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(71) Applicant: **Fire And Rescue Innovation Finland Frif Oy**
**77600 Suonenjoki (FI)**

(72) Inventor: **Hassinen, Marko**
**77600 Suonenjoki (FI)**

(74) Representative: **Wilenius, Jami Juhani**
**Patenttitoimisto Wilenius Oy**
**Eteläranta 21**
**70820 Kuopio (FI)**

## (54) DIRECTABLE PENETRATING NOZZLE FOR EXTINGUISHING FIRES

(57) Penetrating nozzle (10) for extinguishing a burning object. The penetrating nozzle comprises coupler (1) for extinguishing agent adapted to be connected to the source of extinguishing agent, pipe section (5), and nozzle head (7) at the end of pipe section (5), thereby forming a flow channel for the extinguishing agent from coupler (1) for extinguishing agent to nozzle head (7). Penetrating nozzle further comprises control device (6), which can be used to turn nozzle head (7) with respect to the longitudinal axis of pipe section (5).

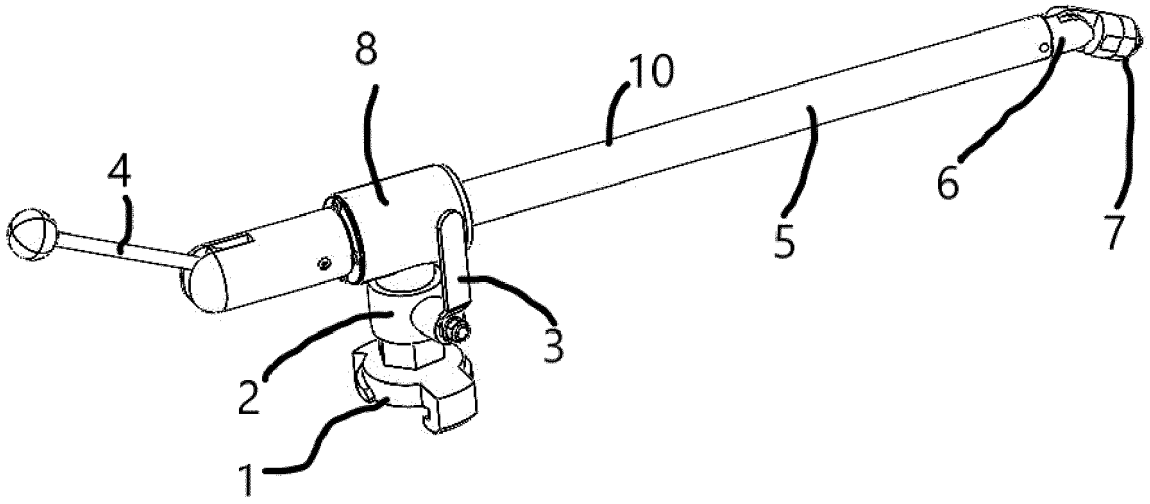


Fig. 1

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## Description

### Field of invention

**[0001]** The invention relates to extinguishing and cooling of flue gases in an apartment fire, more commonly a fire in a closed space or in another burning object.

### Background of the invention

**[0002]** Fires in a closed space have traditionally been extinguished by employing an aggressive technique of smoke diving inside the space. This is a risky and physically very stressful way to extinguish a fire and requires the fire fighters to have a high level of physical fitness. Occasionally a significant number of the rescue personnel arriving at the scene of a fire do not meet the criteria for smoke diving ability, and therefore extinguishing to be done from the inside cannot be undertaken and other alternatives must be used. Smoke diving also exposes the participating personnel to carcinogens.

**[0003]** Most apartment fires or those more generally in closed spaces are what is called oxygen-limited fires, i. e. the intensity of combustion is limited by the oxygen necessary for combustion, more generally by the supply of air. This is a big advantage in extinguishing, as combustion is more restrained. In a traditional method, the door of the room needs to be opened upon entry, whereby the fire receives plenty of air and burning is accelerated. When extinguishing using a penetrating nozzle, only a small opening is needed, whereby the fire will not get more air due to extinguishing process.

### Purpose of the invention

**[0004]** The need for, and associated exposure to smoke diving can be reduced by a practice of extinguishing the fire from outside a building or a burning compartment, using a penetrating nozzle. A penetrating nozzle can be introduced to a burning space without a need for personnel to enter the space.

**[0005]** Penetrating nozzles have been used throughout the ages, among other things, for extinguishing and limiting a fire under a roof. Larger and longer pipes have been used among other things for extinguishing wood chip stacks and peat windrows. Smaller pipes have also been used for extinguishing apartment fires, where for example a hole is bored for the pipe in the window frame. The drawback of this model is that the spraying water only wets a fairly small proportion of the room's surfaces. The now presented penetrating nozzle is essentially different from the ones mentioned above in that a rotating component is placed at the end of the pipe, whereby the water can be directed to the desired part of the room. In this way the surfaces of the entire room can be wetted and extinguished by turning the tip and rotating the pipe.

### Brief description of the invention

**[0006]** The penetrating nozzle according to an embodiment of the invention is based on the fact that at the end of an arm rotating around its axis, a turning nozzle head is constructed which produces a spray of water suitable for extinguishing a fire in an enclosed space, and the direction of the spray can be controlled. By means of directing the spray of extinguishing agent in the room space, it can be applied in the upper part of the room, effectively cooling the fire gases, so that the extinguishing agent also evaporates effectively. The spray of extinguishing agent can also be directed by rotating the pipe section, and the penetrating nozzle can be guided into the burning space through a small opening as well. The required opening is so small that it can be effectively bored, for example in a window frame or through a wall using conventional, preferably battery-operated tools.

### List of Figures

**[0007]** The invention will now be described in more detail in the form of preferred embodiments, with reference to the accompanying drawings, of which:

Figure 1 shows a penetrating nozzle according to one embodiment; and
Figure 2 shows details of a penetrating nozzle according to one embodiment

### Detailed description of the invention

**[0008]** The apparatus according to embodiments of the invention can be commonly used, for example, with various types of fire-fighting equipment, such as pumps and hoses. The use of the apparatus is not limited to be associated with any particular type of extinguishing system or structure, nor, for example to any particular type of extinguishing agent. Types of extinguishing agents used in connection with the apparatus can be for example liquid extinguishing agents such as water, as well as powdered and/or foam type extinguishing agents. Figures 1 and 2 show a penetrating nozzle (10) according to one embodiment. Only elements essential for understanding the invention are shown in the Figures. It should be noted that, for example, the quantity of various elements may vary and differ from those shown in a Figure. A penetrating nozzle similar to the examples in Figures 1 and 2, or one with similar functionality, can be implemented as a separate apparatus or can at least partially or fully be a part of a fire-fighting system. An extinguishing system may also comprise several penetrating nozzles (10) according to different applications.

**[0009]** In the example of Figure 1, the penetrating nozzle comprises coupler (1) for extinguishing agent, flow adjusting device (2) needed for the adjustment of flow including its activating device (3), pipe section (5) containing the flow path for the extinguishing agent, control

device (6), which may for example be a joint, and nozzle head (7) performing the actual application of the extinguishing agent.

**[0010]** Flow adjusting device (2) can preferably be for example a ball valve, but other types of valves and control devices can also be used. Activating device (3), associated with the flow adjusting device, can be used to adjust the flow of the extinguishing agent going through the adjusting device. Activating device (3) can be, for example, a manually operated lever or an electric motor.

**[0011]** The penetrating nozzle of Figure 1 has been revised to extinguish fire in an enclosed space, but can be preferably revised for other extinguishing purposes, for example by changing the length and/or diameter of pipe section (5). When using the apparatus for extinguishing fire in a closed space, a hole must first be made in the wall of the closed space through which nozzle head (7) of the penetrating nozzle can be pushed to the closed space. Preferably, the diameter of pipe section (5), control device (6) and nozzle head (7) is no larger than 30 mm, 35 mm, 40 mm or 50 mm. Preferably, nozzle head (7), control device (6) and at least part of pipe section (5) have been adapted to fit through a hole of circular cross section with a maximum diameter of 30 mm, 35 mm, 40 mm or 50 mm. Preferably, the diameter of nozzle head (7) is at most equal to the diameter of pipe section (5). Preferably, nozzle head (7) and control device (6) have a diameter no larger than the diameter of pipe section (5). In one embodiment, nozzle head (7) and control device (6) are rotatable to a position where the nozzle head and the control device are parallel to the longitudinal axis of the pipe section, and both the nozzle head and the control device each have a diameter no larger than the diameter of the pipe section.

**[0012]** The length of the pipe section is preferably at least 500 mm, 700 mm or 1000 mm. The pipe section must be large enough to allow a sufficient flow of extinguishing agent through it. On the other hand, the pipe section must be thin enough to allow a hole to be made in the wall of the closed space within a reasonable time through which nozzle head (7) can be pushed into the closed space. Preferably, the diameter of the nozzle head and the control device, as well as the pipe section, is in the range of 30 - 50 mm. The pipe section is preferably circular in cross-section, or substantially circular. Substantially circular in this context means a circular cross section, which may have small deviations for functional reasons. In one embodiment, pipe section (5) has a circular cross-section for at least 50% of the length. In one embodiment, pipe section (5) is circular in cross-section for at least 50% of its length, and the deviations from circular shape between the middle of the pipe section and the end of the pipe section towards control device (6) are towards the longitudinal axis of the pipe section. The cross section of the pipe section in this context means the outermost surface of the cross section, perpendicular to the longitudinal axis of the pipe section. The diameters of the control device and the nozzle head should preferably be no larger than the diameter of the pipe section.

**[0013]** Control device (6) is controlled by activating device (4), which can be a lever, for example. Activating device can also be, for example, an electric motor and it can be controlled via a wireless remote connection, or it can operate independently. Control device (6) controls the position of nozzle head (7). The activating device and the control device are functionally linked and located at opposite ends of the pipe section. Preferably a wire rope, chain or other coupler of force runs between the control device and the activating device by which the movement of the activating device of the control device is communicated for the movement of the nozzle head. Said wire rope, chain or equivalent preferably runs inside the pipe section, in the same space as the fire extinguishing agent, thereby avoiding problems caused by heat. Preferably, the movement of the activating device is communicated 1:1 for the movement of the nozzle head by means of a control device, whereby as the activating device is turned by a certain angle, the nozzle head turns the same angle. In one preferred embodiment, nozzle head (7) and activating device (4) of control device (6) have been arranged to be parallel in all positions. The nozzle head is then parallel to the pipe section whenever the activating device is also parallel to the pipe section. Similarly, when the end of activating device is turned upwards from this position for example by 60°, the end of nozzle head turns downwards by 60°, whereby the activating device and the nozzle head stay parallel. It is then easy to manage the flow of extinguishing agent coming from the nozzle head to the desired direction even if there was no line of sight into the closed space. An additional benefit is the simplicity of the solution, which makes it reliable and easy to manufacture.

**[0014]** The extinguishing agent, fed under pressure into coupler (1) of extinguishing agent, passes through flow adjusting device (2) into body (8). Pipe section (5) passes through the body and one or more openings are provided in the part moving in the body, whereby the extinguishing agent is able to flow into the pipe section and to the object to be extinguished, through nozzle head (7). The joint between body (8) and pipe section (5) is preferably sealed at the ends of the body. Pipe section (5) has been arranged to be turned inside body (8), whereby the spray can be freely directed in any direction, for example by turning the activating device (4) of control unit (6).

**[0015]** In the example of Figure 2, the pipe is shown from the other side, where the structure of control device (6) is more clearly visible. Nozzle head (7) is removable, for example using threads, and can be replaced. By changing the size, quantity and orientation of the holes in the nozzle head, the angle and droplet size of the spray can be changed. The nozzle head is preferably arranged in such a way that the extinguishing agent spreads over a small area as it sprays, making it possible to direct the extinguishing agent precisely, for example to a desired point of the ceiling, or to a corner between the ceiling and

the wall. A spray that is too fine or widely dispersed will have a short range and not enough extinguishing agent is applied to the required spot.

**[0016]** One situation for the presented use of penetrating nozzle is to extinguish a fire in the loft of a single-family house. If it is safe to stay inside the house, a hole is drilled in the ceiling from which the nozzle head of the penetrating nozzle and part of the pipe are pushed through into the loft of the house. By turning the activating device of the control device, the nozzle head is turned approximately 80° - 90° in relation to the pipe section and the extinguishing agent is directed to the loft. Extinguishing agent can be efficiently directed all over the loft by rotating the pipe section around its axis, whereby the nozzle head turns together with the pipe section.

**[0017]** The penetrating nozzle shown has been found to be particularly useful in situations where a hole must be made in the structure for a penetrating nozzle in order to extinguish a fire. End of the penetrating nozzle to be pushed through a hole - the nozzle head, the control device and part of the pipe section - have been arranged to be pushed through a round hole and are of moderate diameter, for example no more than 30 mm, 35 mm, 40 mm or 50 mm. Hence a hole can be quickly bored with battery-powered tools and the penetrating nozzle that is pushed through the hole blocks the hole completely or almost completely. Consequently the fire does not get more air (oxygen) through the prepared hole and the extinguishing person is not exposed to flue gases. Especially when working from the roof, it is important that the size of the hole to be made matches the diameter of the penetrating nozzle for shape and size, as the fumes escaping from the hole will otherwise make extinguishing more difficult. The hole sealed with the penetrating nozzle also prevents the dangerous and unexpected discharge of a blowpipe flame from the hole, which is dangerous for the extinguishing person.

**[0018]** The penetrating nozzle, as well as the nozzle head and control unit, have preferably been made of a heat-resistant material, such as steel, stainless steel, aluminum or composite material. The entire penetrating nozzle has been manufactured to withstand the pressure of the source of the extinguishing agent connected to the coupler of extinguishing agent, typically between 500 kPa and 2 MPa. Benefits of a penetrating nozzle when only pressurized extinguishing agent is used are properly demonstrated, as the apparatus does not have its own pump but merely directs the extinguishing agent flowing through the device to the desired target by means of the position of the nozzle head and the design of its holes.

**[0019]** One embodiment of the invention is penetrating nozzle (10) for extinguishing a burning object. The penetrating nozzle according to the embodiment comprises coupler (1) for extinguishing agent, adapted to be connected to a source of extinguishing agent, pipe section (5), from which a flow channel leads to coupler (1) for extinguishing agent, and pipe section (5) of nozzle head (7) at one end, where from said nozzle head a flow channel leads to pipe section (5). A penetrating nozzle according to the embodiment is characterized in that it further comprises control device (6) functionally connected to nozzle head (7), wherein said control device (6) is located at the opposite end of said pipe section (5) with respect to nozzle head (7), said control device (6) being adapted to turn nozzle head (7) by deflecting the position of nozzle head (7) with respect to the longitudinal axis of pipe section (5).

**[0020]** In one embodiment a penetrating nozzle further includes body (8), connected to coupler (1) for extinguishing agent and to pipe section (5), the body (8) of which forms a flow channel between said coupler (1) for extinguishing agent and said pipe section (5).

**[0021]** In one embodiment, pipe section (5) of penetrating nozzle has been rotatably connected to body (8) in such a way, that while attached to body (8), pipe section (5) can be rotated around the longitudinal axis of the pipe section in an unlimited manner while continuously maintaining a flow channel between pipe section (5) and coupler (1) for extinguishing agent.

**[0022]** In one embodiment pipe section (5) of penetrating nozzle has been arranged to pass through body (8) and where one or more openings are arranged in the portion of pipe section (5) inside body (8) to form a flow channel between the pipe section and coupler (1) for extinguishing agent.

**[0023]** In one embodiment, control device (6) of the penetrating nozzle comprises manually operated activating device (4), which is functionally connected to nozzle head (7) in such a way that a change in the position of said activating device (4) will change the position of nozzle head (7).

**[0024]** In one embodiment, a functional connection between activating device (4) and nozzle head (7) has been formed by means of one or more wire ropes or chains. Alternatively, other known transmission devices, such as a rigid or flexible drive shaft or gears, can also be used instead of, or in addition to wire ropes or chains. Preferably said one or more wire ropes or chains have been adapted to communicate the change in position of activating device (4) in order to change the position of nozzle head (7) with a ratio of 1:1.

**[0025]** In one embodiment, the diameter of said nozzle head (7) and pipe section (5) in a direction perpendicular to the longitudinal axis, is no more than 50 mm, preferably no more than 30 mm, with the nozzle head in a position parallel to the pipe section.

**[0026]** In one embodiment, the penetrating nozzle comprises flow adjusting device (2) and an associated activating device (3), adapted to adjust the flow of the extinguishing agent in the penetrating nozzle.

**[0027]** It is obvious to those skilled in the art that, as technology evolves, the basic idea of the invention can be implemented in many different ways. The invention and its applications are therefore not limited to the examples described above, and may vary within the scope of the patent claims.

## Claims

1. A penetrating nozzle (10) for extinguishing a burning object, comprising:

   coupler (1) for extinguishing agent, adapted to be connected to a source of extinguishing agent, pipe section (5), from which a flow channel leads to coupler (1) for extinguishing agent,
   nozzle head (7) at one end of pipe section (5) from which there is a flow channel from said nozzle head to pipe section (5), and
   control device (6), which is functionally connected to nozzle head (7), and said control device (6) being at the opposite end of said pipe section (5) with respect to nozzle head (7), whereby control device (6) is adapted to turn nozzle head (7) by deflecting the position of nozzle head (7) with respect to the longitudinal axis of pipe section (5), where control device (6) comprises a manually operated activating device (4), which is functionally connected by means of a transmission device to nozzle head (7) in such a way that a change in the position of said activating device (4) will cause a change in the position of nozzle head (7),
   said penetrating nozzle being **characterized in that** said transmission device runs inside pipe section (5) in the same space as the extinguishing agent.

2. A penetrating nozzle according to claim 1, further comprising body (8), connected to coupler (1) for extinguishing agent and to pipe section (5), the body (8) of which forms a flow channel between said coupler (1) for extinguishing agent and said pipe section (5).

3. A penetrating nozzle according to claim 2, where pipe section (5) has been rotatably connected to body (8) in such a way, that while attached to body (8), pipe section (5) can be rotated around the longitudinal axis of the pipe section in an unlimited manner while continuously maintaining a flow channel between pipe section (5) and coupler (1) for extinguishing agent.

4. A penetrating nozzle according to claim 2 or 3, where pipe section (5) has been arranged to pass through body (8) and where one or more openings are arranged in the portion of pipe section (5) inside body (8) to form a flow channel between the pipe section and coupler (1) for extinguishing agent.

5. A penetrating nozzle according to claim 1, where said one or more wire ropes or chains have been adapted to communicate the change in position of activating device (4) in order to change the position of nozzle head (7) with a ratio of 1:1.

6. A penetrating nozzle according to one of claims 1 to 5, wherein the diameter of said nozzle head (7) and pipe portion (5) in a direction perpendicular to the longitudinal axis is no larger than 50 mm when the nozzle head is in a position parallel to the pipe section.

7. A penetrating nozzle according to claim 6, wherein the diameter of said nozzle head (7) and pipe portion (5) in a direction perpendicular to the longitudinal axis is no larger than 30 mm when the nozzle head is in a position parallel to the pipe section.

8. A penetrating nozzle according to one of claims 1 - 7, comprising flow adjusting device (2) and an associated activating device (3), adapted to adjust the flow of the extinguishing agent in the penetrating nozzle.

9. A penetrating nozzle according to one of claims 1 to 8, wherein said transmission means comprises one or more wire ropes or chains.

10. A penetrating nozzle of one of claims 1 to 8, wherein said transmission device comprises one or more wire ropes, chains, drive shafts or sprockets.

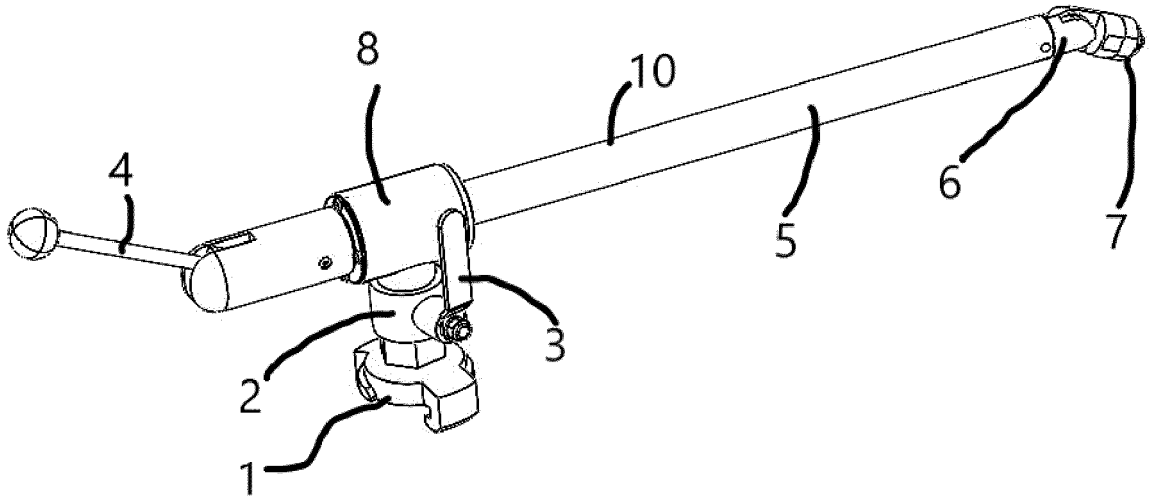


Fig. 1

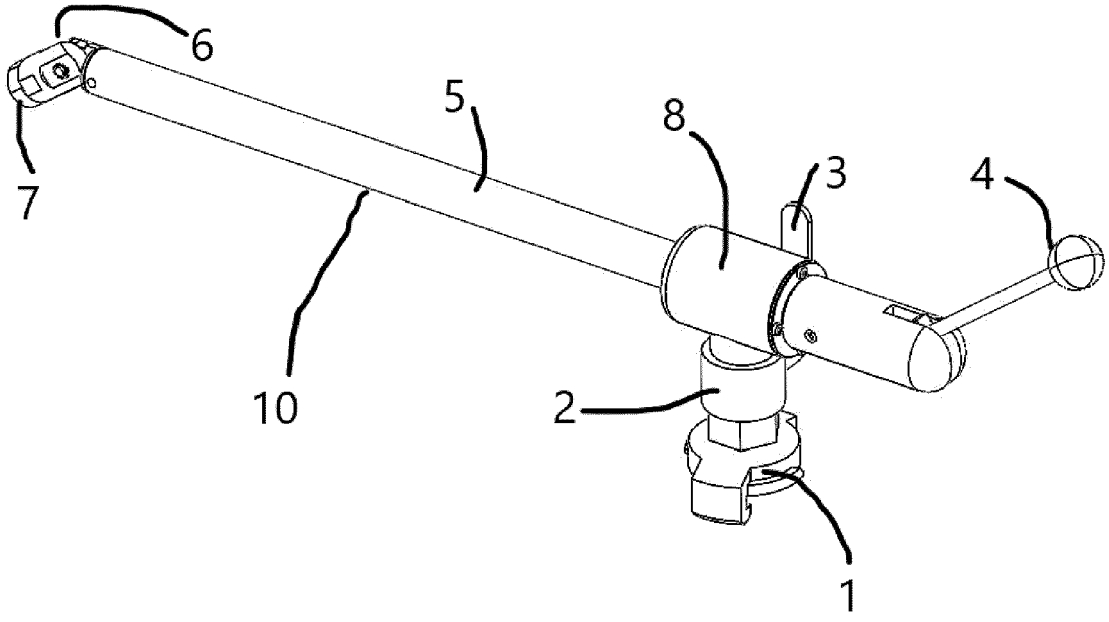


Fig. 2

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# EUROPEAN SEARCH REPORT

Application Number
EP 23 15 8960

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| A | CN 103 372 273 A (WANG GUIGUO)<br>30 October 2013 (2013-10-30)<br>* figures 1-2 * | 1-10 | INV.<br>A62C31/03<br>A62C31/22<br>A62C17/00 |
| A | KR 101 713 236 B1 (HANKOOKNICEENGINEERING CO LTD [KR]) 9 March 2017 (2017-03-09)<br>* the whole document * | 1-10 | |
| A | JP S63 34450 U (MASAO)<br>5 March 1988 (1988-03-05)<br>* the whole document * | 1-10 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | A62C |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 14 July 2023 | Paul, Adeline |

CATEGORY OF CITED DOCUMENTS

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# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 15 8960

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14-07-2023

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| CN 103372273 A | 30-10-2013 | NONE | |
| KR 101713236 B1 | 09-03-2017 | NONE | |
| JP S6334450 U | 05-03-1988 | NONE | |

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82