



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**26.07.2000 Bulletin 2000/30**

(51) Int Cl.7: **E01F 13/12**

(21) Application number: **99402587.2**

(22) Date of filing: **20.10.1999**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU**  
**MC NL PT SE**  
 Designated Extension States:  
**AL LT LV MK RO SI**

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(30) Priority: **22.01.1999 JP 1436199**  
**22.01.1999 JP 1446199**

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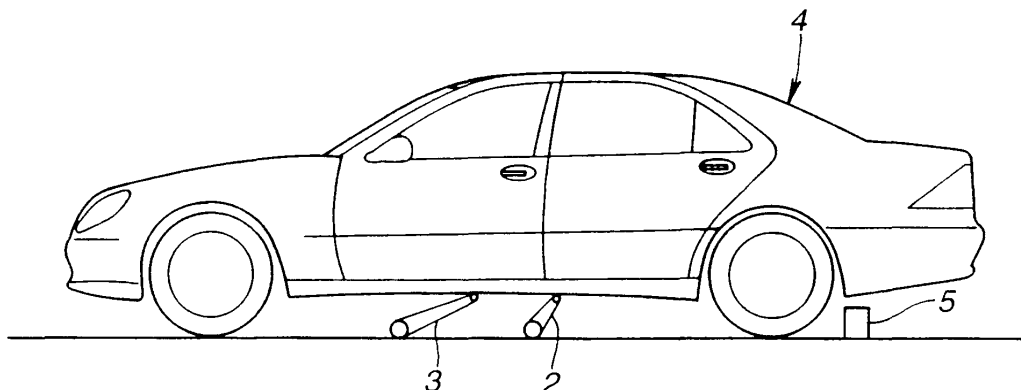
(54) **Unattended parking apparatus**

(57) An unattended parking apparatus comprising a stopper plate which is moved upwardly towards the bottom surface of a vehicle accessed to a predetermined parking position and which is moved downwardly after the bill has been settled to permit departure of the vehicle, said unattended parking apparatus comprising :

- a plurality of stopper plates (2, 3) disposed one behind the other in a direction parallel to the longitudinal axis of the vehicle

- a hydraulic circuit including a plurality of hydraulic cylinders which are operated by a hydraulic pressure source, each hydraulic cylinder being arranged to operate upward and downward movements of a stopper plate, and
- a relief mechanism arranged to relieve the pressure in each hydraulic cylinder when a load which is exerted on said stopper plates is greater than a predetermined value

**FIG.2**



## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

**[0001]** The present invention relates to an unattended parking apparatus, and more particularly to a mechanism for operating a stopper plate which can upwards be moved toward the bottom surface of a vehicle which is parked at a predetermined position.

#### Description of the Related Art

**[0002]** It is a known fact that an unattended parking apparatus incorporates a stopper plate which can upwards/downwards be moved with respect to the bottom surface of a vehicle. The stopper plate is upwards moved toward the bottom surface of the vehicle parked at a predetermined position to maintain a state in which the vehicle cannot be departed from the predetermined position. After the bill has been settled, the stopper plate is moved downwards to permit the vehicle to be departed.

**[0003]** Fig. 7 is a schematic view showing an example of the conventional unattended parking apparatus. Referring to Fig. 7, an unattended parking apparatus P incorporates a wheel-stopping block P1 disposed at a predetermined position in a parking area; and a stopper plate P2 disposed between front wheels or rear wheels which are positioned by the wheel-stopping block P1 and opposite wheels, the stopper plate P2 being a plate which can upwards/downwards be moved.

**[0004]** The stopper plate P2 is upwards moved in a direction in which the stopper plate P2 is brought into contact with the bottom surface of the vehicle V introduced into the parking area. After bill has been settled by operating an accounting machine, departure of the vehicle V is permitted. As an inverse motion preventing mechanism for preventing unintentional downward movement of the stopper plate P2 with small force owing to, for example, depression with the foot or the like, a ratchet method, a feed-screw method or a method using a worm gear has been employed.

**[0005]** The foregoing conventional unattended parking apparatus which employs the mechanical operating method, however, suffers from the following problems. That is, the conventional unattended parking apparatus has been an apparatus unsatisfactory for a person who runs or manages the unattended parking apparatus from an economical viewpoint.

**[0006]** The reason for this lies in that some persons attempt to perform departure of the vehicle without no settlement of the bill. Since a single stopper plate is usually employed in the unattended parking apparatus of the foregoing type, getting over the single stopper enables the person who drives the vehicle to steal parking. Since a single stopper plate P2 is usually employed, the

width (indicated with symbol S shown in Fig. 7) of the stopper plate P2 sometime gives the impression that the wheels are able to get over the stopper plate P2. It leads to a fact that steal of a parking occurs. If the width (S) is too small, access of, for example, a four-wheel drive vehicle, having a large road clearance encounters a fact that the distance from the leading end of the stopper plate P2 to the bottom surface of the vehicle is elongated. Hence it follows that the impression is given that the wheels are able to easily get over the stopper plate P2. If the width is too large, an angle of the upward position is reduced in a case of a vehicle having a small road clearance. The angle is made closer to a horizontal direction. Also in the foregoing case, the impression is given that the wheels are able to easily get over the stopper plate P2. It might be feasible to employ a structure that the stopper plate P2 is disposed at a position in front of the position at which the vehicle is parked, as indicated with a dashed line shown in Fig. 7. In the foregoing case, an attempt is made to prevent giving the impression that the wheels are able to easily get over the stopper plate P2 if the distance from the bottom surface of the vehicle to the leading end of the stopper plate P2 is too short. In the foregoing case, there arises a multiplicity of problems in that the stopper plate P2 disposed in front of the vehicle frequently obstructs passing of the other vehicles. Therefore, a person who runs the unattended parking apparatus cannot collect valid tolls.

**[0007]** If the foregoing mechanical operating method is adapted to an unattended parking area having a multiplicity of parking spaces, a plurality of the mechanical operating apparatuses must independently be provided. Therefore, administration of each of the mechanical operating apparatuses becomes too complicated. Also sources for operating the mechanical operating apparatuses must be provided by the number corresponding to the number of the mechanical operating apparatuses. Thus, there arises a problem in that the cost cannot be reduced. Therefore, the foregoing unattended parking apparatus is unsatisfactory from an economical viewpoint.

**[0008]** If the settlement of the bill is performed after a person except for the person who settles the bill takes ride in the vehicle or a heavy luggage is loaded, the road clearance of the vehicle is changed. Thus, exertion of an excessively heavy load on the leading end of the stopper plate P2 which is made contact with the bottom surface of the vehicle inhibits downward movement of the stopper plate P2.

### SUMMARY OF THE INVENTION

**[0009]** In view of the foregoing, an object of the present invention is to provide an unattended parking apparatus with which an economical advantage can be obtained by employing a structure arranged not to give an impression that the vehicle is able to easily get over a stopper plate thereof and capable of preventing un-

lawful getting over of the vehicle over the stopper plate owing to the impression or by employing a structure capable of smoothly operating a plurality of parking apparatuses disposed in an unattended parking area having a multiplicity of parking spaces with sources for operating the parking apparatuses by a number smaller than the number of the parking apparatuses and with which maintenance and inspection can significantly easily be performed and the running cost can considerably be reduced.

**[0010]** Another object of the present invention is to provide an unattended parking apparatus structured such that the stopper plate can be moved upwards/downwards regardless of change in the road clearance of the bottom surface of the vehicle or the operating load of a safety unit corresponding to the weight of the vehicle which exerts on the stopper plate can be changed to prevent breakage of the stopper plate and realize easy handling.

**[0011]** According to one aspect of the present invention, there is provided an unattended parking apparatus incorporating a stopper plate which is upwards moved toward the bottom surface of a vehicle accessed to a predetermined position to downwards move the stopper plate after the bill has been settled to permit departure of the vehicle, the unattended parking apparatus being characterized by: a plurality of the stopper plates disposed in a direction in which the vehicle moves. Since the plurality of the stopper plates are disposed in the direction in which the vehicle is moved, an undesirable fact that the distance from the bottom surface of the vehicle is elongated excessively can be prevented. Thus, departure of the vehicle before settlement can reliably be prevented. Hence it follows that an economical loss for a person who runs the unattended parking apparatus can be prevented.

**[0012]** According to another aspect of the present invention, there is provided an unattended parking apparatus incorporating a stopper plate which is upwards moved toward the bottom surface of a vehicle accessed to a predetermined position to downwards move the stopper plate after the bill has been settled to permit departure of the vehicle, the unattended parking apparatus being characterized by: a hydraulic circuit incorporating a hydraulic cylinder which is operated by a hydraulic pressure source and arranged to operate the stopper plate such that upward/downward movement of the stopper is permitted; and a relief mechanism provided for the hydraulic circuit and arranged to relieve oil in the hydraulic cylinder when a load which is exerted on the stopper plate is greater than a predetermined value. If a plurality of parking apparatuses are disposed in a unattended parking area having a multiplicity of parking spaces, the parking apparatuses can smoothly be operated with operation sources the number of which is smaller than the number of the parking apparatuses. If an excessively heavy load is exerted on the stopper plate, damage of the hydraulic cylinder can safely be

prevented. If the stopper plate is brought into contact with the bottom surface of the vehicle and thus reaction from the bottom surface of the vehicle acts on the hydraulic cylinder, movement of the stopper plate toward the bottom surface of the vehicle can be prevented. Thus, damage of the bottom surface of the vehicle can be prevented. Hence it follows that an economical loss for a person who runs the unattended parking apparatus can be prevented.

**[0013]** According to another aspect of the present invention, at least one stopper plate of the plural stopper plates has a radius of upward/downward movement which is different from radii of upward/downward movement of the other stopper plates. Therefore, the foregoing aspect is able to prevent occurrence of a fact that the distance from the bottom surface of the vehicle can be prevented. Thus, departure of the vehicle before settlement can reliably be prevented.

**[0014]** According to another aspect of the present invention, the stopper plates are arranged such that downward movement of one of the upward-movement stopper plates causes the other stopper plates to synchronously and upwards be moved. The foregoing aspect is structured such that downward movement of any one of the stopper plates which are at upward positions causes the other stopper plates to upwards be moved. Therefore, if the stopper plate is moved downward owing to getting over of a wheel or the like, the parking state can be maintained by the other stopper plate until settlement is completed. Therefore, unlawful departure of the vehicle can reliably be prevented.

**[0015]** According to another aspect of the present invention, the stopper plate is operated such that upward/downward movement of the stopper is permitted by a hydraulic circuit incorporating a hydraulic cylinder which is operated by a hydraulic pressure source, and the hydraulic circuit is provided with a relief mechanism arranged to relieve oil in the hydraulic cylinder when a load which is exerted on the stopper plate is greater than a predetermined value. Therefore, if a plurality of parking apparatuses are disposed in a unattended parking area having a multiplicity of parking spaces, the parking apparatuses can smoothly be operated with operation sources the number of which is smaller than the number of the parking apparatuses. If an excessively heavy load is exerted on the stopper plate, damage of the hydraulic cylinder can safely be prevented. If the stopper plate is brought into contact with the bottom surface of the vehicle and thus reaction from the bottom surface of the vehicle acts on the hydraulic cylinder, movement of the stopper plate toward the bottom surface of the vehicle can be prevented. Thus, damage of the bottom surface of the vehicle can be prevented.

**[0016]** According to another aspect of the present invention, the relief mechanism has a structure that precise adjustment of the relief pressure is permitted. Therefore, if an excessively heavy load is exerted on the stopper plate, damage of the hydraulic cylinder can

safely be prevented. If the stopper plate is brought into contact with the bottom surface of the vehicle and thus reaction from the bottom surface of the vehicle acts on the hydraulic cylinder, movement of the stopper plate toward the bottom surface of the vehicle can be prevented. Thus, damage of the bottom surface of the vehicle can be prevented. Although the foregoing effect can be obtained if the relief mechanism has not the function capable of precisely adjusting the relief pressure, the foregoing effect can be obtained. If the relief pressure can precisely be adjusted, the foregoing effect can furthermore be improved.

**[0017]** According to another aspect of the present invention, the hydraulic pressure supply source is able to switch a direction in which oil is supplied to the hydraulic cylinder when a direction of operation of the hydraulic-pressure supply source is switched. Therefore, any costly switch valve or the like is not required to control upward/downward movement of the stopper plate with a simple structure.

**[0018]** According to another aspect of the present invention, the hydraulic circuit is provided with oil passages allowed to communicate with a rod-extending oil chamber and a rod-contracting oil chamber of the hydraulic cylinder, and each of the oil passages is provided with first and second pilot check valves which can be opened/closed owing to pilot pressure which is the pressure in a discharge-side oil passage in the operation directions of the hydraulic-pressure supply source. Therefore, oil discharged from the hydraulic pressure source can effectively be supplied to the hydraulic cylinder. Moreover, introduction of oil into the suction side of the hydraulic pressure supply source can smoothly be performed. As a result, wanting of oil which must be sucked into the hydraulic pressure supply source does not occur. Therefore, damage of the hydraulic pressure supply source caused from enlargement of the sucking load can be prevented.

**[0019]** According to another aspect of the present invention, the hydraulic circuit is provided with a third pilot check valve for refluxing oil from the oil chamber which upwards moves the stopper plate with respect to the suction side of the hydraulic-pressure supply source to the hydraulic-pressure supply source, and the third pilot check valve can be opened when the hydraulic pressure is a level set to the relief mechanism and the pressure on the oil discharge side of the hydraulic-pressure supply source after the hydraulic-pressure supply source has been shifted to a direction in which the stopper plate is moved downwards is not higher than the cracking pressure of the second pilot check valve. The third pilot check valve disposed in the oil passage allowed to communicate with the oil chamber of the hydraulic cylinder for upwards moving the stopper plate is able to prevent counterflow of oil supplied to the oil chamber for upwards moving the stopper plate. Thus, the upward position of the stopper plate can be maintained. If the hydraulic pressure supply source has been operated to

downward move the stopper plate, opening can be performed if the pressure is not higher than the set pressure for the relief mechanism. Thus, refluxing of oil from the oil chamber of the hydraulic cylinder for upwards moving the stopper plate to the hydraulic pressure supply source is permitted. Therefore, a portion of oil which is sucked by the hydraulic pressure supply source can be compensated by refluxed oil from the hydraulic cylinder.

**[0020]** According to another aspect of the present invention, the hydraulic cylinder is provided with a limit sensor disposed to be movable in a direction in which a rod is extended/contracted and arranged to detect movement of the rod to a predetermined position in the extending/contracting direction, and the limit sensor controls the operation of the hydraulic-pressure supply source.

**[0021]** According to another aspect of the present invention, the hydraulic cylinder is provided with an elastic member disposed between a head portion of a rod opposite to the projection portion of the rod and a stationary portion opposite to the head portion, and the position of the hydraulic cylinder moved owing to reaction exerted from the rod portion against urging force of the elastic member is detected so that the operation of the hydraulic-pressure supply source is interrupted.

**[0022]** The displacement of the hydraulic cylinder is detected to control the operation of the hydraulic pressure supply source. Therefore, contact of the stopper plate with the bottom surface of the vehicle and exertion of the reaction from the bottom surface of the vehicle on the hydraulic cylinder are used to prevent excessive upward movement of the stopper plate can be prevented. Therefore, engagement of the stopper plate to the bottom surface of the vehicle can be prevented. Hence it follows that damage of the bottom surface of the vehicle can be prevented.

**[0023]** Other objects, features and advantages of the invention will be evident from the following detailed description of the preferred embodiments described in conjunction with the attached drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

##### **[0024]**

Fig. 1 is a hydraulic circuit diagram showing an essential structure of an unattended parking apparatus according to a first embodiment of the present invention;

Fig. 2 is a schematic view showing an example of a state of the operation of the unattended parking apparatus shown in Fig. 1;

Fig. 3 is a perspective view showing a structure for supporting a stopper plate of the unattended parking apparatus shown in Fig. 1;

Fig. 4 is a diagram showing the structure of a hydraulic cylinder of a portion for operating the stopper plate shown in Fig. 3, in which Fig. 4 (A) is a plan

view and Fig. 4 (B) is a diagram taken in a direction indicated with a symbol B shown in Fig. 4 (A);

Fig. 5 is a hydraulic circuit diagram showing an essential structure of an unattended parking apparatus according to a second embodiment of the present invention;

Fig. 6 is a schematic view showing an example of a state of the operation of the unattended parking apparatus shown in Fig. 5; and

Fig. 7 is a schematic view showing the structure of a conventional unattended parking apparatus.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0025]** An embodiment of the present invention will now be described with reference to the drawings. Figs. 1 to 4 shows an unattended parking apparatus according to a first embodiment of the present invention. Referring to Fig. 1, the unattended parking apparatus 1 incorporates a plurality of first and second stopper plates 2 and 3 disposed in a direction in which a vehicle is moved on the ground of a parking area, that is, between front and rear wheels in the longitudinal direction of the vehicle. The first and second stopper plates 2 and 3 are able to move upwards/downwards.

**[0026]** As shown in Fig. 2, the first and second stopper plates 2 and 3 have different widths corresponding to the movable radii in the direction of the movement of the vehicle 4 when the first and second stopper plates 2 and 3 are upwards/downwards moved. In this embodiment, the first stopper plate 2 which is a front stopper plate in the direction in which the direction toward the unattended parking apparatus 1 has a width smaller than the width of the second stopper plate 3 which is the rear stopper plate in the direction of the movement. Referring to Fig. 2, reference numeral 5 represents a curb 5 for stopping the wheels.

**[0027]** Fig. 3 is a diagram bowing the structure of either of the first and second stopper plates 2 and 3 (the first stopper plate 2 will now be described for convenience). Referring to Fig. 3, the first stopper plate 2 has a base portion integrally formed with a support shaft 6. The support shaft 6 is rotatively supported by a bearing member 8 of a base plate 7 so that the first stopper plate 2 can upwards/downwards be moved such that the base portion serves as the fulcrum. A swingable lever 9 is formed integrally with an end of the support shaft 6. A rod 10A of a hydraulic cylinder 10 which is expanded/contracted by a hydraulic circuit to be described later is connected to a swingable end of the swingable lever 9. The moving direction according to this embodiment will now be described. When the rod 10A of the hydraulic cylinder 10 is expanded, the swingable lever 9 is swung in a direction in which the first and second stopper plate 2 and 3 are upwards moved. When the rod 10A is contracted, the swingable lever 9 is swung in a direction in which the first and second stopper plates 2 and 3 are

downwards moved.

**[0028]** An end of the cylinder 10B of the hydraulic cylinder 10, that is, an end (hereinafter called a "head side end") of the cylinder 10B opposite to a position to which the rod 10A projects is joined by a hinge owing to the structure shown in Fig. 4. Referring to Fig. 4, the head side end of the hydraulic cylinder 10 incorporates a bracket 11 formed integrally with an end portion thereof. A hinge shaft 13 inserted into a support member 12 secured to the base plate 7 such that the support member 12 is stood erect is inserted into the bracket 11. Thus, the hydraulic cylinder 10 is able to swing such that the hinge shaft 13 serves as the fulcrum.

**[0029]** An insertion hole 12A formed in the support member 12 in order to permit insertion of the hinge shaft 13 has the inner diameter in a direction running parallel with the direction in which the rod 10A is expanded/contracted, the inner diameter being larger than the outer diameter of the hinge shaft 13, as shown in Fig. 4 (B). Hence it follows that the hinge shaft 13 can be moved in the insertion hole 12A in the expanding/contracting direction of the rod 10A. Usually, the hinge shaft 13 is, at the head side end of the hydraulic cylinder 10, made contact with the inner surface of the insertion hole 12A in the direction in which the rod 10A is expanded by a pressing member 14 capable of exerting urging force owing to a spring 14A thereof.

**[0030]** The hinge shaft 13 is brought into contact with the inner surface of the insertion hole 12A. in the contracting direction in a case where a load is exerted on the stopper plate 2 (3) which is being upwards moved from a direction opposite to the expanding direction. In this embodiment, the foregoing contact is made when the leading end of the stopper plate has been brought into contact with the bottom surface of the vehicle. When the first and second stopper plates 2 and 3 are upwards moved in synchronization with the expansion of the rod 10A of the hydraulic cylinder 10 and the leading ends of the first and second stopper plates 2 and 3 have been brought into contact with the bottom surface of the vehicle, reaction caused from the weight of the vehicle is exerted. Therefore, the pressure in the oil chamber for expanding the rod 10A to which oil has been supplied is raised. Thus, the hydraulic cylinder 10 is moved in a direction in which the reaction is exerted. When the hydraulic cylinder 10 is moved in a direction opposite to the direction in which the rod 10A is expanded, also the hinge shaft 13 disposed at the head side end is moved in the same direction. Thus, the hinge shaft 13 is brought into contact with the inner surface of the insertion hole 12A in the contracting direction.

**[0031]** The hydraulic cylinder 10 is provided with a structure for detecting movement of the expanded rod 10A in the contracting direction. Referring to Fig. 4. an actuator of a limit switch 15 secured to the support member 12 is, at the head side end of the hydraulic cylinder 10, disposed opposite to the outer surface at the end of the hinge shaft 13. Thus, the actuator is operated by the

hinge shaft 13 which has been moved in the contracting direction. Another limit switch 15 (given reference numeral 15' for convenience) is disposed at an end of the cylinder 10B of the hydraulic cylinder 10 adjacent to the rod 10A as well as the above-mentioned position. Thus, the limit switch 15' can be operated by the rod 10A at the contracted position.

**[0032]** The limit switches 15 and 15' are switches for setting timing at which supply of oil to the hydraulic cylinder 10 is interrupted. When the limit switches 15 and 15' have been operated, the operation of an operating motor 23 (see Fig. 1) of an oil pump 22 (see Fig. 1) provided for a hydraulic circuit to be described later is interrupted.

**[0033]** As shown in Fig. 4, a stopper block 16 with which the swingable lever 9 collides at the limit positions of upward movement of each of the first and second stopper plates 2 and 3 is disposed adjacent to the base portion of the swingable lever 9. The swingable lever 9 collides with the stopper block 16 immediately before the rod 10A of the hydraulic cylinder 10 is completely expanded or slightly before the complete expansion so as to prevent furthermore upward movement of the first and second stopper plates 2 and 3. After the swingable lever 9 has been allowed to collide with the stopper block 16, movement of the hydraulic cylinder 10 is inhibited.

**[0034]** Supply/interruption of the supply of oil to the hydraulic cylinder 10 is controlled by the hydraulic circuit shown in Fig. 1. The hydraulic cylinder will now be described. Note that the hydraulic cylinder for upwards/downwards moving the first stopper plate 2 is called a first hydraulic cylinder 10 and the hydraulic cylinder for upwards/downwards moving the second stopper plate 3 is called a second hydraulic cylinder 10'. The expansion strokes of the rod 10A of the first and second hydraulic cylinders 10 and 10' are made to be strokes with which an upward angle which causes substantially the same upward movement heights to be obtained to correspond to the different swinging radii between the first and second stopper plates 2 and 3.

**[0035]** Referring to Fig. 1, the rod expanding chambers (given symbols A and A' for convenience) and the rod contracting chambers (given symbols B and B' for convenience) of the first and second hydraulic cylinders 10 and 10' are collectively connected to one another through oil passages 18 and 19 allowed to communicate with an oil tank 17. In the oil passages 18 and 19, first and second pilot check valves 20 and 21 are disposed which are capable of permitting flow of oil to the oil tank 17 and which are arranged to control opening/closing of the other pilot check valves such that the pressure of the other hydraulic passage is used as the pilot pressure. An oil pump 22 for setting the oil discharge direction to be a forwards/reverse direction is connected to the oil passages 18 and 19. The oil pump 22 is able to suck/discharge oil to and from the oil tank 17 in synchronization with the operating motor 23 which can be rotated forwards/rearwards.

**[0036]** In this embodiment, clockwise rotations of the operating motor 23 cause the oil pump 22 to allow oil to flow into the discharge portion (a position in the oil passage 18 shown in Fig. 1 and indicated with symbol R) communicated with the oil passage 18. The counterclockwise rotations of the operating motor 23 cause the oil pump 22 to allow oil to flow into the discharge portion (a position in the oil passage 19 shown in Fig. 1 and indicated with symbol L) communicated with the oil passage 19. Therefore, when the operating motor 23 has clockwise been rotated, oil is discharged from the oil pump 22 to the oil passage 18. The discharge pressure opens the second pilot check valve 21. When the operating motor 23 has counterclockwise been rotated, oil is discharged from the oil pump 22 to the oil passage 19. The discharge pressure opens the first pilot check valve 20.

**[0037]** The first and second pilot check valves 20 and 21 have set cracking pressure with which opening is permitted with the discharge pressure realized when the operation of the oil pump 22 has been started. Hence it follows that enlargement of the rotation load of the operating motor 23 occurring when the limit switches 15 and 15' have been broken or when the detection operation has not been performed can be prevented.

**[0038]** The oil passage 18 allowed to communicate with rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' is provided with a relief valve 24 which is a relief mechanism, the set pressure of which can be varied. When the pressure in the rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' has excessively been raised, oil discharged from the rod expanding oil chambers (A and A') is discharged to a drain means. The pressure in the rod expanding oil chambers (A and A') is raised excessively when the first and second stopper plates 2 and 3 have upwards been moved. If a multiplicity of persons take ride in the vehicle or if the vehicle gets over the first and second stopper plates 2 and 3, the weight of the vehicle is exerted on the first and second stopper plates 2 and 3. Thus, the rod 10A is moved in the contracting direction so that the pressure in each of the rod expanding oil chambers (A and A') is raised.

**[0039]** Therefore, if the excessively high pressure is exerted on the rod expanding oil chambers (A and A') of the hydraulic cylinder, oil in the rod expanding oil chambers (A and A') is discharged. Thus, breakage of the first and second stopper plates 2 and 3 and that of the first and second hydraulic cylinders 10 and 10' can be prevented. The opening pressure of the relief valve 24 can be changed by a spring 24A. Therefore, the pressure permissible for the first and second hydraulic cylinders 10 and 10' to receive can be adjusted to prevent breakage of the first and second hydraulic cylinders 10 and 10'. Moreover, a third pilot check valve 25 is provided for the oil passage 18 as well as the relief valve 24. When the first and second stopper plates 2 and 3 have

downwards been moved, the third pilot check valve 25 is able to release the pressure in the oil passage 19 which corresponds to the oil passage on the oil discharge side (a state in which oil flows to a position indicated with symbol L) of the oil pump 22, the pressure being discharged as the pilot pressure. If the pressure is the set level at which the relief valve 24 is opened, the third pilot check valve 25 is opened at a pressure not higher than the cracking pressure of the second pilot check valve 21, the pilot pressure of which is the pressure of the oil passage 19.

**[0040]** On the other hand, the oil passage 19 is provided with a check valve 26 which is capable of supplying oil to rod contracting oil chambers (B and B') of the first and second hydraulic cylinders 10 and 10'. When oil in the rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' has been discharged through the relief valve 24, the capacity of each of the rod contracting oil chambers (B and B') of the first and second hydraulic cylinders 10 and 10' is enlarged in synchronization with the movement of the rod 10A. Thus, oil in the rod contracting oil chambers (B and B') becomes insufficient and thus a negative pressure state is realized. The check valve 26 is able to prevent the foregoing phenomenon.

**[0041]** The operation of the unattended parking apparatus structured as described above and according to this embodiment will now be described.

**[0042]** If no vehicle 4 is introduced into the parking area, downward positions of the first and second stopper plates 2 and 3 are maintained. At this time, the first and second hydraulic cylinders 10 and 10' have returned the rod 10A to the contracted position. The foregoing state is detected by the limit switch 15' (see Fig. 4). Thus, the operating motor 23 is stopped. As a result, supply of oil from the oil pump 22 is inhibited. If the vehicle 4 is introduced into the parking area, a vehicle detecting sensor (not shown) disposed on the base plate is operated so that the operating motor 23 is rotated clockwise.

**[0043]** Referring to Fig. 1, when the operating motor 23 has clockwise been rotated, oil is discharged from the oil pump 22 to the oil passage 18. The discharge pressure opens the second pilot check valve 21. As a result, oil sucking into the oil pump 22 is continued. Thus, oil is supplied to the rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' through the oil passage 18. Hence it follows that the rod 10A is expanded so that the swingable lever 9 connected to the rod 10A is swung in the upward movement direction. Therefore, the first and second stopper plates 2 and 3 are moved upwards.

**[0044]** As described above, the first and second stopper plates 2 and 3 according to this embodiment have different radii of movement. The upward angles of the first and second stopper plates 2 and 3 are made to be different from each other. Therefore, the distance from the leading end of each of the first and second stopper

plates 2 and 3 to the bottom surface of the vehicle is not elongated. As a result, the impression that the wheels are able to get over the first and second stopper plates 2 and 3 is not given. When the movable ends of the first and second stopper plates 2 and 3 have been brought into contact with the bottom surface of the vehicle, reaction from the bottom surface of the vehicle is exerted on the rod 10A. Thus, the pressure in the rod expanding oil chambers (A and A') is raised. Therefore, the first and second hydraulic cylinders 10 and 10' are moved in a direction opposite to the direction in which the rod is extended. At this time, the positions, to which the first and second hydraulic cylinders 10 and 10' have been moved in the direction in which the rod is contracted against the urging force of the pressing member 14, are detected by the limit switch 15 (see Fig. 4). Therefore, the rotation of the operating motor 23 is interrupted through the limit switch 15. As a result, the first and second stopper plates 2 and 3 do not exert excessively large contact force on the bottom surface of the vehicle. Thus, engagement of the first and second stopper plates 2 and 3 to the bottom surface of the vehicle can be prevented.

**[0045]** When the first and second stopper plates 2 and 3 have upwards been moved, upward movement of the swingable lever 9 greater than a maximum upward movement angle is inhibited by the stopper block 16 (see Fig. 4). Therefore, the leading ends of the first and second stopper plates 2 and 3 can be positioned apart from the bottom surface of the vehicle for a predetermined distance if the first and second stopper plates 2 and 3 are not made contact with the bottom surface of the vehicle. Therefore, the wheels cannot get over the first and second stopper plates 2 and 3.

**[0046]** The rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' are collected by the oil passage 18. The rod contracting oil chambers (B and B') are collected by the oil passage 19. If the first stopper plate 2 of the first and second stopper plates 2 and 3 which have upwards been moved is moved downwards, oil in the rod expanding oil chamber (A) of the hydraulic cylinder 10 corresponding to the first stopper plate 2 which has downwards been moved is introduced into the rod expanding oil chamber (A') of the other hydraulic cylinder 10'. Therefore, the pressure in the rod expanding oil chamber (A') of the other hydraulic cylinder 10' is raised. As a result, if only the first stopper plate 2 of the two first and second stopper plates 2 and 3 is moved downwards before settling, that is, before the downward movement is performed by the hydraulic cylinder, the angle of upward movement of the second stopper plate 3, the upward movement of which is set by the other hydraulic cylinder 10', can be enlarged if oil is not supplied from the oil pump. As a result, unlawful departure of the vehicle before settlement can reliably be prevented.

**[0047]** After settlement has been completed, the operating motor 23 is rotated counterclockwise, causing oil to be discharged from the oil pump 22 to the oil pas-

sage 19. After oil has been discharged from the oil pump 22 to the oil passage 19, the pressure of the oil passage 19 opens the second and third pilot check valves 21 and 25. After the third pilot check valve 25 has been opened, a refluxing passage for oil is formed from the rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' to the oil tank 17. Therefore, oil discharged from the oil pump 22 is introduced into the rod contracting oil chambers (B and B') of the first and second hydraulic cylinders 10 and 10'. Hence it follows that the rod 10A is contracted and moved so that oil is discharged from the rod expanding oil chambers (A and A') toward the oil tank 17. Thus, the first and second stopper plates 2 and 3 are moved downwards until the rod 10A is detected by the limit switch 15'. When the returned position of the rod 10A has been detected by the limit switch 15' and, therefore, the rotation of the operating motor 23 has been interrupted, departure of the vehicle is permitted.

**[0048]** When departure of the vehicle 4 is performed, when a person except for a person who settles the bill takes ride in the vehicle 4 or when a heavy luggage has been loaded, the road clearance of the vehicle 4 is inevitably enlarged. Thus, an excessively heavy load is sometimes exerted on the first and second stopper plates 2 and 3 which have upwards been moved. In the foregoing case, the rod 10A arranged to be operated in synchronization with the first and second stopper plates 2 and 3 is moved in the contracting direction. After the rod 10A has been moved in the contracting direction and, therefore, the pressure in the rod expanding oil chambers (A and A') of the first and second hydraulic cylinders 10 and 10' has been raised, oil is discharged through the relief valve 24 provided for the oil passage 18. Moreover, oil is supplied to the rod contracting oil chambers (B and B') through the relief valve 24. Therefore, a fact that the pressure in the rod contracting oil chambers (B and B') is made to be negative pressure can be prevented. Thus, enlargement of the load in the first and second hydraulic cylinders 10 and 10' can be prevented. Hence it follows that the first and second stopper plates 2 and 3 can smoothly be swung in the downward direction. As a result, breakage of the first and second hydraulic cylinders 10 and 10' owing to enlargement of the load can be prevented.

**[0049]** As described above, the unattended parking apparatus according to this embodiment is able to control the upward/downward movement of the first and second stopper plates 2 and 3 by simply switching the oil discharge direction from the oil pump 22 by switching the rotational direction of the operating motor 23. Therefore, the necessity of providing a costly direction switch valve or the like having a special structure can be eliminated. As a result, the cost can considerably be reduced. Moreover, the position, to which the rod 10A of the hydraulic cylinder 10 is expanded, is limited by the stopper block 16 as well as the limit switch 15. Therefore, if the stopper plate is not made contact with the

bottom surface of the vehicle, the limit of the upward movement of the stopper plate can be set to an angle with which the impression that the wheels are able to get over the stopper plates is not given. Therefore unlawful departure of the vehicle before settlement can reliably be prevented.

**[0050]** Figs. 5 and 6 show a second embodiment of the present invention. Elements similar to those according to the first embodiment are given the same reference numerals and the description of the same is omitted or simplified. A structure for supporting the stopper plate 2 and that of a hydraulic cylinder 10 provided for the portion for operating the stopper plate 2 are similar to those shown in Figs. 3 and 4. Therefore, illustration of the foregoing structures is omitted and a reference to Figs. 3 and 4 is performed. Referring to Fig. 5, the unattended parking apparatus 1 incorporates a stopper plate 2 disposed in a direction in which a vehicle 4 is moved on the ground of a parking area, that is, between front and rear wheels in the longitudinal direction of the parking vehicle. The stopper plate 2 is able to move upwards/downwards. As shown in Fig. 6, the stopper plate 2 is disposed to be capable of moving upwards/downwards between the front wheels and the rear wheels. The width of the stopper plate 2, that is, the radius of the upward/downward movement of the stopper plate 2 is slightly larger than a road clearance of a usual vehicle.

**[0051]** In the hydraulic circuit shown in Fig. 5, supply/interruption of the supply of oil to the hydraulic cylinder 10 is controlled as follows: a rod-expanding oil chamber A and a rod-contracting oil chamber B of the hydraulic cylinder 10 are connected through oil passages 18 and 19 allowed to communicate with the oil tank 17. In the oil passages 18 and 19, first and second pilot check valves 20 and 21 are disposed which are capable of permitting flow of oil to the oil tank 17 and which are arranged to control opening/closing of the other pilot check valves such that the pressure of the other hydraulic passage is used as the pilot pressure. An oil pump 22 for setting the oil discharge direction to be a forwards/reverse direction is connected to the oil passages 18 and 19. The oil pump 22 is able to suck/discharge oil to and from the oil tank 17 in synchronization with the operating motor 23 which can be rotated forwards/rearwards.

**[0052]** Similarly to the first embodiment, this embodiment has a structure that the clockwise rotations of the operating motor 23 cause the oil pump 22 to allow oil to flow into the discharge portion (a position in the oil passage 18 shown in Fig. 5 and indicated with symbol R) communicated with the oil passage 18. The counter-clockwise rotations of the operating motor 23 cause the oil pump 22 to allow oil to flow into the discharge portion (a position in the oil passage 19 shown in Fig. 5 and indicated with symbol L) communicated with the oil passage 19. Therefore, when the operating motor 23 has clockwise been rotated, oil is discharged from the oil pump 22 to the oil passage 18. The discharge pressure

opens the second pilot check valve 21. When the operating motor 23 has counterclockwise been rotated, oil is discharged from the oil pump 22 to the oil passage 19. The discharge pressure opens the first pilot check valve 20.

**[0053]** The first and second pilot check valves 20 and 21 have set cracking pressure with which opening is permitted with the discharge pressure realized when the operation of the oil pump 22 has been started. Hence it follows that enlargement of the rotation load of the operating motor 23 occurring when the limit switches 15 and 15' have been broken or when the detection operation has not been performed can be prevented. The oil passage 18 allowed to communicate with the rod expanding oil chamber A of the hydraulic cylinder 10 is provided with a relief valve 24 which is a relief mechanism, the set pressure of which can be varied. When the pressure in the rod expanding oil chamber A of the hydraulic cylinder 10 has excessively been raised, oil discharged from the rod expanding oil chamber A is discharged to a drain means.

**[0054]** The pressure in the rod expanding oil chamber A is raised excessively when the stopper plate 2 has upwards been moved. If a multiplicity of persons take ride in the vehicle or if the vehicle get over the stopper plate 2, the weight of the vehicle is exerted on the stopper plate 2. Thus, the rod 10A is moved in the contracting direction so that the pressure in the rod expanding oil chamber A is raised. Therefore, if the excessively high pressure is exerted on the rod expanding oil chamber A of the hydraulic cylinder, oil in the rod expanding oil chamber A is discharged. Thus, breakage of the stopper plate 2 and that of the hydraulic cylinder 10 can be prevented.

**[0055]** The opening pressure of the relief valve 24 can be changed by a spring 24A. Therefore, the pressure permissible for the hydraulic cylinder 10 to receive can be adjusted to prevent breakage of the hydraulic cylinder 10. Moreover, a third pilot check valve 25 is provided for the oil passage 18 as well as the relief valve 24. When stopper plate 2 has downwards been moved, the third pilot check valve 25 is able to release the pressure in the oil passage 19 which corresponds to the oil passage on the oil discharge side (a state in which oil flows to a position indicated with symbol L) of the oil pump 22, the pressure being discharged as the pilot pressure. If the pressure is the set level at which the relief valve 24 is opened, the third pilot check valve 25 is opened at a pressure not higher than the cracking pressure of the second pilot check valve 21, the pilot pressure of which is the pressure of the oil passage 19.

**[0056]** On the other hand, the oil passage 19 is provided with a check valve 26 which is capable of supplying oil to the rod contracting oil chambers B of the hydraulic cylinder 10. When oil in the rod expanding oil chamber A of the hydraulic cylinder 10 has been discharged through the relief valve 24, the capacity of the rod contracting oil chamber B of the hydraulic cylinder

10 is enlarged in synchronization with the movement of the rod 10A. Thus, oil in the rod contracting oil chamber B becomes insufficient and thus a negative pressure state is realized. The check valve 26 is able to prevent the foregoing phenomenon.

**[0057]** The operation of the unattended parking apparatus structured as described above and according to this embodiment will now be described.

**[0058]** If no vehicle 4 is introduced into the parking area, downward position of the stopper plate 2 maintained. At this time, the hydraulic cylinder 10 has returned the rod 10A to the contracted position. The foregoing state is detected by the limit switch 15' (see Fig. 4). Thus, the operating motor 23 is stopped. As a result, supply of oil from the oil pump 22 is inhibited. If a vehicle is introduced, a vehicle detecting sensor (not shown) disposed on the base plate 7 is operated so that the operating motor 23 is rotated clockwise.

**[0059]** Referring to Fig. 5, when the operating motor 23 has clockwise been rotated, oil is discharged from the oil pump 22 to the oil passage 18. The discharge pressure opens the second pilot check valve 21. As a result, suction of oil into the oil pump 22 is continued. Thus, oil is supplied to the rod expanding oil chamber A of the hydraulic cylinder 10 through the oil passage 18. Hence it follows that the rod 10A is expanded so that the swingable lever 9 connected to the rod 10A is swung in the upward movement direction. Therefore, the stopper plate 2 is moved upwards. When the movable end of the stopper plate 2 has been brought into contact with the bottom surface of the vehicle, reaction from the bottom surface of the vehicle is exerted on the rod 10A. Thus, the pressure in the rod expanding oil chamber A is raised. Therefore, the hydraulic cylinder 10 is moved in a direction opposite to the direction in which the rod is extended. At this time, the position to which the hydraulic cylinder 10 has been moved in the direction in which the rod is contracted against the urging force of the pressing member 14 is detected by the limit switch 15 (see Fig. 4). Therefore, the rotation of the operating motor 23 is interrupted through the limit switch 15. As a result, the stopper plate 2 does not exert excessively large contact force on the bottom surface of the vehicle. Thus, engagement of the stopper plate 2 to the bottom surface of the vehicle can be prevented.

**[0060]** When the stopper plate 2 has upwards been moved, upward movement of the swingable lever 9 greater than a maximum upward movement angle is inhibited by the stopper block 16 (see Fig. 4). Therefore, the leading end of the stopper plate 2 can be positioned apart from the bottom surface of the vehicle for a predetermined distance if the stopper plate 2 is not made contact with the bottom surface of the vehicle. Therefore, the wheels cannot get over the stopper plate 2.

**[0061]** After settlement has been completed, the operating motor 23 is rotated counterclockwise, causing oil to be discharged from the oil pump 22 to the oil passage 19. After oil has been discharged from the oil pump

22 to the oil passage 19, the pressure of the oil passage 19 opens the second and third pilot check valves 21 and 25. After the third pilot check valve 25 has been opened, a refluxing passage for oil is formed from the rod expanding oil chamber A of the hydraulic cylinder 10 to the oil tank 17. Therefore, oil discharged from the oil pump 22 is introduced into the rod contracting oil chamber B of the hydraulic cylinder 10. Hence it follows that the rod 10A is contracted and moved so that oil is discharged from the rod expanding oil chamber A toward the oil tank 17. Thus, the stopper plate 2 is moved downwards until the rod 10A is detected by the limit switch 15'. When the returned position of the rod 10A has been detected by the limit switch 15' and, therefore, the rotation of the operating motor 23 has been interrupted, departure of the vehicle is permitted.

**[0062]** When departure of the vehicle 4 is performed, when a person except for a person who settles the bill takes ride in the vehicle or when a heavy luggage has been loaded, the road clearance of the vehicle is inevitably enlarged. Thus, an excessively heavy load is sometimes exerted on the stopper plate 2 which has upwards been moved. In the foregoing case, the rod 10A arranged to be operated in synchronization with the stopper plate 2 is moved in the contracting direction. After the rod 10A has been moved in the contracting direction and, therefore, the pressure in the rod expanding oil chamber A of the hydraulic cylinder 10 has been raised, oil is discharged through the relief valve 24 provided for the oil passage 18. Moreover, oil is supplied to the rod contracting oil chamber B through the relief valve 24. Therefore, a fact that the pressure in the rod contracting oil chamber B is made to be negative pressure can be prevented. Thus, enlargement of the load in the hydraulic cylinder 10 can be prevented. Hence it follows that the stopper plate 2 can smoothly be swung in the downward direction. As a result, breakage of the hydraulic cylinder 10 owing to enlargement of the load can be prevented.

**[0063]** As described above, the unattended parking apparatus according to this embodiment is able to control the upward/downward movement of the stopper plate 2 by simply switching the oil discharge direction from the oil pump 22 by switching the rotational direction of the operating motor 23. Therefore, the necessity of providing a costly direction switch valve or the like having a special structure can be eliminated. As a result, the cost can considerably be reduced. Moreover, the position to which the rod of the hydraulic cylinder is expanded is limited by the stopper block 16 as well as the limit switch 15. Therefore, if the stopper plate 2 is not made contact with the bottom surface of the vehicle, the limit of the upward movement of the stopper plate 2 can be set to an angle with which the impression that the wheels are able to get over the stopper plates is not given. Therefore, unlawful departure of the vehicle before settlement can reliably be prevented. The hydraulic pressure is employed as the operation source. There-

fore, when a plurality of the unattended parking apparatuses according to this embodiment are placed in a line in a plurality of parking spaces, piping of oil pipes and provision of oil-passage switching valves are simply required. If taken to the limit, only one hydraulic pump is able to operate and control all of the parking apparatuses.

**[0064]** According to the present invention, the plural stopper plates are disposed in the direction in which the vehicle is moved. Therefore, an undesirable fact that the distance from the bottom surface of the vehicle is elongated excessively can be prevented. Thus, departure of the vehicle before settlement can reliably be prevented. Since the impression that the wheel is able to get over the stopper plate is not exerted, unlawful parking can physically be prevented. Thus, an economical loss of the person who runs the parking area can be prevented.

**[0065]** According to the present invention, if a plurality of parking apparatuses are disposed in a unattended parking area having a multiplicity of parking spaces, the parking apparatuses can smoothly be operated with operation sources the number of which is smaller than the number of the parking apparatuses. Therefore, maintenance and inspect can easily be performed and the running cost can considerably be reduced. If an excessively heavy load is exerted on the stopper plate, damage of the hydraulic cylinder can safely be prevented. If the stopper plate is brought into contact with the bottom surface of the vehicle and thus reaction from the bottom surface of the vehicle acts on the hydraulic cylinder, movement of the stopper plate toward the bottom surface of the vehicle can be prevented. Thus, damage of the bottom surface of the vehicle can be prevented. Hence it follows that an economical loss for a person who runs the unattended parking apparatus can be prevented. After the stopper plate has upwards been moved, the rod of the hydraulic cylinder for operating the stopper plate is moved downwards if the stopper plate is pressed by the bottom surface of the vehicle in a case where the wheel gets over the stopper plate or the road clearance of the vehicle is reduced. Therefore, engagement of the leading end of the stopper plate to the bottom surface of the vehicle which causes the upward/downward movement of the stopper plate to be inhibited can be prevented.

**[0066]** According to the present invention, occurrence of a fact that the distance from the bottom surface of the vehicle is elongated excessively can be prevented. Thus, departure of the vehicle before settlement can reliably be prevented.

**[0067]** According to the present invention, if one of the stopper plates is moved downward owing to a fact that the wheel gets over the stopper plate, the state of parking can be maintained by the other stopper plate until settlement is completed. Therefore, unlawful departure of the vehicle can reliably be prevented.

**[0068]** According to the present invention, if an excessively heavy load is exerted on the stopper plate, dam-

age of the hydraulic cylinder can safely be prevented. If the stopper plate is brought into contact with the bottom surface of the vehicle and thus reaction from the bottom surface of the vehicle acts on the hydraulic cylinder, movement of the stopper plate toward the bottom surface of the vehicle can be prevented. Thus, damage of the bottom surface of the vehicle can be prevented.

[0069] According to the present invention, any costly switch valve or the like is not required to control upward/downward movement of the stopper plate with a simple structure.

[0070] According to the present invention, oil discharged from the hydraulic pressure source can effectively be supplied to the hydraulic cylinder. Moreover, introduction of oil into the suction side of the hydraulic pressure supply source can smoothly be performed. As a result, wanting of oil which must be sucked into the hydraulic pressure supply source does not occur. Therefore, damage of the hydraulic pressure supply source caused from enlargement of the sucking load can be prevented.

[0071] According to the present invention, the third pilot check valve disposed in the oil passage allowed to communicate with the oil chamber of the hydraulic cylinder for upwards moving the stopper plate is able to prevent counterflow of oil supplied to the oil chamber for upwards moving the stopper plate. Thus, the upward position of the stopper plate can be maintained. If the hydraulic pressure supply source has been operated to downwards move the stopper plate, opening can be performed if the pressure is not higher than the set relief pressure for the relief mechanism. Thus, refluxing of oil from the oil chamber of the hydraulic cylinder for upwards moving the stopper plate to the hydraulic pressure supply source is permitted. Therefore, a portion of oil which is sucked by the hydraulic pressure supply source can be compensated by refluxed oil from the hydraulic cylinder.

[0072] According to the present invention, the displacement of the hydraulic cylinder is detected to control the operation of the hydraulic pressure supply source. Therefore, contact of the stopper plate with the bottom surface of the vehicle and exertion of the reaction from the bottom surface of the vehicle on the hydraulic cylinder are used to prevent excessive upward movement of the stopper plate. Therefore, engagement of the stopper plate to the bottom surface of the vehicle can be prevented. Hence it follows that damage of the bottom surface of the vehicle can be prevented.

[0073] Although the invention has been described in its preferred form and structure with a certain degree of particularity, it is understood that the present disclosure of the preferred form can be changed in the details of construction and in the combination and arrangement of parts without departing from the spirit and the scope of the invention as hereinafter claimed.

## Claims

1. An unattended parking apparatus incorporating a stopper plate which is moved upwardly towards the bottom surface of a vehicle accessed to predetermined parking position and which is moved downwardly after the bill has been settled to permit departure of the vehicle, characterised in that said unattended parking apparatus comprises:

a hydraulic circuit including a hydraulic cylinder which is operated by a hydraulic pressure source and arranged to operate said stopper plate such that upward/downward movement of said stopper is permitted; and  
a relief mechanism provided for said hydraulic circuit and arranged to relieve pressure in said hydraulic cylinder when a load which is exerted on said stopper plate is greater than a predetermined value.

2. An unattended parking apparatus according to claim 1, wherein the stopper plate is pivotable around a horizontal axis.
3. An unattended parking apparatus according to any one of claims 1 and 2, wherein said hydraulic pressure supply source is able to switch a direction in which oil is supplied to a rod-extending oil chamber (A) or a rod-contracting oil chamber (B) of said hydraulic cylinder when a direction of operation of said hydraulic-pressure supply source is switched.
4. An unattended parking apparatus according to any one of preceding claims, wherein said hydraulic circuit is provided with two oil passages (18, 19) allowed to communicate respectively with the rod-extending oil chamber (A) and the rod-contracting oil chamber (B) of said hydraulic cylinder, and each of said two oil passages (18, 19) is provided with a pilot check valve (20, 21) which can be opened/closed owing to pilot pressure which is the pressure in the discharge-side oil passage (18, 19) in the operation directions of said hydraulic-pressure supply source.
5. An unattended parking apparatus according to claim 4, wherein said hydraulic circuit is provided with a third pilot check valve (25) for refluxing oil from the rod-extending oil chamber (A) to said hydraulic-pressure supply source with respect to the suction side oil passage of said hydraulic-pressure supply source, and  
said third pilot check valve (25) can be opened when the hydraulic pressure is a level set to said relief mechanism and the pressure in the discharge-side oil passage of said hydraulic-pressure supply source after said hydraulic-pressure supply source has been shifted to a direction in which said stopper

plate is moved downwardly, is not higher than the cracking pressure of said second pilot check valve.

6. An unattended parking apparatus according to any one of preceding claims, wherein said hydraulic cylinder is provided with a limit sensor disposed to be movable in a direction in which a rod is extended/contracted and arranged to detect movement of the rod to a predetermined position in the extending/contracting direction, and said limit sensor controls the operation of said hydraulic-pressure supply source.

7. An unattended parking apparatus according to any one of preceding claims, wherein it comprises

an elastic member (14A) disposed between the end of the hydraulic cylinder opposite to the rod (10A) and a support of the hydraulic cylinder, and

detection means (15) for interrupting said hydraulic-pressure supply source when a movement of said hydraulic cylinder is detected in a direction opposite to the extending direction of the rod owing to reaction exerted from the rod against urging force of said elastic member.

8. An unattended parking apparatus comprising a stopper plate which is moved upwardly towards the bottom surface of a vehicle accessed to a predetermined parking position and which is moved downwardly after the bill has been settled to permit departure of the vehicle, characterised in that said unattended parking apparatus comprises :

- a plurality of stopper plates (2, 3) disposed one behind the other in a direction parallel to the longitudinal axis of the vehicle
- a hydraulic circuit including a plurality of hydraulic cylinders which are operated by a hydraulic pressure source, each hydraulic cylinder being arranged to operate upward and downward movements of a stopper plate, and
- a relief mechanism arranged to relieve the pressure in each hydraulic cylinder when a load which is exerted on said stopper plates is greater than a predetermined value

9. An unattended parking apparatus according to claim 8, wherein each stopper plate is pivotable around a horizontal axis and at least one stopper plate has a width defined between its pivot axis and its leading end which is different from the width of the other stopper plates.

10. An unattended parking apparatus according to any one of claims 8 and 9, wherein said hydraulic cylinders are connected together in such manner that a

downward movement of one of said stopper plates causes the other stopper plates to be moved upwardly and synchronously.

11. An unattended parking apparatus according to any one of claims 8 to 10, wherein said hydraulic pressure supply source is able to switch a direction in which oil is supplied to rod-extending oil chambers (A, A') or rod-contracting oil chambers (B, B') of each hydraulic cylinder when a direction of operation of said hydraulic-pressure supply source is switched.

12. An unattended parking apparatus according to any one of claims 8 to 11, wherein said hydraulic circuit is provided with two oil passages (18, 19) allowed to communicate respectively with rod-extending oil chambers (A, A') and rod-contracting oil chambers (B, B') of each hydraulic cylinder, and each of said two oil passages (18, 19) is provided with a pilot check valves (20, 21) which can be opened/closed owing to pilot pressure which is the pressure in the discharge-side oil passage (18, 19) in the operation directions of said hydraulic-pressure supply source.

13. An unattended parking apparatus according to claim 12, wherein said hydraulic circuit is provided with a third pilot check valve for refluxing oil from the rod-extending oil chambers (A, A') to said hydraulic-pressure supply source with respect to the suction side of said hydraulic-pressure supply source, and said third pilot check valve (25) can be opened when the hydraulic pressure is a level set to said relief mechanism and the pressure in the discharge-side oil passage of said hydraulic-pressure supply source after said hydraulic-pressure supply source has been shifted to a direction in which said stopper plates are moved downwardly is not higher than the cracking pressure of said second pilot check valve.

14. An unattended parking apparatus according to any one of claims 8 to 13, wherein each hydraulic cylinder is provided with a limit sensor disposed to be movable in a direction in which a rod is extended/contracted and arranged to detect movement of the rod to a predetermined position in the extending/contracting direction, and said limit sensor controls the operation of said hydraulic-pressure supply source.

15. An unattended parking apparatus according to any one of claims 8 to 14, wherein it comprises for each hydraulic cylinder

an elastic member disposed between the end of the hydraulic cylinder opposite to the rod (10A) and a support of the hydraulic cylinder,

and

detection means (15) for interrupting said hydraulic pressure supply source when a movement of said hydraulic cylinder is detected in a direction opposite to the extending direction of the rod owing to reaction exerted from the rod against urging force of said elastic member.

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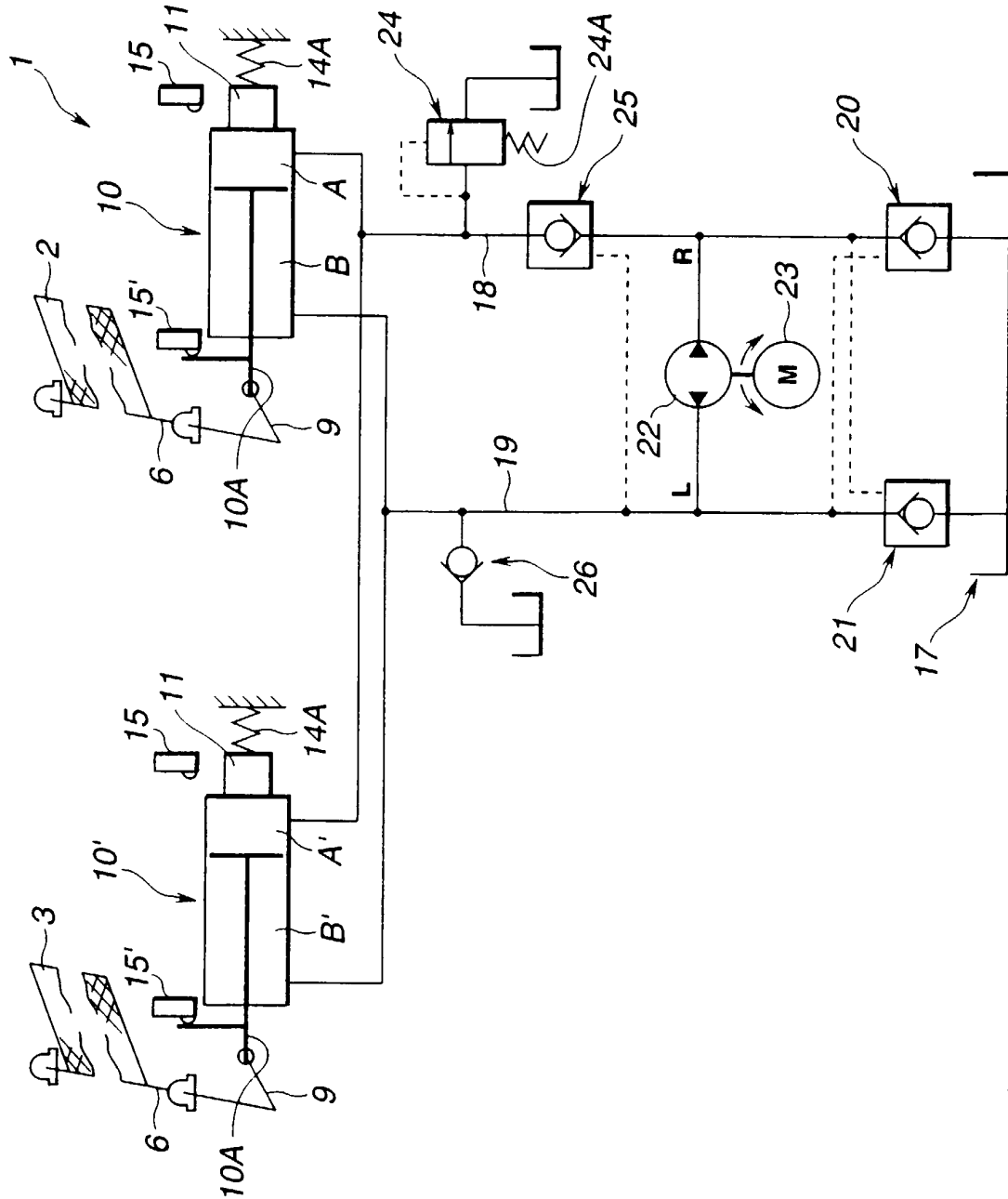
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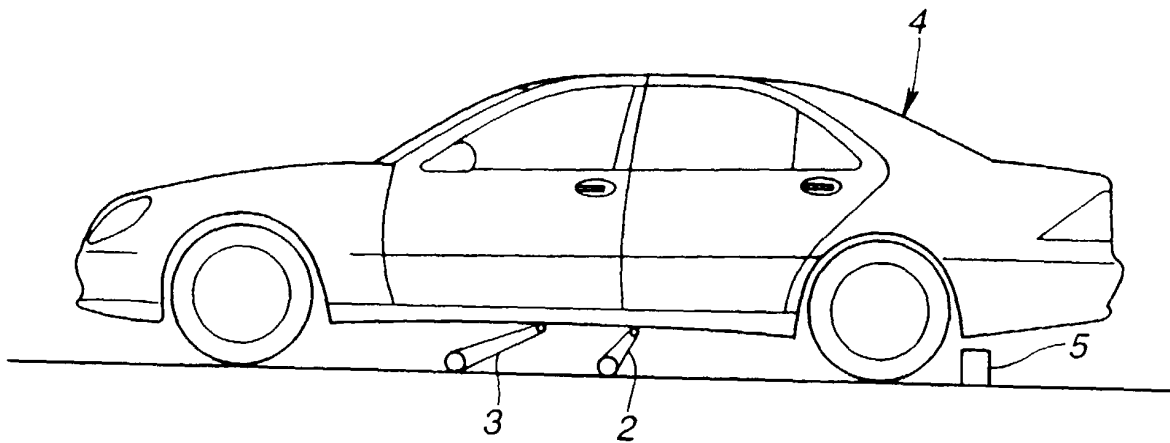
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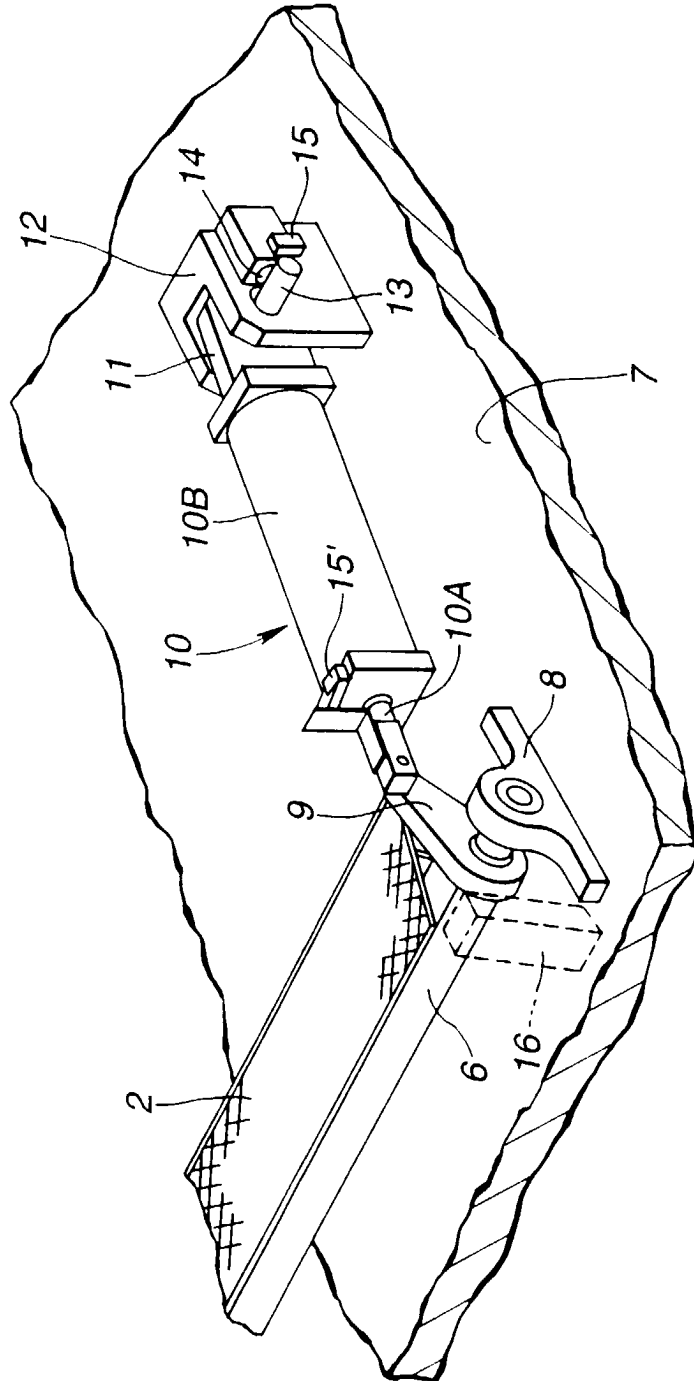
**FIG. 1**



**FIG.2**



**FIG. 3**



**FIG.4**

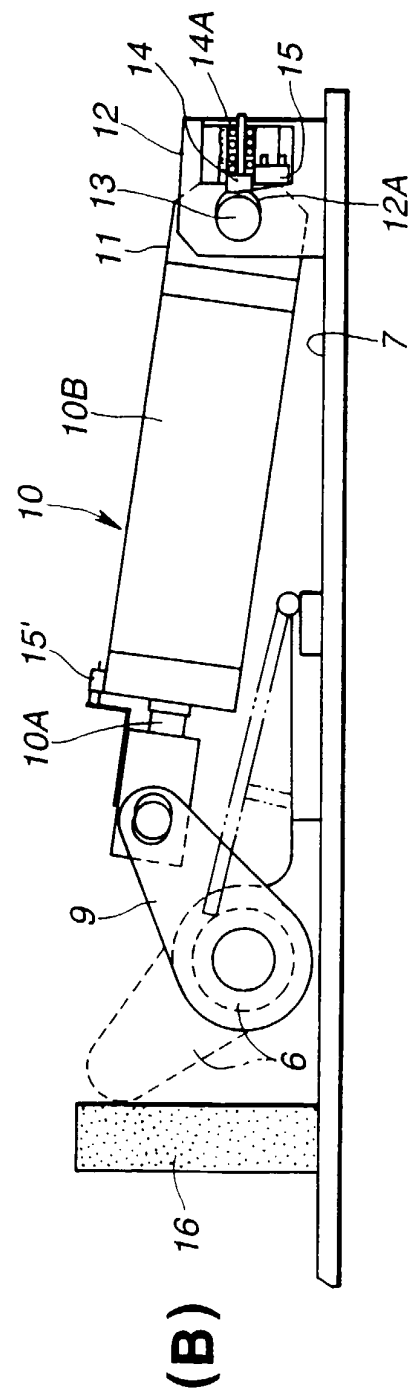
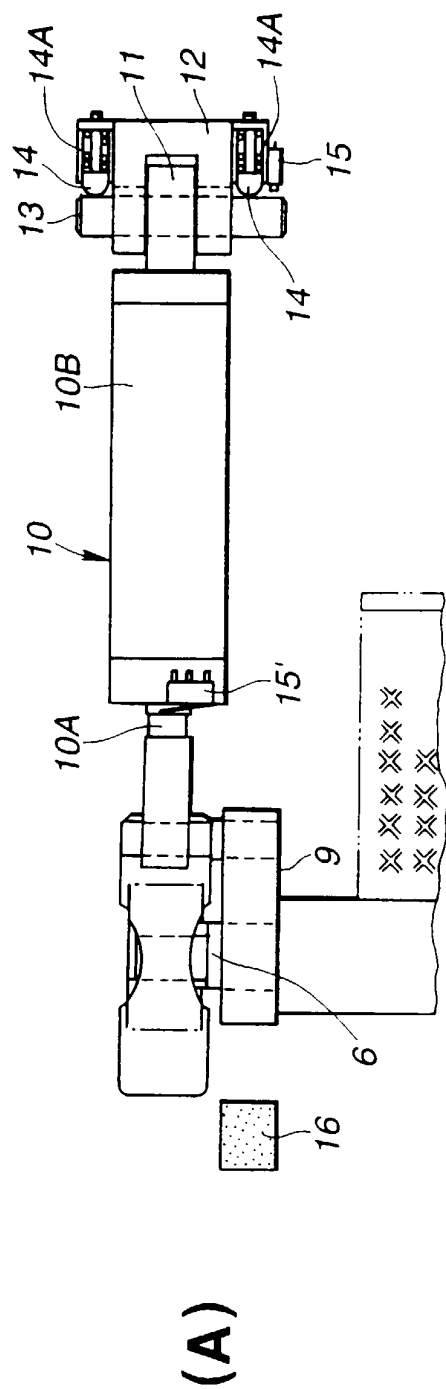
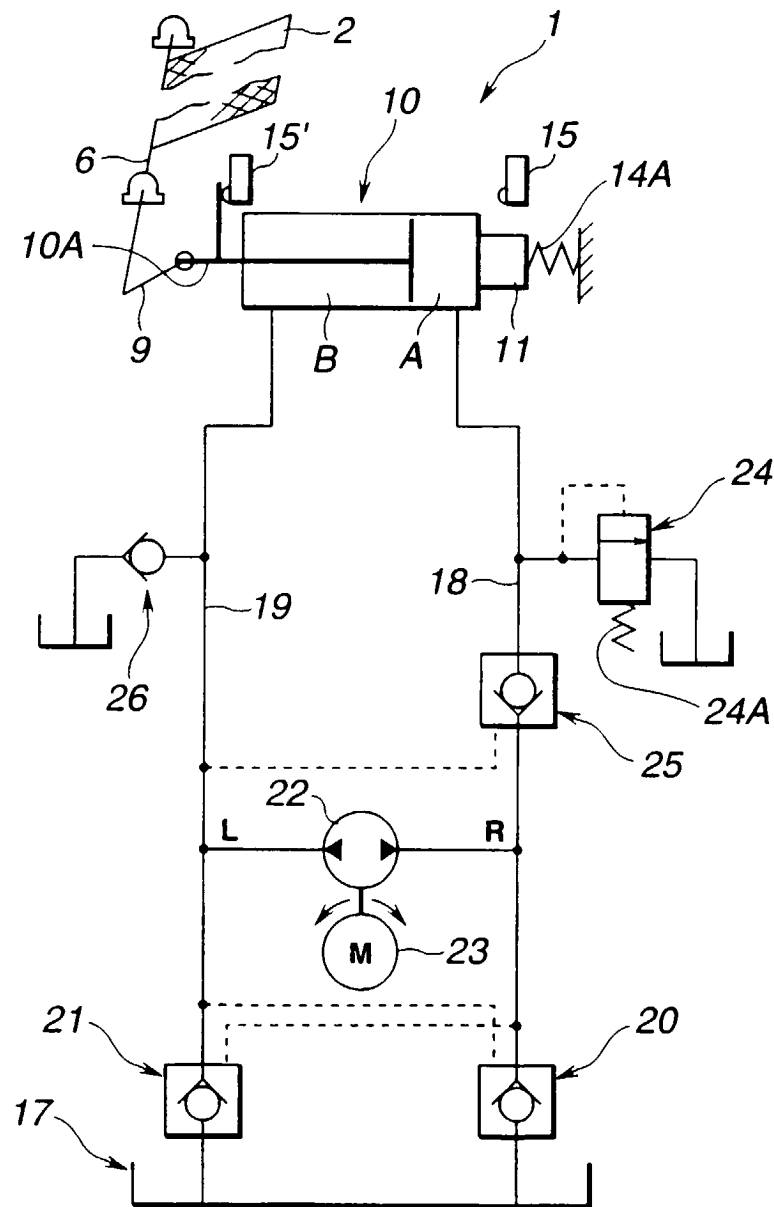
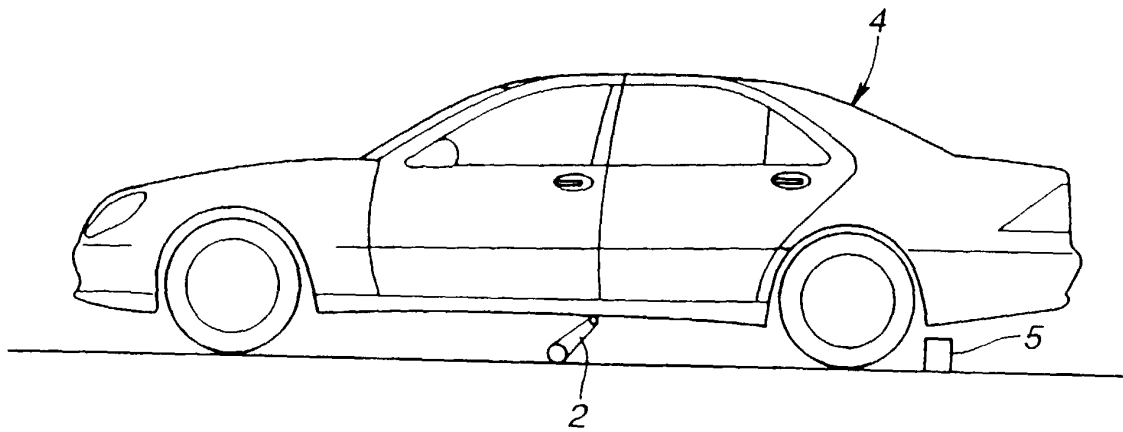


FIG.5



**FIG.6**



**FIG.7**  
PRIOR ART

