a). In this invention, the cross-sections of the portions from the claw-like portions 4, 4' to the straight liner parts 7, 7' at the outside thereof in the output port 5 are curved inwardly. In this case, the flowing efficiency is raised with flowing loss reduced and characteristics are not changed from wear.

Moreover, the first invention and the second invention may be combined to provide claw-like portions rounded and curved inwardly in cross-section so that these effects are even more outstanding.

Next, the results of an experiment comparing the conventional self-vibratory fluid stream jetting nozzle disclosed in Japanese Patent Publication No. 49-1916 etc. and the self-vibratory fluid stream jetting nozzle of the present invention are shown.

Table I Results of experiment

|     | L L  | L ma | C    | R ma | R R  |
|-----|------|------|------|------|------|
| I   | 0.35 | 0.62 | 0.62 | 0.66 | 0.39 |
|     | 0.39 | 0.66 | 0.64 | 0.68 | 0.45 |
| II  | 0.43 | 0.77 | 0.79 | 0.82 | 0.46 |
|     | 0.44 | 0.83 | 0.92 | 0.84 | 0.48 |
| III | 0.60 | 0.66 | 0.76 | 0.76 | 0.65 |
|     | 0.60 | 0.71 | 0.82 | 0.78 | 0.67 |

Notes 1. the units in the table is Kgf/cm<sup>2</sup>

2. the supply pressure is 2.0 Kgf/cm<sup>2</sup>

3. the figures give the averages of the upper 5 ranks

The values in ( ) are maximum values

#### INDUSTRIAL APPLICABILITY

As described previously, the self-vibratory fluid stream jetting nozzle of the present invention achieves the following effects by providing the output port of the self-vibratory fluid stream jetting nozzle with the claw-like portions rounded or straight linear parts rounded at the end thereof and the output port curved inwardly in cross-section.

(1) Flowing efficiency is raised with flowing loss reduced.

(2) Variations in characteristics of the spray angle, the distribution of the water spraying and the characteristics of flowing or the like resulting from wear are prevented.

(3) When the claw-like portions are rounded and the cross-section of the output port is curved inwardly, the effects are even more pronounced.

Consequently, when these self-vibratory fluid stream jetting nozzles are applied to a water spraying device and a jetting cleaning machine, the washing ability or the like is even more increased.

#### Claims

1. A nozzle for jetting self-vibratory fluid stream, comprising spaces defined at the right and the left of a main jet stream from a main nozzle, and of an output port wider than a spreading width of the jet stream, so as to cause self-vibration by means of alternately generated eddies in the right or left space and pressure difference caused by the absorptive effect arising from the wake,

characterized in that the output port is provided with a rounded portion or a straight linear part rounded at the end thereof so as to reduce flowing loss in the jet stream to raise flowing efficiency and to prevent variation in characteristics resulting from wear.

2. A nozzle for jetting self-vibratory fluid stream, comprising spaces defined at the right and the left of a main jet stream from a main nozzle, and an output port wider than a spreading width of the jet stream, so as to cause self-vibration by means of alternately generated eddies in the right or left space and pressure difference caused by the absorptive effect arising from the wake,

characterized in that the output port curves inwardly in cross-section so as to reduce flowing loss in the jet stream to raise flowing efficiency and to prevent variation in characteristics resulting from wear.

FIG.1

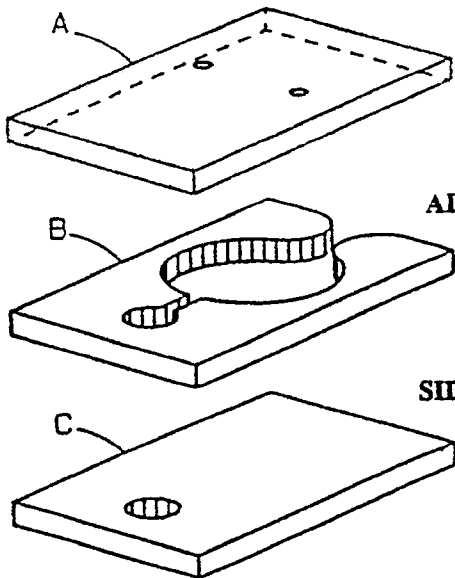


FIG.2

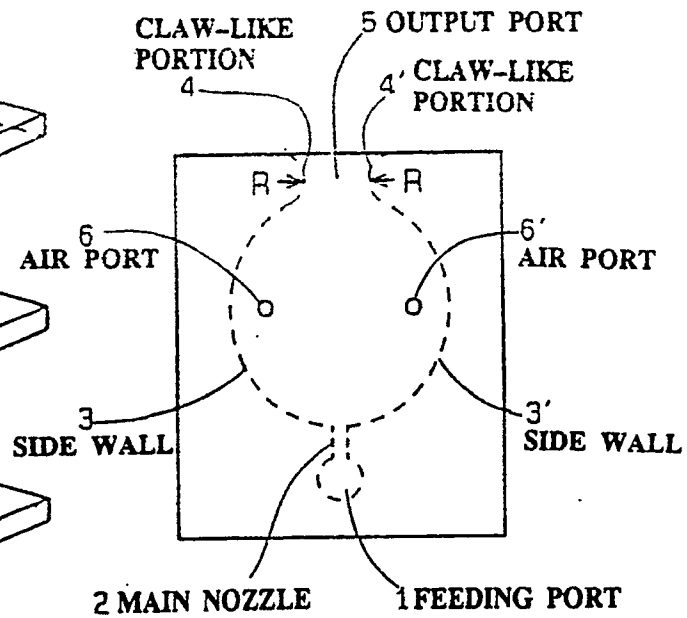


FIG.3

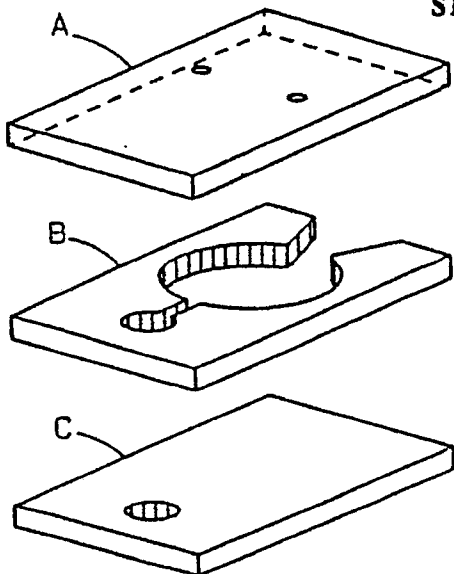
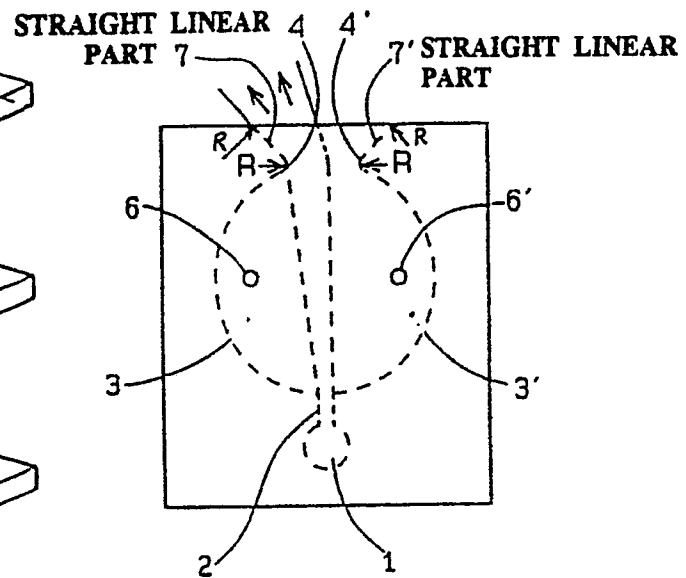


FIG.4



**FIG.5**

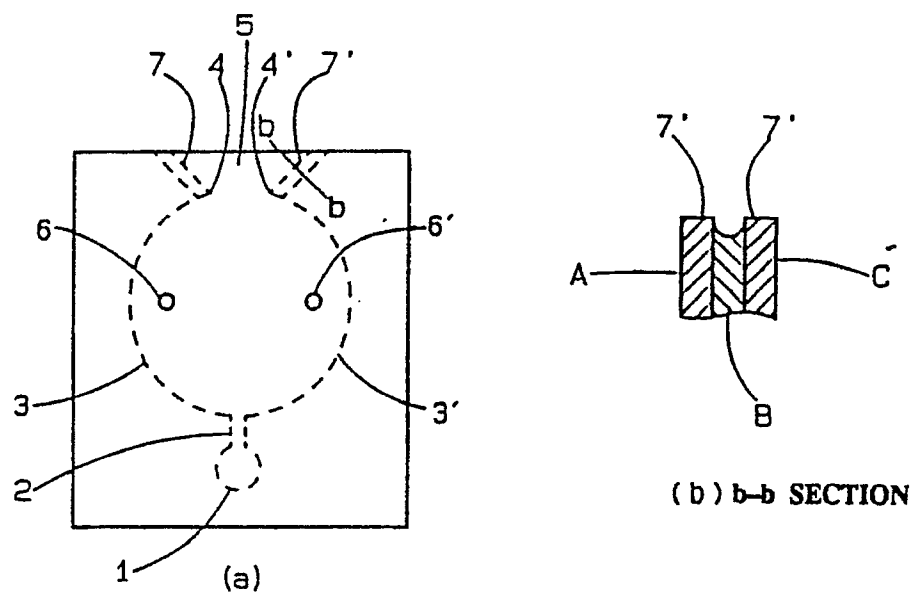
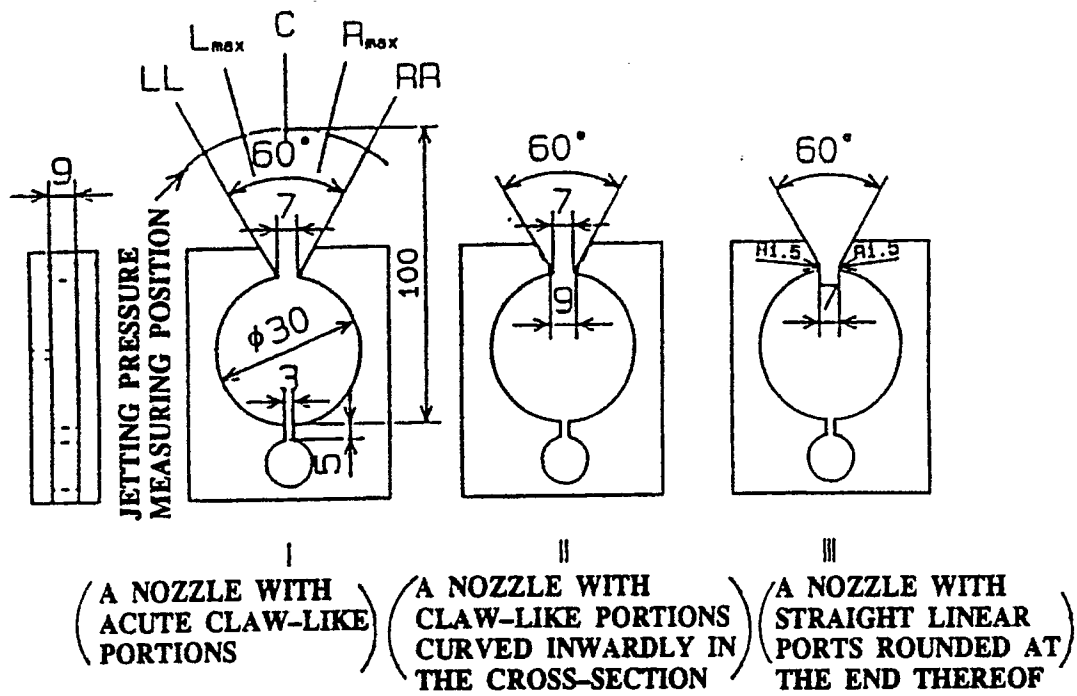


FIG.6





# INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/00994

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                      |                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>4</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                      |                                                     |
| According to International Patent Classification (IPC) or to both National Classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                      |                                                     |
| Int. Cl <sup>5</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | B05B1/08, F15C1/22                                                                                                                                   |                                                     |
| <b>II. FIELDS SEARCHED</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                      |                                                     |
| Minimum Documentation Searched <sup>7</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                      |                                                     |
| Classification System                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Classification Symbols                                                                                                                               |                                                     |
| IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | B05B1/08, 1/04, 1/02, 1/34, F15C1/22, 1/08                                                                                                           |                                                     |
| Documentation Searched other than Minimum Documentation<br>to the extent that such Documents are included in the Fields Searched <sup>8</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                      |                                                     |
| <div style="display: flex; justify-content: space-between;"> <span>Jitsuyo Shinan Koho</span> <span>1972 - 1990</span> </div> <div style="display: flex; justify-content: space-between;"> <span>Kokai Jitsuyo Shinan Koho</span> <span>1973 - 1990</span> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                      |                                                     |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                      |                                                     |
| Category <sup>6</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>                                       | Relevant to Claim No. <sup>13</sup>                 |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | JP, A, 61-35866 (Nihon Jidosha Buhin Sogo Kenkyusho K.K.),<br>20 February 1986 (20. 02. 86),<br>Claim and Figs. 1 to 10<br>& US, A, 4721251          | 1 - 2                                               |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | JP, A, 63-172006 (Matsushita Electric Ind. Co., Ltd.),<br>15 July 1988 (15. 07. 88),<br>Claim and Figs. 1 to 5<br>(Family: none)                     | 1 - 2                                               |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | JP, Y2, 56-21471 (Sumitomo Bakelite Co., Ltd.),<br>21 May 1981 (21. 05. 81),<br>Line 9, left column to line 1, left column,<br>page 2 (Family: none) | 1 - 2                                               |
| <div style="display: flex;"> <div style="width: 50%;"> <p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 50%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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</p> <p>"&amp;" document member of the same patent family</p> </div> </div> |                                                                                                                                                      |                                                     |
| <b>IV. CERTIFICATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                      |                                                     |
| Date of the Actual Completion of the International Search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                      | Date of Mailing of this International Search Report |
| September 13, 1990 (13. 09. 90)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                      | September 25, 1990 (25. 09. 90)                     |
| International Searching Authority                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                      | Signature of Authorized Officer                     |
| Japanese Patent Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                      |                                                     |