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(54) **A HANDLE ASSEMBLY AND A METHOD FOR DETECTING THE POSITION OF A DOOR HANDLE**

(57) A handle assembly (14) for a vehicle door (12), comprising a handle (16) which is moveable between a retracted position and an extended position, an evaluation circuit (17) and at least one capacitive sensor (18) arranged at the handle (16), the evaluation circuit (17) being adapted for detecting the presence of a hand in the vicinity of the capacitive sensor (18) and in addition being adapted for determining the position of the handle (16).

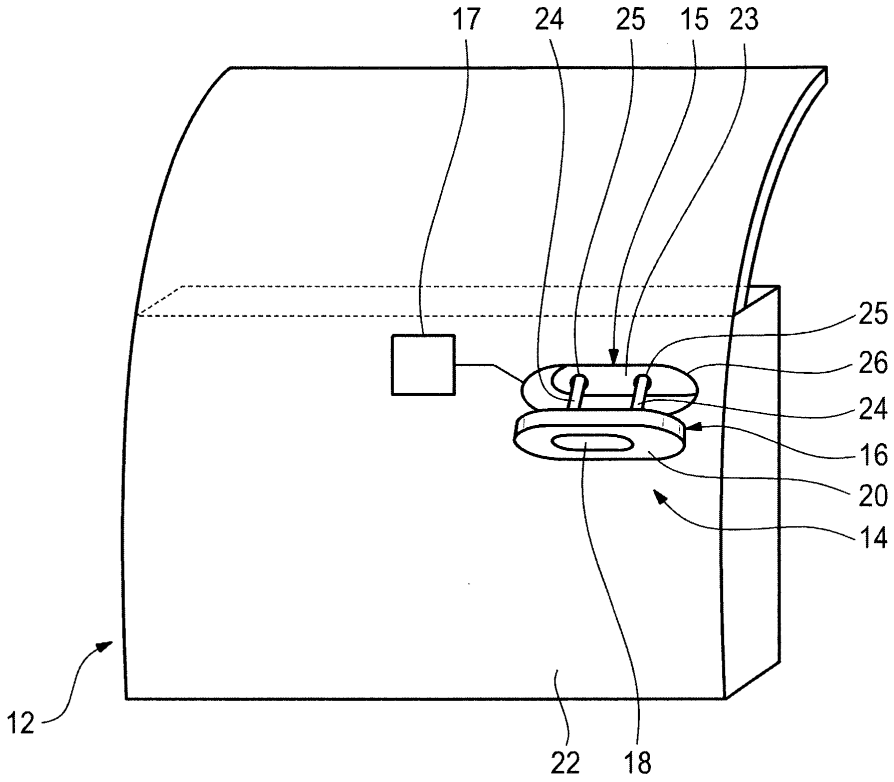

Fig. 3

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Description

[0001] The invention relates to a handle assembly for a vehicle door and to a method for detecting the position of a door handle.

[0002] Door handles for vehicles typically protrude from the vehicle door and may interfere with the aerodynamics and/or the design of the vehicle. For that purpose, extendable door handles have been developed which can be moved from a retracted position in which they are flush with the outer contour of the vehicle, to an extended position of use in which a user can easily grab the handle.

[0003] For proper operation of these handles, it however is essential that a control positively knows in which position the handle currently is. This entails that use of additional micro switches or hall sensors for detecting the position of the handle. These sensors are expensive and require precious space in the handle or in the door structure in the vicinity of the handle.

[0004] The object of the invention is to provide reliable information on the position of the door handle in a manner which is cost effective and space saving.

[0005] For this purpose, the invention provides a handle assembly for a vehicle door, comprising a handle which is movable between a retracted position and an extended position, an evaluation circuit and at least one capacitive sensor arranged at the handle. The evaluation circuit is adapted for detecting the presence of a hand in the vicinity of the sensor and in addition adapted for determining the position of the handle. Furthermore, the object of the invention is achieved by a method for detecting the position of a door handle, in particular of a door handle from the preceding handle assembly, which is movable between a retracted position and an extended position, the method comprising:

a) receiving a signal from a capacitive sensor arranged in the handle,

b) evaluating the signal in order to detect a user hand in the vicinity of the handle,

c) if no user hand is detected, evaluating the signal in order to determine the position of the door handle.

[0006] The invention is based on the basic idea to use the capacitive sensors needed anyhow for the detection of a hand approach or a hand touch of the handle, for also detecting the position of the handle. Thereby, additional micro switches and/or hall sensors are not necessary, and the handle assembly can be built more cost effective and space saving.

[0007] By means of the detection, it can be determined in particular if the door handle is in the retracted or the extended position.

[0008] If desired, intermediate position can however also be detected.

[0009] Advantageously, the capacitive sensor contains no mechanical moving parts and is not subject to wear as it is for example for micro switches. Additionally, a capacitive sensor is less complex that a unit with hall sensor with related magnet and mechanical parts. Therefore, the lifetime of the handle unit is improved.

[0010] According to an embodiment of the invention, provision is made that the capacitive sensor may comprise a copper area on a printed circuit board assembly. Capacitive sensors comprising a copper area on a printed circuit board assembly are very cheap in the production enabling the production of a cost effective handle assembly.

[0011] It may be beneficial to provide a second capacitive sensor to the handle assembly with special shape and position for instance near the edge of the circuit board, which allows better precision for the special purpose of position detection. Consequently, the positions of the handle may be detected more reliably.

[0012] Alternatively, the second sensor could offer additional functionality to the handle assembly if the second sensor is not a capacitive sensor. A finger print sensor could handle, for example, the verification procedure to enter the car and possibly replace the vehicle keys.

[0013] Advantageously, the signal may be evaluated to determine intermediate positions as well. Therefore, additional sensors for detection of intermediate positions for instance, additional micro switches or hall sensors become redundant enabling a cost effective handle assembly.

[0014] According to an embodiment of the invention, provision is made that a signal from a second capacitive sensor may be taken into account in the detection of the different positions. By using all available signals, the resolution of the position detection can be increased and the signals from the different sensors can be mutually verified.

[0015] Advantageously, the first and second capacitive sensors may be used for opening and closing a door lock. As a consequence, additional parts for opening and closing the door lock become redundant.

[0016] Further features and advantages of the invention will be apparent from the following description of two embodiments of the invention with the aid of the enclosed drawings, in which:

- Figure 1 shows a schematic drawing of a car with a handle assembly according to the innovation,
- Figure 2 illustrates a perspective view of the vehicle door of Figure 1 wherein the handle of the handle assembly is in a retracted position,
- Figure 3 shows in perspective view the vehicle door of Figure 1 with the handle of the handle assembly being in an extended position,
- Figure 4 illustrates a perspective view of a second embodiment of the invention.

[0017] It should be understood that figures 1 to 4 are schematic in nature and do not necessarily illustrate the particular appearance or configuration that may be used in the commercial implementation of the invention.

[0018] Figure 1 shows a car 10 with multiple vehicle doors 12 each of which comprises a handle assembly 14.

[0019] A schematic example of the handle assembly 14 is shown in Figure 2. The handle assembly 14 comprises a handle support 15, a handle 16, an evaluation circuit 17, and a capacitive sensor 18 which is located on an outer surface 20 of the handle 16.

[0020] Handle support 15 carries handle 16 and all components (motor, guide for the handle, gear, etc.) necessary for moving handle 16 from the retracted position to the extended position, and vice versa. Further, handle support 15 closes the opening the door structure so that dirt, water, etc. cannot enter into the door. In Figure 2, the handle 16 is shown in a retracted position in which the outer surface 20 of the handle 16 is substantially flush with the outer surface 22 of the vehicle door. As a consequence, capacitive sensor 18 has a small distance from the sheet metal from which defines the outer surface 22 of the vehicle door.

[0021] From the retracted position, handle 16 can be moved into an extended position as shown in figure 3. In the extended position, handle 16 protrudes outwardly from door 12 and from handle support 15 so that it a user can easily grab the handle and open vehicle door 12.

[0022] In the extended position, capacitive sensor 12 has a distance from the outer surface 22 of the vehicle door 12 which is larger than in the retracted position of handle 16.

[0023] In Figure 3, two rods 24 are visible which symbolize the guide for handle 16 and which allow displacing handle 16 between the retracted position and the extended position. The rods 24 extend from handle 16 through apertures 25 in handle support 15 to a drive mechanism which is adapted for displacing handle 16 between the extended and the retracted positions, and vice versa. Details of the drive are not necessary here as the nature of the drive is not necessary for understanding the invention.

[0024] Other types of mounting mechanisms for door handle 16 are feasible as well, e.g. a pivotable mounting mechanism.

[0025] Handle support 15 comprises a cavity 23 which has a contour corresponding to the contour of handle 16. Accordingly, handle 16 snugly fits into cavity 23 in the retracted position

[0026] Displacement of handle 16 from the extended position to the retracted position can be triggered by a signal which indicates that door 12 was closed, by a lapse of a predefined time period since the last actuation, a signal from a keyless go system, etc.

[0027] Displacement of handle 16 from the retracted position to the extended position can be triggered in particular by a signal from capacitive sensor 18 which indicates that a hand is in the vicinity of handle 16 or that handle 16 has been touched. A signal from a keyless go system can be taken into account as well.

[0028] Capacitive sensor 18 here comprises two electrodes realized by copper areas on a printed circuit board assembly. Other types of capacitive sensors can be used as well.

[0029] In a manner known as such, evaluation circuit 17 is able to determine the capacity of capacitive sensor 18 which changes when there is a change of the dielectric constant in the vicinity of capacitive sensor 18. This can be used for detecting whether or not handle 16 was touched by a user or if the hand of a user is approaching handle 16.

[0030] In addition to detection of the change of the dielectric constant caused by body parts of a user approaching capacitive sensor 18, evaluation circuit 17 is able to detect the change of the dielectric constant in the vicinity of capacitive sensor 18 caused by a displacement of handle 16 between the retracted position and the extended position.

[0031] In the retracted position, capacitive sensor 18 is very close to the sheet metal defining the outer structure of vehicle door 12. In the extended position of handle 16, capacitive sensor 12 is at a larger distance from the sheet metal. Thus, there is a notable difference in the capacity of capacitive sensor 18, and evaluation circuit 17 can detect whether door handle 18 is in the retraced position or in and extended position.

[0032] The evaluation circuit 17 is also adapted to detect intermediate positions of door handle 12 between the extracted position and the extended position.

[0033] It is generally possible to integrate more than one capacitive sensor 18 into the outer side of handle 16.

[0034] It is also possible that the evaluation circuit 17 evaluates the capacity between a conductive surface arranged in or at door handle 16, and a conductive surface arranged stationary at vehicle door 12. This could be a dedicated surface associated with handle support 15, or even the sheet metal of door 12.

[0035] In figure 4, a second embodiment of the invention is shown which essentially corresponds to the first embodiment. Therefore, only the differences over the first embodiment are mentioned in the following. Identical and functionally identical components are provided with the same reference numerals.

[0036] The difference over the first embodiment is that in the second embodiment, there is an additional sensor 28 on the inner or outer side of handle 16.

[0037] Advantageously, sensor 28 is an additional capacitive sensor 18 such that the position of the handle can be detected with a higher accuracy.

[0038] In case that the handle assembly 14 comprises at least two capacitive sensors 18, one capacitive sensor 18 could trigger the locking and the other one could trigger the unlocking of the vehicle door 12 in case the evaluation circuit 17 detects the vicinity of a hand and/or a touching of one of the capacitive sensors 18.

[0039] Additionally, the second capacitive sensor 18

could be placed at a position in the handle 16 such that it is only sensitive to the movement of the handle 16 and not to the vicinity of a hand.

[0040] The different features of the two embodiments can be combined with each other in any way. In particular, the features listed as differences to the second embodiment are independent and can also exist in different ways in the first embodiment.

Claims

1. A handle assembly (14) for a vehicle door (12), comprising a handle (16) which is movable between a retracted position and an extended position, and evaluation circuit (17) and at least one capacitive sensor (18) arranged at the handle (16), the evaluation circuit (17) being adapted for detecting the presence of a hand in the vicinity of the sensor and in addition being adapted for determining the position of the handle.

2. The handle assembly (14) of claim 1 wherein the capacitive sensor (18) is completely covered by the material of the handle (16).

3. The handle assembly (14) of any one of the preceding claims wherein the capacitive sensor (18) comprises a copper area on a printed circuit board assembly.

4. The handle assembly (14) of any one of the preceding claims wherein a second sensor (28) is provided.

5. A method for detecting the position of a door handle (16) which is movable between a retracted position and an extended position, in particular of a door handle (16) which is part of the handle assembly (14) as defined in any one of the preceding claims, the method comprising:

    a) receiving a signal from a capacitive sensor (18) arranged in the handle(16),
    b) evaluating the signal in order to detect a user hand in the vicinity of the handle (16),
    c) if no user hand is detected, evaluating the signal in order to determine the position of the door handle (16).

6. The method of claim 5 wherein the signal is evaluated to determine if the door handle is in an extended or in a retracted position.

7. The method of claim 5 or claim 6 wherein the signal is evaluated to determine intermediate positions.

8. The method of any of claims 5 to 7 wherein a signal from a second capacitive sensor (18) is taken into account.

9. The method of claim 8 in the first and second capacitive sensors (18) are also used for opening and closing a door lock.

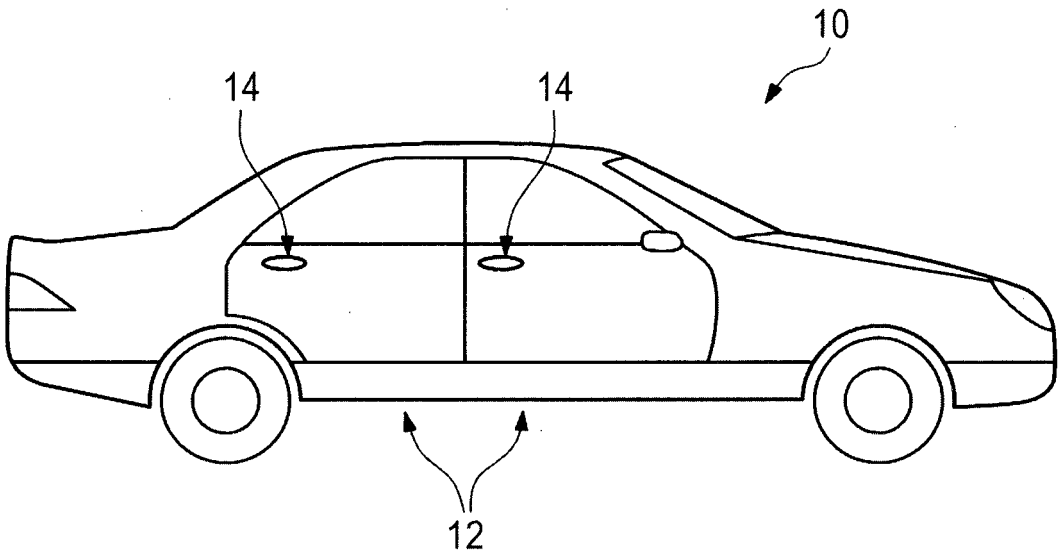

Fig. 1

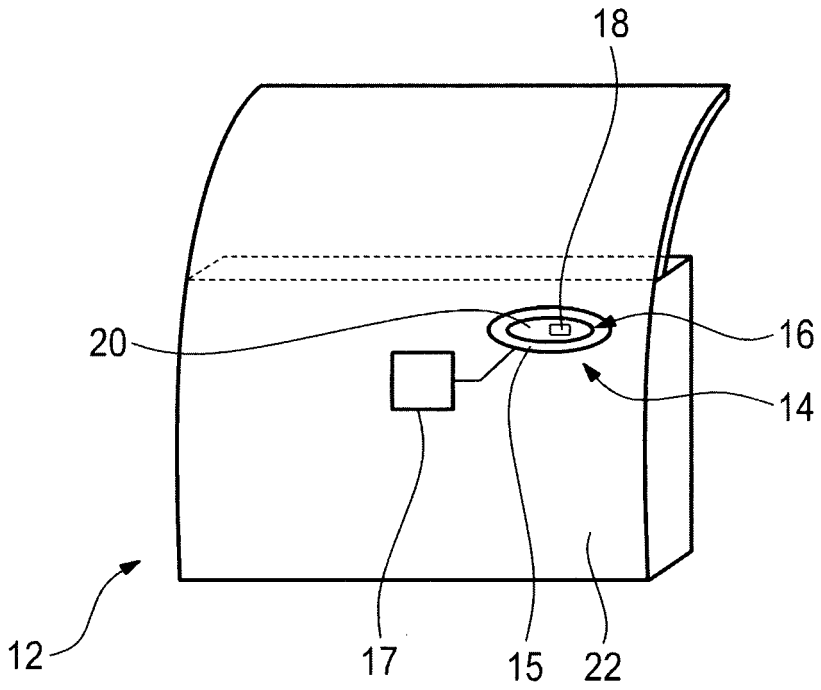

Fig. 2

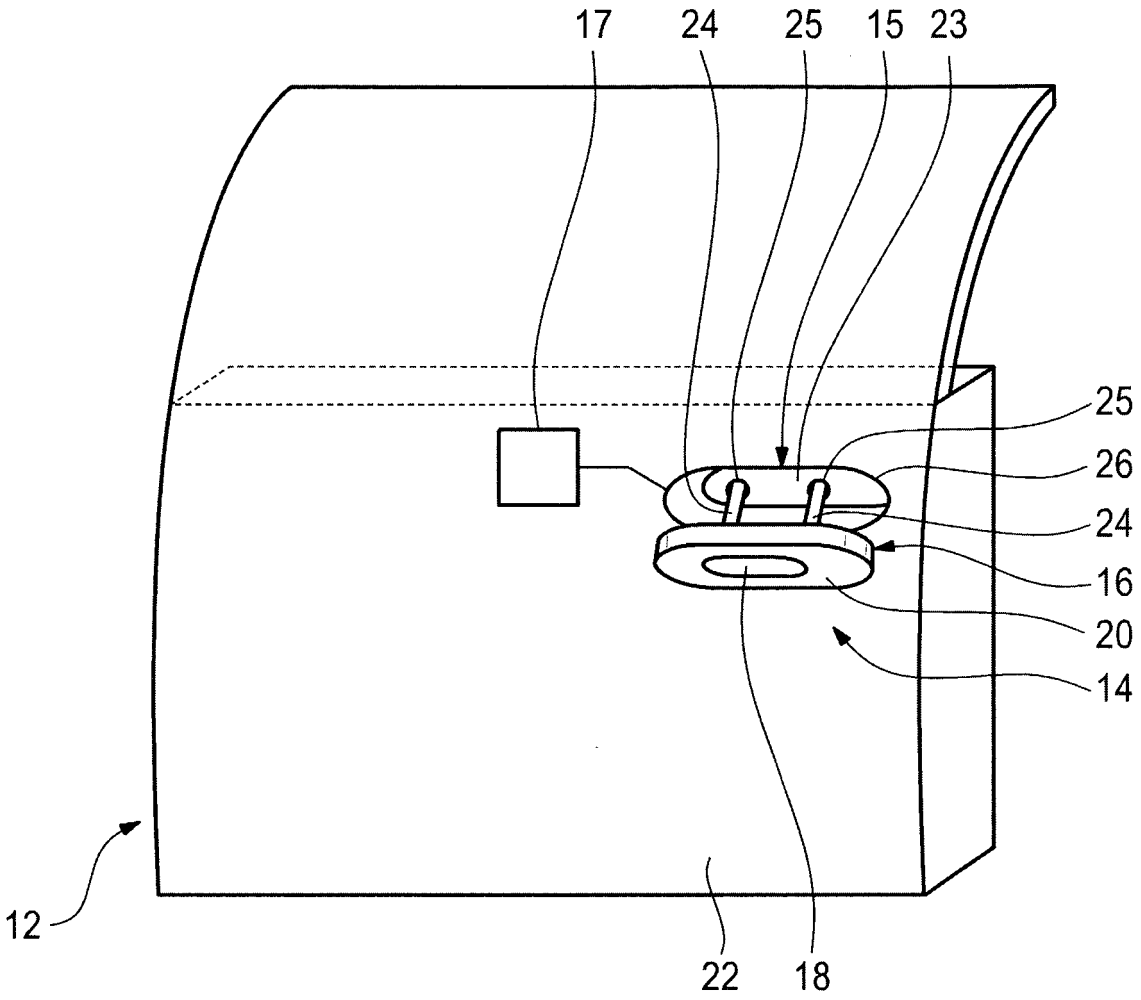

Fig. 3

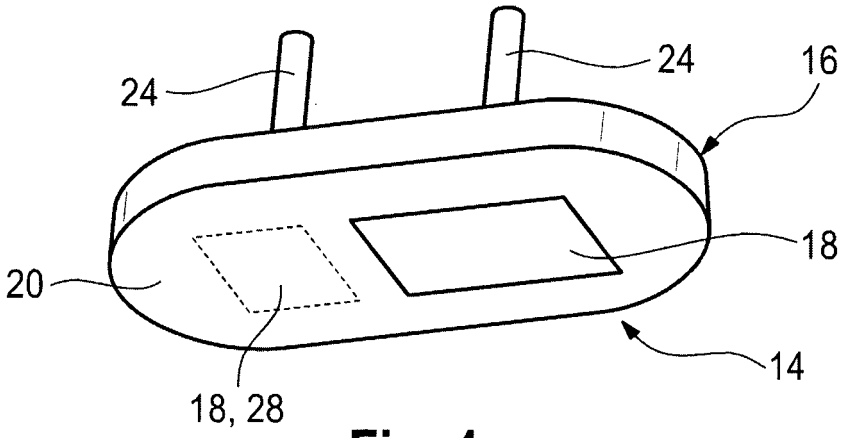

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 20 0755

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2016/222703 A1 (KOIZUMI TAKAAKI [JP] ET AL) 4 August 2016 (2016-08-04) * paragraph [0032] - paragraph [0035] * * paragraph [0057] - paragraph [0061] *	1-9	INV. E05B81/76 ADD. E05B85/10
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A	DE 10 2016 007112 A1 (HUF HÜLSBECK & FÜRST GMBH & CO KG [DE]) 14 December 2017 (2017-12-14) * paragraph [0024]; figure 5 *	1-9	
A	WO 2017/198921 A1 (PSA AUTOMOBILES S A [FR]) 23 November 2017 (2017-11-23) * page 6, line 15 - line 29 *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)

E05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2019	Robelin, Fabrice

CATEGORY OF CITED DOCUMENTS

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