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DOOR OPERATING DEVICE

The present invention relates to a door operating device.

FIGS. 1 and 2 of the accompanying drawings illustrate a typical example of a conventional door operating device, in which 1 designates a door operator attached to a header of a door supporting frame 2 or a wall above the door supporting frame 2. The door operator 1 is provided with an electric motor (not shown). A rotating shaft 3 which is operatively connected to the electric motor projects downwards through the casing of the door operator 1. An arm 4 is attached at its one end to the rotating shaft 3 so as to rotate in a horizontal plane. The other end of the arm 4 is pivotably connected to one end of a connecting arm 5, the other end of latter being pivotably connected to a bracket member 6. The bracket member 6 is fixed to and projects from an upper portion of a door 7 which is hinged to a jamb of the supporting frame 2 so as to be swingable about a vertical axis. The rotating arm 4, connecting arm 5 and bracket member 6 form a door operating link mechanism.

When the rotating shaft 3 is angularly moved in the direction A or clockwise in FIG. 2, the rotating arm 4 is turned in the same direction, which causes the door 7 to

be swung and opened through the connecting arm 5 and the bracket member 6 to a position shown by the phantom line in FIG. 2. In this prior art door operating device, it is necessary to project a rather large length of bracket 5 6 from the door 7 in order to effectively swing it. Thus, for example, when the door 7 is provided transversely of a passageway as shown in FIG 2, the door 7 cannot be fully opened unless a recess 9 for receiving the bracket 6 and the connecting arm 5 is, formed in the side wall 10 8, since the bracket 6 abuts against the side wall 8. The side wall 8 is deteriorated in strength and appearance by the presence of the recess 9.

It is an object of the present invention to overcome this particular difficulty. According to the present invention, 15 there is provided an operating device for a door hinged to a support, comprising rotation means which in use is attached to one of the door and the support, an arm mounted at one end thereof on the rotation means for rotation in a plane, guide means which in use is attached to the other 20 of the door and the support, a slider guided by the guide means for movement in a direction generally parallel to the plane of rotation of the arm, and connection means connection means connecting the slider to the other end of said arm in such a manner as to allow the slider both to rotate 25 relative to the arm about an axis perpendicular to said plane and to move relative to the arm along said axis.

The invention will now be further described, by way of example only, with reference to the remaining figures of the accompanying drawings, in which:-

FIG. 3 is a perspective view illustrating a door operating device according to the present invention;
 FIG. 4 is a view taken along the line IV-IV in FIG.3;
 FIG. 5 is an enlarged perspective view of a link mechanism forming part of the device shown in FIGS 3 and 4;

FIG. 6 is an exploded view of the link mechanism shown in FIG 5; and

FIG. 7 is a perspective view illustrating another mode of mounting the door operating device shown in FIG. 3.

Referring to FIGS. 3 and 4, there is illustrated one embodiment of the present invention, in which each member similar to the member used in the prior art door operating device shown in FIG 1 is designated by the same reference number, and the description thereof is omitted. An arm member 11 of a link mechanism is attached at its one end to a rotating shaft 3 of the door operator 1 so that it is angularly movable in a horizontal plane. The link mechanism is shown in more detail in FIGS. 5 and 6. The arm member 11 is provided at its proximal end portion with a clamping hole 13 which extends perpendicularly to the upper face 11A thereof. The hole 13 communicates with a

slit 15 formed in the proximal end. The rotating shaft 3 is fitted into that clamping hole 13 and fastened there by a screw 17 which threadedly engages with a through hole 19 formed through the slotted end and clamps the latter.

5 to the upper face 11A of the free end of the arm member 11 there is provided a circular recess 21 through which a round supporting hole 23 is centrally formed so as to be in parallel with the clamping hole 13, the supporting hole having an annular shoulder 23A formed on its side wall.

10 A bushing 25 which has a circular flange 25A formed radially outwardly around its upper end is inserted into the supporting hole 23 with its flange 25A tightly fitted against the shoulder 23A, and is coaxially fixed there by fitting and fastening a clamping ring 27 to the recess 21.

15 with screws 29, the clamping ring covering the outer peripheral portion of the flange 25A as shown in FIG. 5.

The link mechanism further includes another bushing 31, as a slider, which is fixedly accommodated in a casing 33 having a shaft 41 projecting from it perpendicularly

20 to the axis of the bushing 31. The bushing 31 is slidably fitted around an elongated guide bar 35, of which the opposite ends are each fixed to a bracket 37 with a screw 39. The bushing 31 is connected to the arm member 11 by fitting the shaft 41 of the casing 33 into the bushing 25

25 so that the shaft is both vertically slideable and rotatable about the axis thereof. The brackets 37 are, as shown in FIG 3, screwed to an upper portion of the door 7 so that

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the guide bar 35 extends horizontally. The vertical position of the brackets 37 may be adjusted by sliding the shaft 41 of the casing 33 relative to the bushing 25.

In operation, when a mat switch 43 (FIG.4) placed in front of the door 7 and connected through a cable to a power source (not shown) is activated, the electric motor of the door operator 1 is energized, causing the rotating shaft 3 to turn in the direction of the arrow B, so that the rotating arm 11 is rotated to a position shown by the phantom line in FIG 4. By this rotation of the arm 11 the bushing 31 slides on the guide bar 35 towards the hinged edge of the door 7, and the door is thereby opened to a position, adjacent to the side wall 8, shown by the phantom line in FIG 4. During this opening of the door 7 the free end of the rotating arm 1, is kept at a predetermined distance from the door 7, and hence when the door 7 is fully opened, the brackets 37 or the bushing 31 brought into contact with the wall 8. The length of the brackets 37 projecting from the door 7 is much smaller than that of the bracket 6 of the prior art due to the difference in structure. Thus, the door operating device according to the present invention is capable of fully opening the door without needing any recess for receiving the brackets 37 to the wall 8.

When the door 7 is hinged to the door supporting frame 2 so that it may be opened in a direction of the arrow c in FIG 4, it is swung toward such direction by rotating the shaft 3 in a direction reverse to the arrow B. Thus, it is



clear that the door operating device according to the present invention can also perform the "push open" operation.

FIG. 7 shows another mode of mounting the door operating device shown in FIG 3, in which the door operator 1 is mounted on an upper portion of the door 7 and the brackets 37 are fastened to the header of the door supporting frame.

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CLAIMS:

1. An operating device for a door hinged to a support, comprising rotation means which in use is attached to one of the door and the support, an arm mounted at one end thereof on the rotation means for rotation in a plane, guide means which in use is attached to the other of the door and the support, a slider guided by the guide means for movement in a direction generally parallel to the plane of rotation of the arm, and connection means connecting the slider to the other end of said arm in such a manner as to allow the slider both to rotate relative to the arm about an axis perpendicular to said plane and to move relative to the arm along said axis.

2. A door operating device as claimed in claim 1, wherein the connection means includes a shaft mounted on the slider and extending in the direction of said axis, and a bearing mounted on said other end of the arm which fits around the shaft.

3. A door operating device as claimed in claim 2, wherein the bearing comprises a sleeve which is received in a supporting hole formed in the arm and which is attached to said arm.

4. A door operating device as claimed in claim 3, wherein a circumferential shoulder is provided around the



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periphery of the supporting hole and is engaged by a radially outwardly extending flange on one end of the sleeve.

5. A door operating device as claimed in any preceding claim, wherein the guide means comprises an elongate guide member having at its ends support members which in use are fastened to said other of the door and the support, and the slider is slidably fitted around the guide member.

6. A door operating device substantially as hereinbefore described with reference to Figure 3 to 7 of the accompanying drawings.



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