ELECTRIC DEVICE

DESCRIPTION

The present invention relates to an electric device of the type comprising the features mentioned in the preamble of claim 1.

In the technical sector relating to civil and industrial electric plants, there are commonly used supports which can be fixed to walls and electric modules, such as, for example, control apparatuses (circuit-breakers, push-buttons, switches, etcetera) or sockets which can be connected in a stable manner to the support by means of suitable engagement systems.

Engagement systems may provide for steel springs or, more generally, resilient elements for fixing the electric module to the above-mentioned support by interlocking the resilient element in suitable seats. It is known to construct the resilient elements in the electric module and to construct the seats in the above-mentioned support, or vice versa. An example of a known engagement system is described in GB 2 578 427.

However, it has been observed that the known technical solutions may be subjected to a number of limitations, such as, for example, a relative difficulty in fixing the electric module to the support or in removing it therefrom.

An object of the present invention is to provide an electric device which is structurally and functionally configured to overcome at least one limitation of the above-cited prior art.

This object is achieved by means of an electric device comprising one or more of the features mentioned in the appended claims.

According to a first aspect of the invention, the electric device comprises a support frame which is intended to be fixed to a wall and which is provided with an internal perimeter which delimits an opening which is intended to receive at least one electric module.

In particular, the support frame comprises a front surface and a rear surface opposite the front surface. The front surface is the surface of the support frame which is intended to be directed at the side opposite the wall to which the support frame is fixed.

The internal perimeter comprises an upper side and a lower side opposite the upper side. When the support frame is fixed to a wall, the upper side is in a position above the lower side.

According to a second aspect of the invention, the electric device comprises at least one electric module which comprises a main body which is provided with an upper face, a lower face opposite the upper face and a front face which extends between the upper face and the lower face in a first direction.

The front face is intended to be directed at the opposite side in relation to a wall when the electric module is received in the opening of the support frame and the support frame is fixed to the above-mentioned wall.

In the context of the present invention, the term "electric module" can be identified as an electrical apparatus, such as, for example, a button, a circuit-breaker, a push-button, a commutator, a switch, an excess voltage limiter, a light source, a voltage regulator, a timer, an actuator, an electric socket, a telephone socket and/or a data transmission socket or a coaxial socket, which may or may not be provided with wireless technology, or a so-called hole covering device.

The electric device further comprises an engagement device for locking the main body to the support frame when the electric module is received in the opening of the support frame.

Preferably, the first direction corresponds to a vertical direction when the main body of the electric module is locked to the support frame.

The engagement device comprises a pair of projections which extend from one side between the upper side and the lower side of the internal perimeter towards the other side between the aforesaid sides.

Both the upper side and the lower side are provided with the respective pair of projections.

The two projections are spaced apart from each other so as to delimit with a portion of the support frame which extends from one of the projections to the other a seat which is intended to receive a connection portion of an engagement element.

In particular, the portion of the support frame which extends from one of the projections to the other extends between the front surface and the rear surface of the support frame.

The engagement device comprises the engagement element, that is to say, an engagement element which comprises a connection portion which is formed to be received in the above-mentioned seat.

The engagement element is resiliently secured to one face between the upper face and the lower face of the electric module so as to be movable between an expanded configuration and a retracted configuration.

Preferably, the engagement device comprises two engagement elements, one being secured to the upper face of the electric module and the other engagement element being secured to the lower face of the same electric module.

In the expanded configuration, the electric module is locked to the support frame by means of interference between the support frame and the engagement element when the connection portion is received in the seat.

In the retracted configuration, the electric module can be removed from the support frame.

The engagement device comprises a pair of abutment surfaces which belong to the face of the electric module which is provided with the engagement element.

The pair of abutment surfaces extend one opposite the other with respect to the engagement element so as to act as a guide for respective projections of the engagement device for the insertion of the connection portion in the seat.

These features are found to be particularly advantageous from the point of view of ease of insertion and removal of the electric module into and out of the support frame, respectively.

In fact, the pair of projections of the engagement device forms a receiving element for the support frame which allows easy insertion which is extremely precise for the connection portion in the relevant seat. It is evident that the ease of sliding of the projections on the respective abutment surfaces of the electric module contributes to making the insertion or removal of the electric module easier.

According to an embodiment of the invention, the connection portion of the engagement element is in a position moved away, in the first above-mentioned direction, from the respective face of the electric module when the engagement element is in the expanded configuration, in such a manner that the main body is locked to the support frame by means of abutment between a first protrusion which extends in the first direction of the engagement element and the support frame when the connection portion is received in the seat.

Preferably, the first protrusion projects with respect to the connection portion at the side opposite the face of the electric module which is provided with the engagement element.

In particular, the first protrusion is provided to come into contact with the front surface or the rear surface of the support frame when the connection portion is received in the seat.

Therefore, the first protrusion allows the movement of the electric module to be blocked at least in a direction transverse to the first direction.

Conversely, the connection portion of the engagement element is in a position moved close, in the first direction, to the respective face of the electric module when the engagement element is in the retracted configuration so as to allow the connection portion to be inserted in or removed from the seat.

According to an embodiment of the invention, the engagement element is in the expanded configuration when the electric module is not subjected to external forces which act on the engagement element.

Therefore, the support frame moving into abutment against the first protrusion during a step of inserting the electric module into the support frame allows the configuration of the engagement element to be moved from the expanded configuration to the retracted configuration so as to allow the connection portion to be inserted in the relevant seat.

The engagement element extends longitudinally from a first end thereof, which is positioned in the region of an intermediate portion of the face of the electric module provided with the engagement element, towards the front face of this electric module, terminating in the connection portion.

In particular, the above-mentioned intermediate portion may correspond to any portion of the face of the electric module which is provided with the engagement element which is positioned at a given distance from the front face of this module.

Therefore, the connection portion corresponds to an end portion of the engagement element directed towards the front face of the electric module.

The first protrusion extends between the first end of the engagement element and the connection portion.

This provision allows the first protrusion to come into contact with the rear surface of the support frame in order to block the movement of the electric module in a direction counter to the direction of insertion of the engagement element, that is to say, of the electric module, into the support frame.

The engagement element comprises, at a free end of the connection portion directed towards the front face of the electric module, a second protrusion which extends in the first direction.

Therefore, the engagement element is provided with the second protrusion at the side opposite the first protrusion with respect to the connection portion.

Preferably, the second protrusion projects with respect to the connection portion at the side opposite the face of the electric module provided with the engagement element.

The second protrusion is configured to come into contact with the front surface of the support frame when the connection portion is received in the seat.

Consequently, the second protrusion allows the movement of the electric module to be blocked in the direction of insertion of the engagement element, thereby acting as a stop element for the introduction of the electric module into the support frame.

Preferably, the first protrusion and the second protrusion both project with respect to the connection portion in the same direction away from the connection portion.

It is thereby possible to define a blocking cavity between the two protrusions, the base of which comprises the connection portion, contributing to ensuring

optimum stability of the electric device when it is inserted into the relevant frame.

Preferably, the first protrusion and the second protrusion together delimit the connection portion of the engagement element.

Preferably, the front surface portion of the support frame which is intended to abut the second protrusion has a development which is inclined with respect to the adjacent portions of the support frame.

In other words, the front surface of the support frame preferably comprises a portion which is inclined with respect to the adjacent portions of the support frame, the inclined portion being intended to abut the second protrusion.

This allows the second protrusion to be readily acted on when the connection portion of the engagement element is received in the seat so as to move the engagement element from the expanded configuration to the retracted configuration in order to remove the electric module from the support frame.

According to an embodiment of the invention, the engagement element is provided with at least one lateral shoulder which is intended to abut a lateral surface of a projection of the engagement device in order to guide the insertion of the connection portion in the seat. Preferably, the engagement element is provided with a pair of lateral shoulders which are intended to abut a lateral surface of a respective projection of the engagement device in order to guide the insertion of the connection portion in the seat.

This feature is found to be particularly advantageous for facilitating the correct insertion of the electric module into the support frame.

Preferably, the at least one lateral shoulder extends longitudinally from the first end of the engagement element as far as the first protrusion. More preferably, the lateral shoulder is connected to the first protrusion by means of a portion

which is tapered towards the first end, which promotes the insertion of the connection portion in the seat.

According to an embodiment of the invention, the face of the electric module provided with the engagement element comprises a hollow portion under the connection portion in order to at least partially contain the connection portion when the engagement element is in the retracted configuration.

In particular, the connection portion is separated from the hollow portion in the first direction when the engagement element is in the expanded configuration.

This aspect allows the overhang of the engagement element to be reduced with respect to the respective face of the electric module and, therefore, the extent of the electric module in the first direction after the connection portion can be received at least partially in the main body of the electric module when the engagement element is in the retracted configuration.

According to an embodiment of the invention, at least one side from the upper side and the lower side of the internal perimeter comprises a hole which extends between the projections of the pair of above-mentioned projections so as to receive the first protrusion when the connection portion is inserted in the seat.

Preferably, both the upper side and the lower side are provided with the respective hole.

According to an embodiment of the invention, the face of the electric module which is provided with the engagement element comprises a pair of abutments which are placed near the front face of the electric module. Furthermore, the abutments are positioned one opposite the other with respect to the above-mentioned engagement element.

The abutments further extend in the first direction in order to move into contact with respective projections of the engagement device when the connection portion is inserted in the seat.

Therefore, these abutments act as a stop element for the insertion of the electric module in the support frame.

Preferably, the projections of the engagement device each comprise a slot which is orientated towards the front surface of the support frame, that is to say, a slot which extends on the front surface of the support frame. The abutments of the electric module may be provided with respective overhangs which are provided to each be introduced into the slot of a relevant projection when the connection portion is inserted in the seat.

According to an embodiment of the invention, the upper side and/or the lower side of the internal perimeter of the support frame comprise(s) a row of three or more projections which are spaced apart from each other in such a manner that two adjacent projections delimit, with a portion of the support frame which extends from one of those projections to the other, a relevant seat which is intended to receive a connection portion of a relevant engagement element.

This provision allows the definition of a plurality of receiving members in the support frame in order to receive a plurality of electric modules.

Features and additional advantages of the invention will be better appreciated from the following detailed description of preferred though non-limiting embodiments thereof which are illustrated by way of non-limiting example with reference to the appended drawings, in which:

- Figure 1 is a schematic, perspective view of an electric device according to one embodiment of the invention,
- Figure 2 is a partial view of an electric module of the electric device shown in Figure 1,
- Figure 3 is a cross-section of a detail of the electric device shown in Figure 1, and
- Figures 4 and 5 are additional views of an electric device according to one embodiment of the invention.

Initially with reference to Figure 1, there is generally designated 100 an electric device according to one embodiment of the invention.

The electric device 100 comprises a support frame 1 which is intended to be fixed to a wall and which is provided with an internal perimeter 2 which delimits an opening 3 which is intended to receive at least one electric module 4, the internal perimeter 2 comprising an upper side 5 and a lower side 6 opposite the upper side 5.

The support frame 1 comprises a front surface 7 and a rear surface 8 opposite the front surface 7.

The electric device 100 comprises at least one electric module 9 comprising a main body 10 which is provided with an upper face 11, a lower face 12 opposite the upper face 11 and a front face 13 which extends between the upper face 11 and the lower face 12 in a first direction 14.

With reference to Figures 1 and 2 the electric device 100 comprises an engagement device 15 for locking the main body 10 to the support frame 1 when the electric module 4 is received in the opening 3 of the support frame 1.

The engagement device 15 comprises a plurality of projections 16 which extend from the upper side 5 towards the lower side 6 and a plurality of additional projections 17 which are opposite the projections 16 and which extend from the lower side 6 towards the upper side 5.

Each pair of adjacent projections are spaced apart from each other so as to delimit with a portion of the support frame which extends from one of these projections to the other a seat 18 which is intended to receive a connection portion 19 of an engagement element 20.

With reference to Figure 1, the electric module 4 comprises a first engagement element 20 which is resiliently secured to the upper face 11 and a second engagement element 20 which is resiliently secured to the lower face 12 so as

to be movable between an expanded configuration shown in Figure 2 and a retracted configuration illustrated in Figures 1 and 4.

In the expanded configuration, the connection portion 19 of the engagement element 20 is in a position moved away, in the first direction 14, from the respective face of the electric module 4 in such a manner that the main body 10 is locked to the support frame 1 by means of abutment between a first protrusion 21 which extends in the first direction 14 of the engagement element 20 and the support frame 1 when the connection portion 19 is received in the relevant seat 18.

In the retracted configuration, the connection portion 19 of the engagement element 20 is in a position moved close, in the first direction 14, to the respective face of the electric module 4 so as to allow the connection portion 19 to be inserted in or removed from the seat 18. In other words, in the retracted configuration, the electric module 4 can be removed from the support frame 1.

The engagement device 15 comprises a pair of abutment surfaces 22 which belong to the face of the electric module 4 which is provided with the engagement element 20.

The two abutment surfaces 22 extend one opposite the other with respect to the engagement element 20 so as to act as a guide for respective projections 16, 17 of the engagement device 15 for inserting the connection portion 19 in the seat 18.

With reference to Figures 2 and 5, the engagement element 20 extends longitudinally from a first end 23 thereof which is positioned in the region of an intermediate portion 24 of the face of the electric module 4 which is provided with the engagement element 20 towards the front face 13 of this electric module 4. The connection portion 19 corresponds to an end portion of the engagement element 20 which is directed towards the front face 13 of the electric module 4.

In an alternative embodiment of the invention, which is not illustrated in the Figures, the first end of the engagement element is adjacent to a rear face of the electric module opposite the front face and the engagement element extends longitudinally towards the front face of the electric module. In this embodiment of the electric device, the connection portion also corresponds to an end portion of the engagement element directed towards the front face of the electric module.

In an additional alternative embodiment of the invention which is not illustrated in the Figures, the first end of the engagement element is adjacent to the front face of the electric module rather than in the region of the above-mentioned intermediate portion and the engagement element extends longitudinally towards the rear face of the electric module.

In the above-mentioned alternative embodiments, the connection portion corresponds to an end portion of the engagement element which is directed towards the rear face of the electric module.

In an additional alternative embodiment of the invention which is not illustrated in the Figures, at least one face of the electric module from the upper face and the lower face is provided with a guide which limits the connection portion to sliding in the first direction between the remote position and the close position.

With reference to the Figures, the first protrusion 21 extends between the first end 23 of the engagement element 20 and the connection portion 19. A second protrusion 25 which extends in the first direction 14 extends in the region of a free end 26 of the connection portion 19 which is directed towards the front face 13 of the electric module 4. The connection portion 19 is therefore delimited by the protrusions 21 and 25.

With particular reference to Figures 1 and 4, the portion of the front surface of the support frame 1 which is intended to abut the second protrusion 25 has an inclined development with respect to the portions of the support frame 1 adjacent thereto. This inclined portion is designated 33 in the Figures.

It will be appreciated that using an inclined portion 33 allows the engagement element 20 to be made reachable even if an aesthetic cover which is not illustrated in the Figure is applied to the front face 13 of the electric module 4.

The inclined portion 33 is further advantageously configured so as to be also readily visible if the aesthetic cover is mounted on the front face 13. In this manner, it is readily possible to make visible the zone where the operator has to act, for example, with a screwdriver, for disengaging the electric module 4.

With particular reference to Figure 2, the engagement element 20 is provided with a pair of lateral shoulders 27 which are intended to abut against a lateral surface of a respective projection 16 (or 17) of the engagement device 15 in order to guide the insertion of the connection portion 19 in the seat 18.

The lateral shoulders 27 extend longitudinally from the first end 23 of the engagement element 20 as far as the first protrusion 21. The lateral shoulders 27 are connected to the first protrusion 21 by means of a portion 34 which is tapered towards the first end 23 which promotes the insertion of the connection portion 19 in the seat 18.

With reference to Figure 4, the face of the electric module 4 provided with the engagement element 20 comprises a hollow portion 28 under the connection portion 19 for at least partially containing the connection portion 19 when the engagement element 20 is in the retracted configuration.

With reference to Figures 3 and 5, the upper side 5 and the lower side 6 of the internal perimeter 2 comprise a plurality of holes 29 which extend between the respective projections 16 (or 17) so as to each receive a protrusion 21 of a relevant electric module 4 when the connection portion 19 is inserted in the seat 18.

With particular reference to Figures 2 and 4, the face of the electric module 4 provided with the engagement element 20 comprises a pair of abutments 30

which are positioned near the front face 13 of the electric module 4. The abutments are further positioned one opposite the other with respect to the engagement element 20 and extend in the first direction 14 in order to come into contact with respective projections 16 (or 17) of the engagement device 15 when the connection portion 19 is inserted in the seat 18.

In particular, the projections 16, 17 of the engagement device 15 each comprise a slot 31 which is orientated towards the front face 7 of the support frame 1 while the abutments 30 of the electric module 4 are provided with respective overhangs 32 which are each provided to be introduced into the slot 31 of a projection 16, 17 when the connection portion 19 is inserted in the seat 18.

The invention thereby solves the problem proposed, at the same time achieving a plurality of advantages. In particular, the invention allows the insertion and removal of an electric module in and out of the support frame to be simplified, respectively. The presence of the holes which are formed in the lower lateral portion of the support frame further also allows the electric modules to be disengaged from the rear, which possibility may be advantageous in some situations.

Furthermore, the mechanism is configured so as to also afford the possibility of disengaging the electric modules only using the fingers, if the operating situation allows it.

Claims

1. An electric device (100) comprising:
   - a support frame (1) which is intended to be fixed to a wall and which is provided with an internal perimeter (2) which delimits an opening (3) which is intended to receive at least one electric module (4), the internal perimeter (2) comprising an upper side (5) and a lower side (6) opposite the upper side (5),
   - at least one electric module (4) comprising a main body (10) which is provided with an upper face (11), a lower face (12) opposite the upper face (11) and a front face (13) which extends between the upper face (11) and the lower face (12) in a first direction (14) and which is intended to be directed at the opposite side in relation to a wall when the electric module (14) is received in the opening (3) and the support frame (1) is fixed to the wall,
   - an engagement device (15) for locking the main body (10) to the support frame (1) when the electric module (4) is received in the opening (3),

   wherein the engagement device (15) comprises:
   - a pair of projections (16; 17) which extend from one side between the upper side (5) and the lower side (6) of the internal perimeter (2) towards the other side between the upper side and the lower side, the projections (16) being spaced apart from each other so as to delimit, with a portion of the support frame (1) which extends from one of the projections (16) to the other, a seat (18) which is intended to receive a connection portion (19) of an engagement element (20),
   - wherein the engagement element (20) comprises the connection portion (19) which is formed to be received in the seat (18), and wherein the engagement element (20) is resiliently secured to one face between the upper face (11) and the lower face (12) of the electric module (14) so as to be movable between an expanded configuration, in which the electric module (4) is locked to the support frame (1) by means of interference between the support frame and the engagement element (20) when the connection portion (19) is

received in the seat (18), and a retracted configuration, in which the electric module (4) can be removed from the support frame (1), and

- a pair of abutment surfaces (22) which belong to the face of the electric module (4) which is provided with the engagement element, the pair of abutment surfaces (22) extending one opposite the other with respect to the engagement element (20) so as to act as a guide for respective projections (16) of the engagement device (15) for the insertion of the connection portion (19) in the seat (18),

wherein the engagement element (20) extends longitudinally from a first end (23) thereof, which is placed at an intermediate portion (24) of the face of the electric module provided with the engagement element, towards the front face (13) of the electric module (4), terminating in the connection portion (19),
wherein the first protrusion (21) extends between the first end (23) of the engagement element (20) and the connection portion (19),
characterized in that the engagement element (20) comprises, in the region of a free end (26) of the connection portion (19) which is directed towards the front face (13) of the electric module (4), a second protrusion (25) which extends in the first direction (14).

2. An electric device according to claim 1, wherein the connection portion (18) of the engagement element (20) is in a position moved away, in the first direction (14), from the respective face of the electric module (4) when the engagement element (20) is in the expanded configuration, in such a manner that the main body (10) is locked to the support frame (1) by means of abutment between a first protrusion (21) of the engagement element (20) which extends in the first direction and the support frame (1) when the connection portion is received in the seat.

3. An electric device according to claim 2, wherein the connection portion (18) of the engagement element (20) is in a position moved close, in the first direction (14), to the respective face of the electric module (4) when the engagement element (20) is in the retracted configuration so as to allow the connection portion to be inserted in or removed from the seat.

4. An electric device according to any one of the preceding claims, wherein the engagement element (20) is provided with at least one lateral shoulder (27) which is intended to abut a lateral surface of a projection (16) of the

engagement device (15) in order to guide the insertion of the connection portion (18) in the seat (19), and wherein the lateral shoulder (27) is preferably connected to the first protrusion (21) by means of a portion (34) which is tapered towards the first end (23), which promotes the insertion of the connection portion (19) in the seat (18).

5. An electric device according to any one of the preceding claims, wherein the face of the electric module (4) provided with the engagement element (20) comprises a hollow portion (28) under the connection portion (19) in order to at least partially contain the connection portion (19) when the engagement element (20) is in the retracted configuration, and wherein the connection portion (19) is preferably separated from the hollow portion (28) in the first direction (14) when the engagement element (20) is in the expanded configuration.

6. An electric device according to any one of the preceding claims, wherein the first protrusion (21) projects with respect to the connection portion (19) at the side opposite the face of the electric module provided with the engagement element.

7. An electric device according to any one of the preceding claims, wherein the second protrusion (25) projects with respect to the connection portion (19) at the side opposite the face of the electric module provided with the engagement element, and/or wherein the first protrusion (21) and the second protrusion (25) together delimit the connection portion (19) of the engagement element (20).

8. An electric device according to any one of the preceding claims, wherein the face of the electric module (4) which is provided with the engagement element (20) comprises a pair of abutments (30) which are placed near the front face (13) of the electric module (4) and one opposite the other with respect to the engagement element (20), the abutments (30) extending in the first direction (14) in order to move into contact with respective projections (16) of the engagement device when the connection portion (19) is inserted in the seat (18).

9. An electric device according to any one of claims 2 to 8, wherein at least one side from the upper side (5) and the lower side (6) of the internal perimeter (2) comprises a hole (29) which extends between the projections (16) of the pair of projections so as to receive the first protrusion (21) when the connection portion (18) is inserted in the seat (18), and/or wherein the first protrusion (21) is provided to come into contact with a front surface (7) or a rear surface (8), opposite the front surface, of the support frame when the connection portion (19) is received in the seat (18).

10. An electric device according to any one of the preceding claims, wherein the second protrusion (25) is configured to come into contact with a front surface (7) of the support frame when the connection portion (19) is received in the seat (18), and wherein the front surface (7) of the support frame comprises preferably a portion (33) which is inclined with respect to the adjacent portions of the support frame (1), the inclined portion (33) being intended to abut the second protrusion (25).

11. An electric device according to any one of the preceding claims, wherein the projections (16; 17) of the engagement device (15) each comprise a slot (31) which extends on a front surface (7) of the support frame.

12. An electric device according to claim 11 when dependent on claim 8, wherein the abutments (30) of the electric module (4) are provided with respective overhangs (32) which are provided to each be introduced into the slot (31) of a relevant projection (16; 17) when the connection portion (19) is inserted in the seat (18).

13. An electric device according to any one of the preceding claims, wherein the upper side (5) and/or the lower side (6) of the internal perimeter of the support frame comprise(s) a row of three or more projections (16; 17) which are spaced apart from each other in such a manner that two adjacent projections delimit, with a portion of the support frame which extends from one of those projections

to the other, a relevant seat (18) which is intended to receive a connection portion (19) of a relevant engagement element (20).

14. An electric device according to any one of the preceding claims, wherein the first protrusion (21) and the second protrusion (25) both project with respect to the connection portion (19) in the same direction away from the connection portion (19).

15. An electric module (4) comprising a main body (10) provided with an upper face (11), a lower face (12) opposite the upper face (12) and a front face (13) which extends between the upper face and the lower face and which is intended to be directed at the opposite side in relation to a wall when the electric module (4) is received in an opening (3) which is delimited by an internal perimeter (2) of a support frame (1) which is fixed to the wall, the electric module (4) comprising the engagement element (20) and the pair of abutment surfaces (22) of an electric device (100) according to any one of claims 1 to 14.

16. A support frame (1) which is intended to be fixed to a wall, the support frame being provided with an internal perimeter (2) which delimits an opening (3) which is intended to receive at least one electric module (4), the internal perimeter (2) comprising an upper side (5) and a lower side (6) which is opposite the upper side (5), wherein the support frame (1) comprises the pair of projections (16) of an electric device (100) according to any one of claims 1 to 14.