(54) LOCKING DEVICE, PARTICULARLY HOLD-OPEN DEVICE, FOR A DOOR ACTUATOR ASSEMBLY

The present disclosure relates to a locking device (25), particularly a hold-open device, for a door actuator assembly (10) with a guide rail (24) and a slide arm (14). The locking device (25) comprises a stopper (28) for securing at the guide rail (24). The stopper (28) includes an engagement portion (58). The locking device (25) comprises a movement member (26), particularly a slider, for being movably guided by the guide rail (24) to guide the slide arm (14) along the guide rail (24). The movement member (26) includes an engagement wire spring (34) configured to engage with the engagement portion (58) of the stopper (28) for holding the movement member (26). The locking device (25) may have a very low engagement or impact sound, because the area of impact between the engagement wire spring (34) and the engagement portion (58) is reduced due to a thin wire of the engagement wire spring (34).

FIG. 3
The invention relates to a locking device, particularly a hold-open device, for a door actuator assembly including a guide rail and a slide arm.

Door actuator assemblies with guide rails mounted to doorframes may use locking devices mounted to the guide rails for holding-open a door leaf at a desired position. A plurality of those locking devices is known from the prior art, for example from EP 2 672 046 A2, EP 1 544 394 A2, and EP 2 169 160 B1.

EP 2 672 046 A2 discloses an arrangement having a guide rail. A moving element is provided with a first stopper. The detent is firmly connected with the moving element. The guide rail is provided with a hold-open portion. A second detent is rotatably mounted about an axis of rotation. The detents are separated from each other. The axis of rotation of the second detent is arranged parallel to a mounting surface.

EP 1544 394 A2 discloses a device including a drive and slide arm with a slider guided in a slide rail. A spring-tensioned stop element is mounted on a pivotal lever which is assigned an overload security device with an overload spring acting on the overload element, which can be connected through force engagement with the stop element.

EP 2 169 160 B1 discloses a device having a door closer connected with a sliding arm. A slider is arranged at the sliding arm and guided in a sliding rail. A locking element is arranged at the slider. The locking element combines together with a locking extension for fixing the slider and for locking a door leaf. A locking lever is pivotally mounted at carriages in a rotary bearing on one end. An elastomeric element is arranged in the locking lever, retains force of the locking device and damps a movement of the door leaf.

Conventional locking devices may suffer from bad performance quality and poor durability. Furthermore, conventional locking devices may tend to be very loud during operation, which may be experienced as a negative quality feature by a user.

Therefore, a problem to be solved by the present disclosure is to provide an alternative or improved locking device for a door actuator assembly. Particularly, the locking device has improved engagement features for reducing an impact and/or noise during engagement.

The problem is solved by a locking device according to the independent claim. Preferable embodiments are given in the dependent claims and the description.

The locking device is particularly configured as a hold-open device. The locking device is suitable for a door actuator assembly with a guide rail and a slide arm. The locking device comprises a stopper for securing at the guide rail. The stopper includes an engagement portion. The locking device comprises a movement member, particularly a slider, for being movably guided by the guide rail to guide the slide arm along the guide rail. The movement member includes an engagement wire spring configured to engage with the engagement portion of the stopper for holding the movement member.

The locking device has a very low engagement or impact sound, because the area of impact between the engagement wire spring and the engagement portion is reduced due to a (thin) wire of the engagement wire spring.

In some embodiments, the engagement portion and the engagement wire spring form a releasable snap-in connection between the stopper and the movement member.

In some embodiments, the engagement portion has a spearhead-shape with a blunt end or a pointed end, and/or a dart flight-shape with a blunt end or a pointed end. The spearhead-shape or dart flight-shape enables the engagement spring to snap into or hook onto a neck of the engagement portion adjacent to the spearhead-shape or the dart flight-shape.

In some embodiments, the engagement portion includes a constriction section and a tip end section, wherein, particularly, the constriction section and the tip end section smoothly transition into each other. The engagement wire spring can snap into or hook onto the constriction section after having passed the tip end section for engaging the movement member and the stopper to hold open the door leaf.

In some embodiments, the constriction section tapers in a direction (for example, an axial direction) away from the tip end section with a taper angle within a range between 45° and 85°. Additionally or alternatively, the tip end section tapers in a direction (for example, an axial direction) away from the constriction section with a taper angle within a range between 100° and 130°. It has been found, that those taper angles values result in a particularly low engagement sound between the stopper and the movement member.

In some embodiments, the engagement wire spring is configured to engage the engagement portion by encompassing the engagement portion on two sides of the engagement portion, particularly two oppositely directed sides of the engagement portion. Thereby, a retaining force of the engagement wire spring can be shared by two sections of the engagement wire spring.

In some embodiments, the engagement wire spring is formed as a single claw or a double claw for engaging the engagement portion. Additionally or alternatively, the engagement wire spring includes at least one arcuate, particularly u-shaped, wire section for engaging the engagement portion. Additionally or alternatively, the engagement wire spring includes a first u-shaped wire section for engaging the engagement portion, and a second u-shaped wire section for engaging the engagement portion. For example, the arcuate or u-shaped wire sections can snap into the constriction section of the engagement portion.

In some embodiments, the first u-shaped wire...
section and the second u-shaped wire section are arranged side by side. Additionally or alternatively, the first u-shaped wire section and the second u-shaped wire section are connected to each other at respective ends of the first and second u-shaped wire sections, particularly to form a closed wire spring.

In some embodiments, the engagement wire spring is fastened at the respective ends, for example by a locking screw, in a reception of the movement member. The engagement wire spring may extend out of the reception in an axial direction to the stopper.

In some embodiments, the movement member further comprises at least one biasing element, particularly at least one pin, arranged in a reception of the movement member for biasing the first u-shaped wire section and the second u-shaped wire section in a direction to each other.

In some embodiments, the tip end section is configured to push the first u-shaped wire section and the second u-shaped wire section apart from each other during engaging the engagement wire spring and the engagement portion. Additionally or alternatively, the first u-shaped wire section and the second u-shaped wire section are configured to snap into the constriction section when having passed the tip end section during engaging of the engagement wire spring and the engagement portion.

In some embodiments, the locking device further comprises a dampening element, for example made of an elastic or compressible material. The dampening element is arranged to dampen an impact of the movement member onto the stopper. Particularly, the dampening element is provided separate from the engagement wire spring for separating the dampening feature and the engagement feature from each other. Thus, there is not a single component integrating the function of dampening and engagement as a compromise solution. The dampening element can dampen strong impacts, whereas the engagement wire spring may have a filigree structure to reduce an engagement noise.

In some embodiments, the movement member includes a protruding portion for contacting the dampening element. The protruding portion protrudes over the engagement wire spring in an axial direction to the stopper. Additionally or alternatively, the dampening element is positioned behind the engagement portion in an axial direction to the movement member and/or the stopper comprises the dampening element. Additionally or alternatively, the dampening element is fastened at a web portion of the stopper by encompassing the web portion. The web portion transitions into the engagement portion in an axial direction to the movement member. For example, the dampening element has a u-shape.

As used herein, axial direction relates to a direction parallel to a longitudinal axis of a respective component (for example, the guide rail, the stopper and/or the movement member).

In some embodiments, the stopper includes a fastening portion, particularly a throughhole, for fastening the stopper to the guide rail, and/or the movement member includes a connecting portion, particularly a throughhole, for pivotable connecting the slide arm to the movement member. Additionally or alternatively, the movement member includes a movement body, particularly a slide shoe, and/or the engagement wire spring is made of a metal or plastic material.

The present disclosure also relates to a door actuator assembly for a door leaf. The door actuator assembly comprises a guide rail, which may include a slide channel. The door actuator assembly comprises a slide arm, which may be a one-piece or a multi-piece component. The door actuator assembly comprises a door actuator, for example a door closer, which may be configured for mounting to the door leaf. The door actuator assembly comprises a locking device as disclosed herein, wherein the stopper is securable at the guide rail, the movement member is movably guided by the guide rail, and the slide arm connects the movement member and the door actuator.

The present disclosure also relates to a guide rail assembly. The guide rail assembly comprises a guide rail, which may include a slide channel. The guide rail assembly comprises a locking device as disclosed herein, wherein the stopper is securable at the guide rail and the movement member is movably guided by the guide rail.

The above described preferred embodiments and features of the invention can be combined as required. Further details and advantages of the invention are described in the following with reference to the attached drawings. In the drawings:

Fig. 1 shows a perspective view of a door actuator assembly mounted to a door leaf and a doorframe;

Fig. 2 shows a perspective bottom view of an exemplary hold-open device of a door actuator assembly mounted in a guide rail of the door actuator assembly, the hold-open device being shown in an engaged state;

Fig. 3 shows a perspective top view of the exemplary hold-open device in the engaged state, wherein the guide rail of the door actuator assembly is transparent for showing components of the hold open device;

Fig. 4 shows an exploded view of the exemplary hold-open device;

Fig. 5 shows a top view of the exemplary hold-open device in a disengaged (or released) state; and

Fig. 6 shows a perspective top view of the exemplary hold-open device in the engaged state.

The embodiments shown in the Figs. are at least partially identical. Similar and identical parts are identified with the same reference sign, and for describing those parts it is referred to the description of the other
embodiments and Figs., respectively, to avoid repetitions.

[0029] Fig. 1 shows a door actuator assembly 10. The door actuator assembly 10 includes a door actuator 12, a slide arm 14 and a guide rail assembly 16.

[0030] The door actuator 12 is mounted to a door leaf 18. The door actuator 12 is configured as a door closer. Particularly, the door actuator 12 is inserted or integrated into a frame of the door leaf 18. The door actuator 12 includes a pin or shaft 20 for connecting to the slide arm 14.

[0031] The slide arm (main arm) 14 is pivotally connected to the pin or shaft 20. The slide arm 14 interconnects the pin 20 of the door actuator 12 and a movement member (not visible in Fig. 1) of the guide rail assembly 16.

[0032] The guide rail assembly 16 is inserted or integrated into a doorframe 22. For example, the guide rail assembly 16 may be mounted to the doorframe 22 by a plurality of screw connections. Alternatively, the guide rail assembly 16 may be mounted on a door leaf or a wall.

[0033] Referring to Figs. 2 to 5, a section of the guide rail assembly 16 is shown in more detail in a perspective view from below (Fig. 2), in a perspective view from above (Fig. 3), in an exploded view (Fig. 4), and in a top view (Fig. 5). Furthermore, in Fig. 6, a hold-open device of the guide rail assembly 16 is shown in a perspective view without a guide rail of the guide rail assembly 16.

[0034] The guide rail assembly 16 includes a guide rail 24 and a locking device 25 configured and referred hereinto as a hold open device for holding open the door leaf 18 (see Fig. 1) at a desired position. The hold-open device 25 comprises a movement member 26 and a stopper 28.

[0035] The guide rail 24 extends in a longitudinal direction. Particularly, the guide rail 24 extends along a top beam of the doorframe 22 (see Fig. 1). The guide rail 24 includes a sliding channel 30.

[0036] The movement member 26 is axially guided by the guide rail 24. Particularly, the movement member 26 is axially movably, particularly slidably, arranged in the sliding channel 30. The movement member 26 includes a movement body 32 and an engagement wire spring 34.

[0037] The movement body 32 is configured as a slide shoe, which is slideable in the sliding channel 30. For example, the movement body 32 may be made of a plastic material. The movement body 32 includes a connecting portion 36, a reception 38, and a protruding portion 40.

[0038] The connecting portion 36 is configured for connecting the movement body 32 and the slide arm 14. For example, the connecting portion 36 may be configured as a throughhole accommodating a screw insert 42. A shoulder screw 44 may extend through a throughhole of the slide arm 14, and may be screwed into the screw insert 42 for connecting the slide arm 14 and the movable body 32. In other examples, other kinds of swivel or pivotable connections between the movement body 32 and the slide arm 14 may be used, for example a shaft joint.

[0039] During opening and closing of the door leaf 18 (see Fig. 1), the movement member 26 axially slides in the sliding channel 30. Particularly, a pivoting movement of the door leaf 18 is transferred via the slide arm 14 to the axial sliding movement of the movement body 32 in the sliding channel 30.

[0040] The reception 38 for the engagement wire spring 34 is formed as a recess opening in an axial direction to the stopper 28. The reception 38 accommodates the engagement wire spring 34. Particularly, the engagement wire spring 34 is secured in the reception 38 by a locking screw 46. The engagement wire spring 34 extends out of the reception 38 for engaging with the stopper 28. The engagement wire spring 34 is biased by two opposing pins 48 accommodated in the reception 38. The engagement wire spring 34 has a (double) claw design to engage with the stopper 28.

[0041] The protruding portion 40 has a cuboid shape. The protruding portion 40 protrudes from the main section of the movement body 32 in an axial direction to the stopper 28. The protruding portion 40 is arranged next to the engagement wire spring 34. The protruding portion 40 protrudes over the engagement wire spring 34 in an axial direction to the stopper 28.

[0042] The engagement wire spring 34 is configured to engage with the stopper 28 to hold open the door leaf 18 (see Fig. 1) at a desired position. The engagement wire spring 34 is formed by two u-shaped wire sections 50, 52. The two u-shaped wire sections 50, 52 are connected to each other at respective ends of the wire sections 50, 52 to form a closed wire spring. The locking screw 46 fastens the engagement wire spring 34 in the reception 38 at the connections of the two u-shaped wire sections 50, 52. For example, those connections are formed as half ring segments. The two u-shaped wire sections 50, 52 are biased in a direction to each other by the pins 48. The two u-shaped wire sections 50, 52 form a claw design of the engagement wire spring 34. For example, a wire of the engagement wire spring 34 may be made of a metal or plastic material.

[0043] The stopper 28 serves to set a desired hold-open position of the door leaf 18. The stopper 28 is axially securable in the sliding channel 30 by a locking screw 54. The locking screw 54 is screwed into a nut 56, which is non-rotatably mounted in a fastening portion 55, for example a throughhole, of the stopper 28. The stopper 28 is axially secured by the locking screw 54 in the sliding channel 30 at a position which corresponds to a desired opening degree of the door leaf 18 (see Fig. 1) at which it is desired to hold the door leaf 18 open. Additionally or alternatively, the stopper 28 may be axially secured at the guide rail 24 in any other fashion, for example, by a form-fit, a force-fit or a material-locking. For example, the stopper 28 may be made of a plastic material.

[0044] The stopper 28 includes an engagement portion 58 and a dampening element 60.

[0045] The engagement portion 58 faces the movement member 26. The engagement portion 58 is config-
ured to engage with the engagement wire spring 34 of the movement member 26. Specifically, the engagement portion 58 and the engagement wire spring 34 form a releasable snap-in connection between the stopper 28 and the movement member 26, wherein the engagement wire spring 34 can snap into the engagement portion 58. Particularly, in an engaged state, the first and second u-shaped wire sections 50, 52 encompass the engagement portion 58 (see, for example, Fig. 6).

[0046] Referring to Fig. 5, it can be seen that the engagement portion 58 includes a constriction section 62 and a tip end section 64. The constriction section 62 and the tip end section 64 smoothly transition into each other. The constriction section 62 forms a neck section of the engagement portion 58. The constriction section 62 and the tip end section 64 together form a spearhead or a dart flight-shape of the engagement portion 58. The spearhead or dart flight-shape has a blunt end (tip). In other embodiments, the spearhead may have a pointed end (tip).

[0047] The constriction section 62 tapers in a direction away from the tip end section 64, i.e. a direction away from the movement member 26. For example, a taper angle $\alpha$ of the constriction section 62 may be within a range between 45° and 85°. Additionally, the tip end section 64 tapers in a direction away from the constriction section 62, i.e. a direction to the movement member 26. For example, a taper angle $\beta$ of the tip end section 58 may be within a range between 100° and 130°.

[0048] The dampening element 60 may be formed of a compressible and/or elastic material. The dampening element 60 is secured to a web portion 66 of the stopper 28. Particularly, the dampening element 60 is u-shaped, and encompasses the web portion 66 of the stopper 28. The web portion 66 transitions into the engagement portion 58 so that the dampening element 58 is positioned further away from the movement member 20 than the engagement portion 58.

[0049] The hold-open device 25 operates as follows. The stopper 28 is axially fixed at a desired axial position of the guide rail 24. The desired axial position corresponds to a desired hold-open degree of the door leaf 18. The stopper 28 is axially fixed in the guide rail 24 via the fastening portion 55. Specifically, the locking screw 54 is screwed into the nut 56 for contacting the sliding channel 30 to fasten the stopper 28 in the sliding channel 30.

[0050] When the door leaf 18 is opened, the movement member 26 slides in the slide channel 30 in an axial direction to the stopper 28. The u-shaped wire sections 50, 52 contact the tip end portion 64. The tip end portion 64 pushes the u-shaped wire sections 50, 52 apart from each other as the movement member 26 continues sliding in the direction to the stopper 28. After having passed the tip end section 64, a spring force of the engagement wire spring 34 pushes the u-shaped wire sections 50, 52 in a direction to each other. The u-shaped wire sections 50, 52 snap into the constriction section 62. The movement body 26 moves further in the direction to the stopper 28 until an end face of the protruding portion 40 contacts an end face of the dampening element 60. The dampening element 60 dampens an impact of the movement member 26 onto the stopper 28. The movement member 26 is engaged with the stopper 28. The door leaf 18 is held open at a desired position.

[0051] For disengaging the movement member 26 from the stopper 28, the door leaf 18 is pushed to close. The movement member 26 moves in a direction away from the stopper 28. The engagement wire spring 34 and the engagement portion 58 disengage from each other.

[0052] The invention is not limited to the above described preferred embodiments. Instead, a plurality of variations and modifications using the inventive idea of the present application and, thus, falling under the scope of protection are conceivable. Particularly, the present application also discloses the subject-matter and the features of the dependent claims independent of the claim references of the dependent claims. For example, the features of the dependent claims are disclosed independent of a presence and/or a configuration of the engagement portion and the engagement wire spring of independent claim 1. Additionally, the features of independent claim 1 are disclosed independent from each other.

List of reference signs

[0053]  

10 Door actuator assembly
12 Door actuator
14 Slide arm
16 Guide rail assembly
18 Door leaf
20 Pin
22 Doorframe
24 Guide rail
25 Locking device (hold-open device)
26 Movement member
28 Stopper
30 Sliding channel
32 Movement body
34 Engagement wire spring
36 Connecting portion
38 Reception
40 Protruding portion
42 Screw insert
44 Shoulder screw
46 Locking screw
48 Pin
50 First u-shaped wire section
52 Second u-shaped wire section
54 Locking screw
55 Fastening portion
56 Nut
58 Engagement portion
60 Dampening element
Claims

1. A locking device (25), particularly a hold-open device, for a door actuator assembly (10) with a guide rail (24) and a slide arm (14), comprising:

   a stopper (28) for securing at the guide rail (24),
   the stopper (28) including an engagement portion (58); and
   a movement member (26), particularly a slider,
   for being movably guided by the guide rail (24)
   to guide the slide arm (14) along the guide rail
   (24), the movement member (26) including an
   engagement wire spring (34) configured to en-
   gage with the engagement portion (58) of
   the stopper (28) for holding the movement member
   (26).

2. The locking device (25) of claim 1, wherein:

   the engagement portion (58) and the engage-
   ment wire spring (34) form a releasable snap-in
   connection between the stopper (28) and the
   movement member (26).

3. The locking device (25) of claim 1 or claim 2, wherein:

   the engagement portion (58) has a spearhead-
   shape with a blunt end or a pointed end; and/or
   the engagement portion (58) has a dart flight-
   shape with a blunt end or a pointed end.

4. The locking device (25) of any one of the preceding

   claims, wherein:

   the engagement portion (58) includes a constric-
   tion section (62) and a tip end section (64),
   wherein, particularly, the constriction section
   (62) and the tip end section (64) smoothly tran-
   sition into each other.

5. The locking device (25) of claim 4, wherein:

   wherein the constriction section (62) tapers in a
   direction away from the tip end section (64) with
   a taper angle (α) within a range between 45°
   and 85°; and/or
   wherein the tip end section (64) tapers in a di-
   rection away from the constriction section (62)
   with a taper angle (β) within a range between
   100° and 130°.

6. The locking device (25) of any one of the preceding

   claims, wherein:

   the engagement wire spring (34) is configured
to engage the engagement portion (58) by en-
compassing the engagement portion (58) on two
sides of the engagement portion (58), particu-
larly two oppositely directed sides of the engage-
ment portion (58).

7. The locking device (25) of any one of the preceding

   claims, wherein:

   the engagement wire spring (34) is formed as a
single claw or a double claw for engaging the
engagement portion (58);
the engagement wire spring (34) includes at
least one arcuate, particularly u-shaped, wire
section (50, 52) for engaging the engagement
portion (58); and/or
the engagement wire spring (34) includes a first
u-shaped wire section (50) for engaging the en-
gagement portion (58), and a second u-shaped
wire section (52) for engaging the engagement
portion (58).

8. The locking device (25) of claim 7, wherein:

   the first u-shaped wire section (50) and the sec-
ond u-shaped wire section (52) are arranged
side by side; and/or
the first u-shaped wire section (50) and the sec-
ond u-shaped wire section (52) are connected
to each other at respective ends of the first and
second u-shaped wire sections (50, 52), partic-
ularly to form a closed wire spring.

9. The locking device of claim 8, wherein:

   the engagement wire spring (34) is fastened at
the respective ends, for example by a locking
screw (46), in a reception (38) of the movement
member (26).

10. The locking device (25) of any one of claims 7 to 9,

   wherein:

   the movement member (26) further comprises
at least one biasing element (48), particularly at
least one pin, arranged in a reception (38) of the
movement member (26) for biasing the first u-
shaped wire section (50) and the second u-
shaped wire section (52) in a direction to each
other.

11. The locking device (25) of any one of claims 7 to 10,

   wherein:
the tip end section (64) is configured to push the first u-shaped wire section (50) and the second u-shaped wire section (52) apart from each other during engaging the engagement wire spring (34) and the engagement portion (58); and/or the first u-shaped wire section (50) and the second u-shaped wire section (52) are configured to snap into the constriction section (62) when having passed the tip end section (64) during engaging of the engagement wire spring (34) and the engagement portion (58).

12. The locking device (25) of any one of the preceding claims, further comprising:

a dampening element (60) arranged to dampen an impact of the movement member (26) onto the stopper (28).

13. The locking device (25) of claim 12, wherein:

the movement member (26) includes a protruding portion (40) for contacting the dampening element (60), the protruding portion (40) protruding over the engagement wire spring (34) in an axial direction to the stopper (28); and/or the dampening element (60) is positioned behind the engagement portion (58) in an axial direction to the movement member (26); and/or the stopper (28) comprises the dampening element (60); and/or the dampening element (60) is fastened at a web portion (66) of the stopper (28) by encompassing the web portion (66), the web portion (66) transitioning into the engagement portion (58) in an axial direction to the movement member (26); and/or the dampening element (60) has a u-shape.

14. The locking device (25) of any one of the preceding claims, wherein:

the stopper (28) includes a fastening portion (55), particularly a throughhole, for fastening the stopper (28) to the guide rail (24); and/or the movement member (26) includes a connecting portion (36), particularly a throughhole, for pivotable connecting the slide arm (14) to the movement member (26); and/or the movement member (26) includes a movement body (32), particularly a slide shoe; and/or the engagement wire spring (34) is made of a metal or plastic material.

15. A door actuator assembly (10) for a door leaf (18), comprising:

a guide rail (24);
## DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document with indication, where appropriate, of relevant passages</th>
<th>Relevant to claim</th>
<th>CLASSIFICATION OF THE APPLICATION (IPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>* paragraphs [0001], [0006], [0019] - [0024], [0030], [0032], [0033] *</td>
<td>12, 13</td>
<td>E05C17/28</td>
</tr>
<tr>
<td></td>
<td>* figures 5, 6 *</td>
<td></td>
<td></td>
</tr>
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<td>A</td>
<td>* paragraphs [0025] - [0027] *</td>
<td>1, 15</td>
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The present search report has been drawn up for all claims.

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**PLACE OF SEARCH**: The Hague  
**DATE OF COMPLETION OF THE SEARCH**: 18 May 2018  
**EXAMINER**: Wagner, Andrea

**CATEGORY OF CITED DOCUMENTS**
- X: particularly relevant if taken alone
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- A: technological background
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**TECHNICAL FIELDS SEARCHED (IPC)**
- E05F
- E05C
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<table>
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For more details about this annex: see Official Journal of the European Patent Office, No. 12/82.
REFERENCES CITED IN THE DESCRIPTION

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