Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

TECHNICAL FIELD

[0001] The present invention relates to a manoeuvring arrangement which comprises a manoeuvring lever and a sensor arrangement for detecting the movements of the manoeuvring lever as described in the preamble of claim 1.

STATE OF THE ART

[0002] In conventional manoeuvring organs, such as gear levers in motor vehicles, the gear lever is in most cases mechanically connected to the system that the gear lever is to control, in other words the gearbox. However, some newer systems have constructions without a mechanical connection between the gear lever and the gearbox, in which case use is made of sensor arrangements for sensing the position and movements of the gear lever in order to be able to act on the gearbox in the desired manner.

[0003] In systems that use sensor arrangements for sensing the position of the gear lever, it is of great importance that the sensor arrangements included in the system are as few in number, and as compact and as inexpensive as possible. In most cases, previously known systems with sensor arrangements make use of a separate sensor arrangement for each direction in which the gear lever can move, or a sensor arrangement for each position in which the gear lever may be located.

[0004] US patent 4 987 792 discloses an example of a solution of the latter type, with one sensor arrangement for each position the gear lever can assume. It may be considered to be a disadvantage of such a solution that it is relatively expensive and also that it takes up a relatively large area. It may moreover be considered to be a further disadvantage of such a solution that further sensor arrangements must be provided if it is desired to have information on the position of the gear lever while gear-shifting movement is taking place.

[0005] Document EP 620 385 A1, which comprises the features mentioned in the preamble of claim 1, discloses a manoeuvring arrangement with a detector arrangement in the bottom of the manoeuvring arrangement. A disadvantage of this manoeuvring arrangement is that its extent in the direction of the manoeuvring lever is increased because of the positioning of the detector arrangement, which counteracts the desire for the arrangement as a whole to be of as compact and space-saving design as possible.

[0006] Document US 5 243 871 discloses an arrangement in which a code arrangement and a detector plate are arranged at the side of the manoeuvring lever and in the wall of the manoeuvring console respectively, which in other words provides a compact solution compared with the arrangement in EP 620 385. However, a disadvantage of the arrangement according to US 5 243

SUMMARY OF THE INVENTION

[0007] The aim of the present invention is therefore to produce a manoeuvring arrangement with a compact and inexpensive sensor arrangement for detecting different positions of the manoeuvring lever, which manoeuvring arrangement can be used in, for example, gearboxes in motor vehicles.

[0008] The manoeuvring arrangement is also to have reduced requirements for sensitivity compared with previously known arrangements, and also to be less susceptible to disturbances than previously known arrangements.

[0009] These objects are achieved by means of a manoeuvring arrangement as described in claim 1.

DESCRIPTION OF THE DRAWINGS

[0010] The invention will be described in greater detail below with the aid of an example of a preferred embodiment and also with reference to the appended drawings, in which

Fig. 1 shows diagrammatically a cross-section from the side of the present invention, and

Fig. 2 shows diagrammatically a direction of movement of a code arrangement according to the invention, and

Fig. 3 shows diagrammatically from above the available movement patterns of the gear lever in a preferred embodiment of the invention, and

Fig. 4 shows diagrammatically a direction of movement of a code arrangement according to the invention, and

Fig. 5 shows the code arrangement and the sensor arrangement according to the invention, and

Fig. 6 illustrates the principle of the interaction of the code arrangement with the sensor arrangement, and

Fig. 7 shows a preferred embodiment of the code arrangement according to the invention, and

Fig. 8 shows an example of a code table for use in
the invention, and

Fig. 9 shows an exploded view of a preferred embodiment of the invention, and

Fig 10 and 11 show the principle of movement of a code arrangement according to the invention.

PREFERRED EMBODIMENTS

[0011] Fig. 1 shows a cross-section of a manoeuvring arrangement 100 according to the invention. The manoeuvring arrangement 100 in Fig. 1 is intended to be used for controlling gear positions in a vehicle. The manoeuvring arrangement 100 comprises a manoeuvring console 101 which, in this embodiment, encloses at least part of the manoeuvring arrangement 100. For the sake of clarity, only a relatively small part of the manoeuvring console 101 is shown.

[0012] The manoeuvring arrangement 100 also comprises a manoeuvring lever 103, in this embodiment a gear lever, which is mounted pivotably about a pivot joint 105 in the form of a ball, by means of which pivot joint 105 the gear lever 103 can be moved relative to the manoeuvring console 101 in the direction shown by the arrow 1, and also in another corresponding curved movement essentially at right angles to the curved movement defined by the arrow 1. In that part of the wall of the console 101 which is shown in Fig. 1, there is a sensor arrangement 107, in this case a detector board which is provided with four sensors 109 for reasons that will become clear below.

[0013] The manoeuvring arrangement 100 in the exemplary embodiment shown also comprises a plate 111 which is intended to move when the gear lever 103 moves, and in so doing to interact with the detector board 107 in a manner that will be described in greater detail below. The plate 111 is connected to the gear lever 103 via a frame 113, a pin 115 and a plate spring 117. In a preferred embodiment, both the detector board 107 and the plate 111 are plane and parallel to one another.

[0014] So as to ensure that the plate 111 moves with the movements of the gear lever 103, the plate 111 is, as mentioned above, connected to the frame 113 of the gear lever 103 via a pin 115 which engages in an opening in the plate 111. The pin 115 runs in a groove (not shown) in the console wall 101, and is biased in the direction towards the console wall 101 by means of a spring element 119.

[0015] The plate 111 is also connected to the frame 113 by means of a plate spring 117. This plate spring 117 holds the plate 111 in the same plane as the detector board 107 and engages in the plate 111 but not in the console wall 101, which is shown diagrammatically by the connection 121.

[0016] This connection 121 can be made in a great many ways, for example by the plate spring 117 engaging in a recess in the plate 111 or, in a preferred embodiment, by means of a pin which engages in an opening in the plate 111 without engaging in the console wall 101.

[0017] One of the directions of movement that are possible with the gear lever 103 is shown by the arrow 1 in Fig. 1. When the gear lever 103 moves according to the arrow 1, the plate 111 will move along the console wall 101, over the detector board 107, in the direction shown by the arrow 1', on account of the pin 115 running in a groove (not shown) in the direction of the arrow 1' in the console wall 101 and in doing so taking the plate 111 with it in this direction of movement. It will be understood that the reason why the pin 115 is biased in the direction towards the console wall 101 is to ensure that the pin 115 remains in the groove (not shown) during its movement according to the arrow 1'.

[0018] The essentially two-dimensional movement of the gear lever 103 in the direction of the arrow 1 is thus converted into an essentially one-dimensional movement of the plate 111 in the direction of the arrow 1'.

[0019] Fig. 2 shows the outline of the plate 111, its direction of movement 1' during movement of the gear lever according to the arrow 1, and also a number of different positions that the plate 111 can assume during movement in the direction of movement 1'. Fig. 2 also shows the opening in the plate 111, in which the pin 115 engages, and also, an imaginary centre line 202 in the plate 111.

[0020] Fig. 3 shows diagrammatically from above the available positions that the gear lever 103 according to the invention can assume in this exemplary embodiment, and also grooves in the manoeuvring console, in which the gear lever 103 can be moved so as to reach its different positions.

[0021] As can be seen in Fig. 3, the gear lever 103 in the preferred embodiment has six positions, designated below as R, N, D, - , + and M, where the positions - and + correspond to upshifting and downshifting respectively in a manual mode in an automatic gearbox, M is a resting position between + and - , N is the neutral position, D corresponds to the drive position in an automatic gearbox and R is the reverse position.

[0022] As can also be seen in Fig. 3, the embodiment of the invention shown comprises three essentially longitudinal grooves 323, 325, 327 for the movements of the gear lever 103 and also an essentially transverse groove 329 for movement of the gear lever 103.

[0023] The arrow 1 shows the same movement as in Fig. 1 but seen from above, and corresponds to the gear lever 103 moving in the transverse groove 329. The movement of the gear lever 103 in the three longitudinal grooves 323, 325, 327 is shown by the arrow 2. It is to be understood that the movement that the gear lever 103 performs in the longitudinal grooves and that shown by the arrow 2 is a curved movement like the movement shown by the arrow 1 in Fig. 1, and also that the two curved movements defined by the arrows 1 and 2 are essentially at right angles to one another.

[0024] With reference to the above, it will be under-
stood that, when the gear lever 103 moves according to the arrow 1, the plate 111 will, on account of the engagement of the pin 115 in the opening in the plate 111, move in the direction of the arrow '1' and, when the gear lever 103 moves according to the arrow 2, the plate 111 will rotate about the pin 115 in the direction of movement of the arrow 2. This rotational movement of the plate 111 occurs because the pin 115 engages in the plate 111 and in the console wall 101 and thus constitutes an axis of rotation for the plate 111, and also because the plate spring 117 causes the plate 111 to rotate about this axis of rotation as the plate spring 117 is connected to the plate 111 via the connection 121.

Therefore, during movement of the gear lever 103 according to the arrow 2, the plate 111 will move in a circular arc over a surface that coincides with the plane defined by the plane detector board 107. In this way, in other words, it has been possible to convert all the movements of the gear lever 103 into movements of the plate 111 in essentially one plane. It is to be pointed out that the noun "plane" used above and below relates to an essentially two-dimensional area, which in different embodiments of the present invention may have different shapes, for example plane or curved.

When the main direction of movement of the gear lever 103 is according to the arrow 2, the gear lever 103 is located in one of the longitudinal grooves 323, 325, 327 that are shown in Fig. 3. Depending on which of the longitudinal grooves 323, 325, 327 the gear lever 103 is located in, the abovementioned circular arc will have a radius of different size because the pin 115 will assume different positions in the direction of the arrow '1'. In the exemplary embodiment, three longitudinal grooves are shown and, consequently, there will be three different radii for this circular arc.

The principle of the rotation of the plate 111 in a circular arc during movement of the gear lever 103 according to the arrow 2 is shown in Fig. 4. Fig. 4 shows the outline of the plate 111, an imaginary centre line 202 in this outline, and also, by a dashed line, the circular arc along which a given point x on the plate 111 will move during movement of the gear lever 103 according to the arrow 2.

Fig. 4 also shows the three different positions according to the arrow '1' that the pin 115 - and thus the plate 111 - can assume in the exemplary embodiment. In this way, it will be understood that the point x on the plate 111, like every point on the plate 111, will be able to move along three different circular arcs, depending on which of the longitudinal grooves 323, 325, 327 the gear lever 103 is located in.

Fig. 5 shows the plate 111, the imaginary centre line 202 of the plate 111, the point x on the plate 111 and also, located behind the plate 111, the detector board 107 which in the example is provided with four sensors 109, designated below as A, B, C and D. Dashed lines show the outer positions that the imaginary centre line 202 of the plate 111 can assume during its rotation about the pin 115, which outer positions correspond to the two positions of the gear lever 103 located furthest from one another, the positions "R" and "+" in the example shown. As the area that the imaginary centre line 202 of the plate 111 covers during movement between its outer positions forms a circular segment, the suitability of designing the plate 111 as a circular segment with a size adapted to the abovementioned area will be understood.

The principles of the interaction according to the invention of the plate 111 with the detector board 107 will now be clear, and are shown in Fig. 6. Fig. 6 shows the plate 111 in the position that corresponds to the gear lever 103 being in the "R" position. The detector board 1.07 is arranged in a fixed manner in the console wall 101, for which reason the detector board 107 and its sensors are in the same position as in Fig. 5. As can be seen in the drawing, the point x on the plate 111 is now in front of sensor B.

As the plate 111 moves with the movements of the gear lever 103, and each of the positions of the gear lever 103 corresponds to a unique position of the plate 111 relative to the detector board 107, detection of the positions of the gear lever 103 can take place by the plate 111 being provided with a suitable coding which can be detected by the detector board 107. In this way, the plate 111 becomes a code plate.

In a preferred embodiment, the sensors A, B, C, D in the detector board 107 are so-called Hall sensors, which can detect variations in magnetic fields. In this embodiment, the plate 111 is suitably a magnetized plastic plate, the whole plate 111 being magnetized as a "south pole", except for certain of the regions on the plate 111 which will end up in front of the sensors A, B, C, D in the different positions of the gear lever 103. These regions are then magnetized as a "north pole".

In the example shown, four sensors are used, which means that the detector board 107 will be able to produce a four-digit binary code, where "0" of a sensor corresponds to a "south pole" on the code plate 111 and "1" of a sensor corresponds to a "north pole" on the code plate 111.

As can be seen in Fig. 6, the point x on the plate 111 ends up in front of sensor B when the gear lever 103 is in the "R" position. The point x has been magnetized as a "north pole", and the remainder of the plate 111 is a "south pole", which, in other words, means that the code that is detected by the detector board 107 in the "R" position of the gear lever 103 becomes A=0, B=1, C=0, D=0.

Correspondingly, "north poles" are magnetized in regions of the code plate 111 that correspond to the other positions of the gear lever 103. The "north poles" are introduced in such a manner that the desired code is produced for each of the positions of the gear lever 103. Arbitrary codes may of course be used, the only requirement for the code being that it is unique, although a suitable code in this connection is the so-called
Gray code, which means that only one position in the four-figure binary code is changed when the gear lever 103 is moved between two closely-situated positions. Fig. 7 shows a code plate 111 according to the invention coded in this way, with an imaginary centre line 202.

Some of the "north poles" on the code plate in Fig. 7 consist of relatively large continuous regions. This is due to the abovementioned principle of only changing one figure at a time in the code. Some of the Hall sensors in the detector board 107 will then be covered by "north poles" in a number of successive positions, for which reason the positions on the code plate 111 corresponding to these positions have been connected and formed into a larger, continuous "north pole".

Fig. 8 shows an example of a complete code table according to the invention for all the positions of the gear lever 103. Not all the codes in the table are used in the example.

Fig. 9 shows a more detailed exploded view of a preferred embodiment of a manoeuvring arrangement 100 according to the invention. The reference numbers in Fig. 9 correspond to those in Fig. 1. Fig. 9 also shows in greater detail how the pin 115 is designed and how it interacts with the code arrangement 111. As indicated in Fig. 9, and as will be described in greater detail below, the pin 115 is designed in such a manner that that part 990 of the pin which is in mechanical contact with the plate 111 is shaped like a slice from an imaginary sphere. Those parts of the plate 111 which come into mechanical contact with this part of the pin 115 are in turn shaped like the inside of a corresponding imaginary sphere.

As has been mentioned previously in this description, the pin 115 runs in a groove (not shown) in the console wall. In order to facilitate the movement of the pin in the groove, at least that part 980 of the pin which runs in the groove is designed as a narrower part that projects from the centre of that part 990 of the pin which comes into mechanical contact with the plate 111. This is also shown in Fig. 9. In principle, however, the whole of the imaginary sphere could be included in the pin 115.

Fig. 10 shows in greater detail the principle of the interaction of the pin 115 with the code plate 111. As has been described previously, that part 990 of the pin 115 which comes into mechanical contact with the plate 111 is shaped like a slice from an imaginary sphere 935, which is shown by dashed lines. The end point 980 of the pin 115 is shaped like part of a smaller sphere 985 which is also shown by dashed lines. The pivoting axis 920 for the movements of the plate 111 passes through the centre of this smaller sphere, at right angles to the plate 111. It is advantageous to design the arrangement so that the centre of the smaller sphere constitutes the point of intersection of the two pivoting axes 910, 920 during all movements and in all positions of the gear lever 103.

The direction in which the pin 115 has its main extension coincides with the pivoting axis 910 of the lever 103. In a preferred embodiment, as shown in Fig. 10, the pivoting axis 910 of the lever 103 passes through the centre of the pin 115 in the longitudinal direction of the pin.

When the manoeuvring lever 103 is in the position shown in Fig. 10, the pivoting axis 910 of the lever 103 coincides with the pivoting axis 920 for the movements of the plate.

Fig. 11 shows the interaction of the pin 115 with the code plate 111 when the gear lever 103 is in a different position to that shown in Fig. 10. The spherical design of that surface 925 in the plate 111 which comes into mechanical contact with the pin 115 can also be seen in Fig. 11.

In the position of the lever 103 shown in Fig. 11, the plate 111 has been moved in the direction indicated by the arrow 1'. Irrespective of this, the pivoting axis 920 for the movements of the plate 111 will be at right angles to the plate, which applies for all the movements and shifts the plate 111 can perform.

The second element 121 that plays a part in the movements of the plate is parallel to the pivoting axis 910 of the gear lever 103 during all movements of the gear lever 103.

By virtue of the spherical design of those parts of the pin 115 and the plate 111 which come into mechanical contact with one another, the angle of the element 117 relative to the pivoting axis 910 of the manoeuvring lever 103, and also the fact that the pivoting axis 920 for the movements of the plate 111 is at right angles to the plane of movement of the plate, all movements and shifts of the plate 111 take place in one plane.

The invention is not limited to the embodiment described above, but may be freely varied within the scope of the appended patent claims. The sensor principle that is used does not, for example, need to be Hall sensors and a magnetized code plate, but may be arbitrary interacting code members and sensors, for example a light-emitting or light-permeable plate together with light-sensitive sensors.

The principle described above can of course be used in gear levers with more or fewer gear positions than those shown above. The principle described above can also be used in applications of manoeuvring levers that are quite different to gear levers for motor vehicles, for example steering levers for various types of vehicle and craft.

The principle described above for converting the movements of the gear lever into movement in two dimensions of the code arrangement can of course be achieved in a number of alternative ways. One possible alternative is, for example, the code arrangement moving in tracks in the manoeuvring console, which could replace the pin.

In an alternative embodiment according to the invention, the code plate can also be given codes for positions that correspond to the gear lever being located between any of the gear positions. In this way, informa-
tion can be obtained about the gear lever undergoing shifting, and the direction of such shifting.

Claims

1. Manoeuvring arrangement (100) comprising a manoeuvring console (101), a manoeuvring lever (103) which is movable between a number of predetermined positions in first (1) and second (2) curved movements, said two movements being perpendicular to each other, a code arrangement (111) and a detector arrangement (107) with which the code arrangement (111) is adapted to interact, whereby:

the manoeuvring arrangement (100) comprises means (113, 115, 119, 117, 121) of converting all movements of the manoeuvring lever (103) into movements of the code arrangement (111) over a surface in such a manner that the first curved movement of the manoeuvring lever is converted into a movement in a first direction, the detector arrangement (107) comprises means (109) of detecting the positions of the code arrangement (111) over said surface, the detector arrangement (107) is plane and arranged in a wall in the manoeuvring console (101), the code arrangement (111) is plane, arranged parallel to the detector arrangement (107), and performs all its movements essentially in one plane,

characterized in that the means of converting all movements of the manoeuvring lever into movements of the code arrangement over a surface convert the second curved movement into a rotational movement about an axis.

2. Manoeuvring arrangement (100) according to claim 1, characterized in that the means of converting all the movements of the manoeuvring lever (103) into movements of the code arrangement (111) over a surface comprise at least one frame (113) arranged in association with the manoeuvring lever (103), at least one biased pin (115) arranged on this frame (113), which pin (115) engages in an opening in the code arrangement (111) and runs in a groove in the manoeuvring console (101), and also at least one plate spring (117) arranged in association with the frame (113), which plate spring (117) engages in the code arrangement (111).

3. Manoeuvring arrangement (100) according to either of claims 1 and 2, characterized in that the detector arrangement (107) comprises Hall elements (109) and also in that the code arrangement (111) consists of a plate with magnetized regions.

4. Use of a manoeuvring arrangement (100) according to any one of the preceding claims as a gear lever in a motor vehicle.

Patentansprüche

1. Manövriervorrichtung (100), umfassend eine Manövrierkonsole (101), einen Manövrierhebel (103), der zwischen einer Anzahl vorbestimmter Positionen in einer ersten (1) und einer zweiten (2) gekrümmten Bewegung bewegbar ist, wobei die beiden Bewegungen senkrecht zueinander sind, eine Codevorrichtung (111) und eine Detektorvorrichtung (107), mit der die Codevorrichtung (111) zusammenwirkend ausgelegt ist, wobei:

- die Manövriervorrichtung (100) eine Einrichtung (113, 115, 119, 117, 121) zum Umwandeln aller Bewegungen des Manövrierhebels (103) in Bewegungen der Codevorrichtung (111) über eine Fläche auf solche Weise, dass die erste gekrümmte Bewegung des Manövrierhebels in eine Bewegung in einer ersten Richtung umgewandelt wird, aufweist,

- die Detektorvorrichtung (107) eine Einrichtung (109) zum Detektieren der Positionen der Codevorrichtung (111) über die Fläche aufweist,

- die Detektorvorrichtung (107) eben ist und in einer Wand der Manövrierkonsole (101) angeordnet ist,

- die Codevorrichtung (111) eben ist, parallel zu der Detektorvorrichtung (107) angeordnet ist, und alle ihre Bewegungen im wesentlichen in einer Ebene ausführt, dadurch gekennzeichnet, dass die Einrichtung zum Umwandeln aller Bewegungen des Manövrierhebels (103) in Bewegungen der Codevorrichtung (111) über eine Fläche die zweite gekrümmte Bewegung in eine Rotationsbewegung um eine Achse umwandelt.

2. Manövriervorrichtung (100) nach Anspruch 1, dadurch gekennzeichnet, dass die Einrichtung zum Umwandeln aller Bewegungen des Manövrierhebels (103) in Bewegungen der Codevorrichtung (111) über eine Fläche mindestens einen Rahmen (113) aufweist, der in Verknüpfung mit dem Manövrierhebel (103) angeordnet ist, mindestens einen vorgespannten Stift (115) aufweist, der an diesem Rahmen (113) angeordnet ist, der in einer Nut in der Manövrierkonsole (101) läuft,
und ebenso mindestens eine Blattfeder (117) aufweist, die in Verknüpfung mit dem Rahmen (113) angeordnet ist, welche Blattfeder (117) in die Codevorrichtung (111) eingreift.

3. Manövriervorrichtung (100) nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Detektorvorrichtung (107) Hall-Elemente (109) aufweist, und dass die Codevorrichtung (111) aus einer Platte mit magnetisierten Regionen besteht.

4. Verwendung einer Manövriervorrichtung (100) nach einem der vorhergehenden Ansprüche als Schalthebel in einem Motorfahrzeug.

Revendications

1. Agencement de manoeuvre (100) comportant une console de manoeuvre (101), un levier de manoeuvre (103) qui est mobile entre plusieurs positions prédéterminées dans des premier (1) et deuxième (2) mouvements courbes, lesdits deux mouvements étant perpendiculaires l’un à l’autre, un agencement de code (111) et un agencement de détecteur (107) avec lequel l’agencement de code (111) est prévu pour interagir, de sorte que :

- l’agencement de manoeuvre (100) comporte des moyens (113, 115, 119, 117, 121) de conversion de tous les mouvements du levier de manoeuvre (103) en mouvements de l’agencement de code (111) sur une surface d’une manière telle que le premier mouvement courbe du levier de manoeuvre est converti en un mouvement dans une première direction,
- l’agencement de détecteur (107) comprend des moyens (109) de détection des positions de l’agencement de code (111) sur ladite surface,
- l’agencement de détecteur (107) est plan et disposé dans une paroi de la console de manoeuvre (101),
- l’agencement de code (111) est plan, disposé parallèlement à l’agencement de détecteur (107), et réalise tous ses mouvements essentiellement dans un plan,

caractérisé en ce que les moyens de conversion de tous les mouvements du levier de manoeuvre en mouvements de l’agencement de code sur une surface convertissent le deuxième mouvement courbe en un mouvement de rotation autour d’un axe.

2. Agencement de manoeuvre (100) selon la revendication 1, caractérisé en ce que les moyens de conversion de tous les mouvements du levier de manoeuvre (103) en mouvements de l’agencement de code (111) sur une surface comporte au moins un cadre (113) disposé en association avec le levier de manoeuvre (103), au moins un axe rappelé (115) disposé sur ce cadre (113), lequel axe (115) s’engage dans une ouverture dans l’agencement de code (111) et se déplace dans une rainure dans la console de manoeuvre (101), et également au moins un ressort à lame (117) disposé en association avec le cadre (113), lequel ressort à lame (117) s’étendant dans l’agencement de code (111).

3. Agencement de manoeuvre (100) selon l’une des revendications 1 et 2, caractérisé en ce que l’agencement de détecteur (107) comprend des éléments à effet Hall (109) et également en ce que l’agencement de code (111) se compose d’une plaque avec des zones magnétisées.

4. Utilisation d’un agencement de manoeuvre (100) selon l’une quelconque des revendications précédentes comme levier de vitesses dans un véhicule à moteur.
<table>
<thead>
<tr>
<th>D</th>
<th>C</th>
<th>B</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*FIG. 8*