

(12) PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 200058610 B2**
(10) Patent No. **769828**

(54) Title
Apparatus for operating gates and the like

(51) ⁶ International Patent Classification(s)
E05F 013/00 E05F 013/04

(21) Application No: 200058610 (22) Application Date: 2000.06.14

(87) WIPO No: W000/77334

(30) Priority Data

(31) Number	(32) Date	(33) Country
9902237	1999.06.14	SE

(43) Publication Date : 2001.01.02
(43) Publication Journal Date : 2001.03.15
(44) Accepted Journal Date : 2004.02.05

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(56) Related Art
US 4115954
GB 2322669
EP 0571305

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 December 2000 (21.12.2000)

PCT

(10) International Publication Number
WO 00/77334 A1

(51) International Patent Classification: E05F 13/00,
13/04

(21) International Application Number: PCT/SE00/01249

(22) International Filing Date: 14 June 2000 (14.06.2000)

(25) Filing Language: Swedish

(26) Publication Language: English

(30) Priority Data: 9902237-8 14 June 1999 (14.06.1999) SE

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

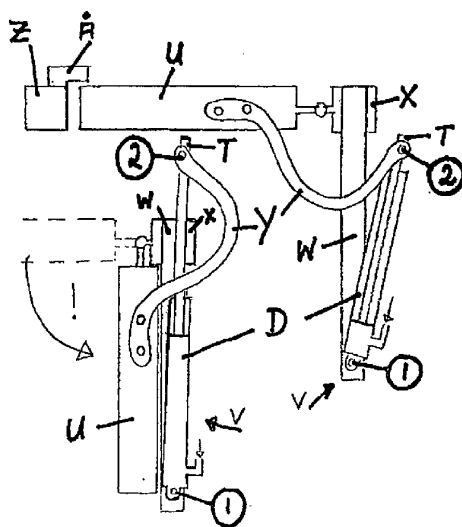
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Published:
— With international search report.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS FOR OPERATING GATES AND THE LIKE



(57) Abstract: The invention relates to an apparatus for operating a gate (U), which apparatus is provided with a pressure generating unit, which can be mounted in the ground and which is provided with a hydraulic cylinder (A) as well as restoring springs (O) and which by means of a hydraulic circuit system actuates an opening and closing mechanism for said gate. According to the invention said cylinder (A) is designed as a primary compression cylinder, which hydraulically is connected partly to an accumulator tank (C), to accumulate a portion of the force as an overpressure, and partly to a secondary opening cylinder (D), to open the gate (U) against the force of a closing valve (V). The overpressure in the liquid is released through a duct to an expansion tank (B) through a check valve (G) in order to delay the discharge process, an effect being obtained only after the fact, that a car has passed the apparatus and the gate and that the overpressure in the expansion tank has started to decrease. Pressure peaks from very heavy cars and a second and a third axle on a car respectively will be released directly through an overpressure valve (I) back into the expansion tank.

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APPARATUS FOR OPERATING GATES AND THE LIKE

The present invention relates to an apparatus for operating gates defined in more detail in the preamble of claim 1.

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Such operative apparatuses are primarily used in places without the use of electricity, e.g. used to open and close gates in fences, designed to protect wild animals and fences designed to mark off pasture land. These apparatuses are designed to, when a vehicle arrives to the immediate surroundings of a gate, on either side of the gate, automatically open the gate and after a certain

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time, when the vehicle has passed the gate opening, close the gate again.

Examples of already made proposals for such operative apparatuses are mentioned in GB-A-2 322 669, US-A-4 115 954 and AU-A1-65 309/80.

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These known solutions have various drawbacks and consequently they have never had any impact on the market. None of these publications meets a substantial number of various requirements in combination, which is a prerequisite for a general applicability, since it is hardly defensible, to a larger extent than what is very exceptional, to have to repair, serve and replace such devices, which thus in combination must meet the following requirements:

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Very far reaching but not completely maintenance-free; independent of the use of electricity, solar cells, engines, fuels, compressed air units etc; functioning in practically all climatic conditions, e.g. from -30°C to $+60^{\circ}\text{C}$; absolutely reliable and having a very large life; an opening and a closing of the gate without requiring, that a person in the approaching and passing respectively vehicle must

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leave it; selective actuatability solely by vehicles, particularly cars and not by e.g. human beings, wild animals or cattle; faultless functioning in the case of e.g. small private cars and heavy trucks; without complicated and expensive special means easily adjustable opening, opening keeping and closing times; smooth closing processes; noiselessness; possibility of module construction for a simple production and mounting; mounting possibility on existing constructions, e.g. stakes, and

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using existing stakes.

The object of the present invention, particularly in the above-mentioned respect, is to in combination improve and develop the state of the art in this technical field.

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This object is attained according to the present invention by designing an apparatus for operating gates and the like, according to the introduction, mainly as set forth in the characterizing clause of

claim 1. Additional characterizing features and advantages of the invention are mentioned in the following description, reference being made to the enclosed drawings, which in a schematic and only non-limiting, exemplifying way show a preferred embodiment of the invention. The drawings show in detail in :

- 5 Fig 1 a lateral view of a pressure generating unit in an apparatus for operating gates and the like according to the invention, which unit is actuated by an approaching private car;
Fig 2 a lateral view of a pivoting mechanism in the apparatus according to the invention;
Fig 3 the mechanism according to Fig 2, seen from above;
Fig 4 a schematic diagram for a hydraulic circuit in the apparatus according to the invention;
10 Fig 5 a perspective view from above of a preferred embodiment of an apparatus for operating gates and the like according to the invention;
Fig 6 a perspective view of a detail shown in Fig 5; and
Fig 7 an alternative schematic diagram, similar to the one shown in Fig 4.

- 15 It is principally feasible to design an apparatus according to the invention in such a way, that the gate, which also can comprise two halves, always will be opened horizontally away from an approaching vehicle, regardless of from which side it arrives, but in this specification only the more practical case is described of a gate, which can be moved against a stop in or beside the gate opening and consequently always is opened and closed in the same direction, e.g. with the opening
20 movement towards an enclosed area. If wild animals or cattle are pressing against the gate, then the stop will prevent it from being opened.

Also, it is of course feasible to open the gate or the gate parts vertically and/or to use weight mechanisms.

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Furthermore, it is feasible to let the apparatus according to the invention include a lock device, which locks the gate in its closing position but which unlocks it in an initial phase of the opening movement, e.g. by including a lock plunger in said hydraulic circuit.

- 30 In Fig 1 a pressure generating unit is shown, which normally is disposed at each side of a gate U on and/or in the ground. This unit comprises a stationary exterior box M having spider legs N, which provide increased stability, because they are fastened to the ground by means of holding-down bolts or the like. Inside the upwardly open exterior box an inverted, vertically movable interior box P is telescopically disposed, compression springs O extending between the bottoms of the two boxes.
35 Also, one or several hydraulic compression cylinders A extend between the bottoms of the two boxes, which cylinders contain an anti-freezing liquid, e.g. water or glycol, which without problems

functions between -30°C and $+60^{\circ}\text{C}$. Said hydraulic cylinders can be fastened to the bottom of the stationary box, whereas their pistons can be pressed against the interior side of the bottom of the movable box, thresholds S being provided on the upper side of the bottom of the movable box, which detect and establish the driving position of a car. Ramp plates Q, which are flexibly fastened to e.g. the upper/interior box close to its bottom, can constitute a guide to said upper side.

The hydraulic circuit will now be explained, reference being made to Fig 4. When eg the right front wheel of a car runs over a pressure generating unit, a pressure against cylinders A is exerted due to the weight of the car against the action of restoring springs O, which pressure is sufficient to press a hydraulic liquid through e.g. maintenance-free plastic pipes partly to an accumulator tank C, which accumulates some of the force as an overpressure, and partly to a secondary opening cylinder D, which by its piston stem T opens gate U against the action of the force of a closing spring V. The overpressure in the liquid is immediately released through a tube to an expansion tank B. The discharge takes place through a check valve G and is so slow, that it produces an effect only after the passage of the car and the start of the reduction of the overpressure in the expansion tank. A check valve H, mounted in the duct to opening cylinder D, provides a gentle opening of the gate and guarantees, that the pressure liquid excess flows to accumulator tank C.

Possible pressure peaks from very heavy cars and a second and a third axle respectively of the car are released directly through a overpressure valve I back to the expansion tank. However, since this valve only is opened at 10 bars, it does not obstruct the ordinary opening process and the ordinary slow closing but only handle possible overpressures, e.g. from several axles or heavy vehicles, which otherwise would break the system.

The ordinary operative pressure in the system is 5-6 bars, which causes the gate to be fully opened against the force of closing spring V.

Secondary opening cylinder D is mounted on a holder W, which in its turn is mounted on e.g. an existing fencing stake X in a pivoting way, which results in, that it during the opening and the closing process respectively by itself finds the correct angle in relation to a power arm Y. Cylinder D lies in a plane above holder W and power arm Y lies in its turn in a plane above cylinder D, which results in, that the opening cylinder is allowed to move freely in relation to holder W, whereas the power arm is allowed to move freely in relation to opening cylinder D. Power arm Y suitably is shaped like a boomerang in order to not collide with stake X. It extends around the stake, which also facilitates the mounting.

Gate U is closed against the other existing stake Z with a contact surface or stop Å. When the gate has been opened and the car has left the pressure generating unit, springs O press back the interior box to its upper starting position. By that means a negative pressure is obtained in the primary pressure cylinder, which consequently draws back liquid from the expansion tank. In this way the primary cylinder is ready to start the entire cycle again. In the secondary cylinder the pressure is reduced, since liquid is released back to the expansion tank through a check valve G. In this way the closing spring starts functioning and closes the gate slowly, since liquid must be pressed out of the secondary opening cylinder and through the check valve back to the accumulator tank.

10 In Fig 4 an aerator L is also shown in the duct branch to accumulator tank C, an aerator M in the duct branch to opening cylinder D, check valves E and F in two duct branches from the pressure side of pressure cylinder A, a manometer J, connected after sheet valve F in the branch, and an aerator K, connected to the same branch.

15 The entire pressure generating unit preferably is enclosed. The enclosure can downwards comprise a reinforced plastic fabric, which allows it to be simply spread out instead of using a substantially more expensive injection molded box of a suitable age resistant plastic material, which of course also is a possibility. Upwards the pressure generating unit can be covered with a steel mat-reinforced rubber mat, which partly will seal against moisture and dirt and partly tolerate tens of
20 thousands of car runs.

The exterior rigid metallic box is provided with four spider legs, which have holes in their outermost corners. Long bolts are inserted through these holes and fastened to the primary rock or long screws, which are fastened in plugs or the like in softer ground.

25 Since the force, when the non-rigid interior metallic box is run over by a car, partly comprises a straight downwardly directed component and partly a component in the direction of travel of the car and forwardly directed parallel to the ground, it is important to eliminate the last-mentioned distortion force, which primarily runs the risk of throwing off the non-rigid box.

30 One way of solving this problem is the following: The non-rigid box is provided with a number of cylinder bearings, which solely allow a vertical movement in the interior of the rigid box. Alternatively, ball bearings can be chosen or simply Teflon-coated surfaces, which however may result in fouling and seizure problems, or expander rails. Thanks to the chosen solution the entire active force from the car is converted into a vertical direction, a maximal power yield being
35 obtained designed to influence the hydraulic system.

A particular advantage of the design, shown in Figs 5 and 6, is obtained, since the pressing downwards of the interior box, already when the access ramp, which has been movably inserted into the box, is hit by the car, is facilitated. The ramp is fastened in the pressure indicator unit in such a way, that the fastening of it against the non-rigid box remains at the same point, seen in the direction of travel of the car, whereas the end of the ramp moves a small distance backwards seen in the direction of travel of the car, since the non-rigid box is pressed downwards and the ramp will be positioned more parallel to the ground.

The pressure generating unit is conveniently made as a first module, which through two plastic hoses partly transfers the operative pressure to the secondary opening cylinder and partly brings back hydraulic liquid from the expansion tank to the primary compression cylinder, when negative pressure occurs in it, when the car has left the pressure generating unit and the interior box is pressed upwards by the restoring springs.

The accumulator tank, the pressure meter, the check valves, the overpressure valve and ancillary connections and attachments are conveniently made as a second module, which can be placed in a box (not shown), which can be fastened to a gate stake or the like.

The secondary opening cylinder with its holder, spring and power arm can finally form a third module, which preferably is mounted on an existing stake in order to handle an existing gate, substantial cost savings being attained.

The modules can be assembled in a factory and finished, filled with e.g. glycol for application areas, where frost may occur. Otherwise water will be adequate. The modules are connected to each other and air is discharged through aeration nipples. Subsequently the pressure generating unit is installed in the ground and the entire apparatus is ready to be used.

In the diagram shown in Fig 7, besides the symbols already described, symbol 2 represents three measuring/aeration (venting) points, 5 a manometer, 21 three check valves, 23 a pressure limiting valve and 25 a manual opening valve.

This apparatus functions in the following fashion and arbitrary details can of course be used on the apparatus described above and shown in the other figures:

1. Closed Gate

The piston stem in cylinder D is activated by the basic pressure in accumulator B plus the force of spring V. The piston stem in cylinder A is activated by the basic pressure in accumulator B. The gate is hydraulically locked through valve 25, which is a pilot-controlled check valve.

5 2. Manual Opening

Valve 25 can be opened manually by means of a bar. Liquid flows, when the gate is opened, partly through check valve 21a to the negative side of cylinder D and partly due to an equalization of the differential area of accumulator B. (The difference area is the difference of the area due to the fact, that the piston stem occupies an area of the negative side). Subsequent to a manual opening the gate is closed automatically, since there is the same pressure on both sides of the piston in cylinder D, but it is the force of spring V and the area difference in cylinder D, which causes the closing. By a manual opening the force is charged, which is needed for an automatic closing. Thus, the manual opening can be repeated an arbitrary number of times.

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3. Automatic Opening

When cylinder A is run over by a car, the pressure and the flow are forwarded through check valve 21a. The gate starts to open due to choking Ha. This effect is loaded into accumulator C. Simultaneously pressure and flow starts to decrease through choking Hb. It is to be noted, that Ha is much larger than Hb, why a complete opening of the gate has time to occur and will remain for a certain time, before the discharge will produce an effect. At the same time as the gate opens, cylinder D will have a negative position (the piston stem is withdrawn), the hydraulic medium on the positive side of the cylinder jointly with accumulator B filling cylinder A. pilot-valve 25 is then kept open by the pressure of the negative side.

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4. Overload Protection

Valve 23 opens at a pressure above 10 bars. Thus, a repeated load on cylinder A, before the operative cycle has been concluded, results in, that the excess pressure and liquid will be emptied through valve 23. Compared to the construction shown and described above an automatic hydraulic locking of the gate is now obtained. Instead of (or possibly in addition to) a spring the hydraulic pressure, which is generated in the ramp, is used. In addition to that, a single hydraulic duct between the gate and the ramp is sufficient.

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The present invention is not limited to the embodiments described above and shown in the enclosed drawings, but it can be modified and supplemented in an arbitrary way within the scope of the inventive idea and the following claims. Thus, the apparatus can, as has already been mentioned, be used in connection with a pivotally suspended revolving gate, or a gate, which slides in rails in a straight or bent path. Instead of gates containers can also be contemplated, the contents of which will be emptied on e.g. a truck platform. By utilizing the driving and the weight of a car it is advantageous to use the described and shown apparatus in order to carry out an opening, closing, loading, discharging or the like movement, which otherwise only can be carried out in an engine-driven or manual way.

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CLAIMS

1. An apparatus for operating one or several gates or the like (U), comprising a pressure generating unit, which can be mounted in or on the ground and is provided with restoring springs (O) and is designed, by a hydraulic circuit system, to actuate an opening and closing mechanism for a gate or the like, **characterized in that** said cylinder (A) is designed as a primary compression cylinder, which is hydraulically connected to partly an accumulator tank (C), which is designed to accumulate a portion of the force as an overpressure, and partly a secondary opening cylinder (D), which is designed to open the gate (U) against the force of a closing spring (V), in that the overpressure in the liquid is to be released through a duct to an expansion tank (B) through a check valve (H), which is designed to delay the discharge process in such a way, that it will have an effect only subsequent to the passage of e.g. a car past the apparatus and the gate and to the start of the reduction of the overpressure in the expansion tank, and in that possible pressure peaks from very heavy cars and the second and the third axle respectively of a car are to be released directly through an overpressure valve (I) back to the expansion tank.

2. An apparatus according to claim 1, **characterized in that** the apparatus comprises a lock mechanism, which is designed to lock the gate in a closing position and to be inactivated in an initial phase by the opening movement, particularly by including a lock plunger in said hydraulic circuit.

3. An apparatus according to claim 1, **characterized in that** a pressure generating unit normally is mounted on each side of a gate (U) on and/or in the ground, and/or in that it comprises a stationary exterior box (M) having spider legs (N), which provide improved stability by a fastening in the ground by means of fastening bolts or the like, in that inside the upwardly open exterior box an inverted vertically movable interior box (P) is telescopically mounted, compression springs (O) extending between the bottoms of the two boxes, and in that one or several hydraulic compression cylinders (A) extend between the bottoms of the boxes, which cylinders contain a frostless liquid, e.g. water and glycol, to make the unit operative between -30°C and $+60^{\circ}\text{C}$.

4. A apparatus according to claim 3, **characterized in that** said hydraulic cylinders are fastened to the bottom of the stationary box, whereas their plunges are designed to be pressed against the inner side of the bottom of the movable box, thresholds (S) suitably being provided on the upper side of said bottom, said thresholds being designed to detect and establish a running overposition, and in that ramp plates (Q) are articulately fastened to e.g. the upper/interior box near its bottom, which ramp plates are to lead a car wheel to said upper side.

5. An apparatus according to any of claims 1-4, **characterized in that** the secondary opening cylinder (D) is mounted on a holder (W), which is its turn is mounted on e.g. an existing fencing stake (X) in a pivotable way in order to, during the opening and closing process respectively, itself find the right angle in relation to a force arm (Y), in that the cylinder (D) lies in a
5 plane above the holder (W) and the force arm (Y) in its turn lies in a plane above the cylinder (D), the opening cylinder being able to freely move in relation to the holder (W), while the force arm is able to freely move in relation to the opening cylinder (D), and in that the force arm (Y) suitably is shaped like a boomerang in order not to collide with the stake (X), it being designed to pass round the stake in order to also facilitate the mounting.

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6. An apparatus according to any of claims 3-5, **characterized in that** the gate (U) is designed to be closed against the second existing stake (Z) having a contact surface or stop (Å), in such a way, that, when the gate has been opened and e.g. a car has left the pressure indicator unit, the springs (O) will press the interior box back to its upper starting position and create an
15 underpressure in the primary compression cycle, which will draw back liquid from the expansion tank in such a way, that the primary cylinder will be ready to start the entire operative cycle again and in the secondary cylinder the pressure will be reduced, since liquid will return to the expansion tank through the check valve (G), the closing spring being able to function and close the gate slowly, since liquid will be pressed out of the secondary opening cylinder and through the check
20 valve back to the accumulator tank.

7. An apparatus according to any of claims 1-6, **characterized by** an aerator (L) in the duct branch to the accumulator tank (C), an aerator (M) in the duct branch to the opening cylinder (D), check valves (E and F) in two duct branches from the pressure side of the compression cylinder (A),
25 a manometer (J) connected after the check valve (F) in the branch, and an aerator (K) connected to the same branch.

8. An apparatus according to any of claims 3-7, **characterized in that** the entire pressure generating unit is enclosed, the enclosure downwards being made of a reinforced plastic fabric in
30 order to be able to simply spread it out, and the pressure generating unit upwards being covered by a steel net-reinforced rubber mat in order to partly seal against moisture and dirt and to partly withstand tens of thousands of approaching and leaving runs of cars and/or in that the exterior rigid metal box is provided with four spider legs, which have holes in their outermost corners, through which holes long bolts will be inserted, which will be fastened in the ground, or long screws, which
35 will be fastened in plugs or the like in looser ground.

9. An apparatus according to any of claims 3-8, **characterized in that** the movable box is provided with a number of roller bearings, which solely allow vertical movements within the rigid box, or ball bearings or simply Teflon-coated surfaces, and/or in that the pressing downwards of the interior box will be facilitated by a run by a car on the ramp, one end of which is movably inserted
5 into the box, which ramp is fastened in such a way, that its fastening to the loose box remains at the same point, seen in the direction of travel of the car, whereas the other end of the ramp moves a short distance backwards in relation to the direction of travel of the car, the loose box being pressed downwards and the ramp lying more parallel to the ground.
10. An apparatus according to any of claims 1-9, **characterized in that** the pressure generating unit is manufactured as a first module, which by means of two plastic hoses partly transfers the operative pressure to the secondary opening cylinder and partly returns hydraulic liquid from the expansion tank to the primary compression cylinder, when an underpressure occurs in it, when a car has left the pressure generating unit and the interior box is pressed upwards by the
15 restoring springs, in that the accumulator tank, the pressure meters, the check valves, the overpressure valve and their connections and attachments are manufactured as a second module, which can be placed in a box, which can be fastened to a gate stake or the like, and in that the secondary opening cylinder with its holder, valve and power arm is manufactured as a third module, which preferably will be mounted on an existing stake in order to handle an existing gate.
- 20 11. An apparatus according to any of claims 1-10, **characterized in that** the apparatus also comprises three measure/aeration points (2), a manometer (5), a check valve (21), a pressure limiting valve (23) and a manual opening valve (25), in that, when the gate is closed, the piston stem in the cylinder (D) will be actuated by the basic pressure in the accumulator (B), plus the force
25 of spring (V), in that the piston stem (A) will be actuated by the basic pressure in the accumulator (B), and in that the gate will be hydraulically locked through a pilot-guided check valve (25).
12. An apparatus according to claim 11, **characterized in that** in order to carry out a manual opening the valve (25) will be opened manually by means of a bar in such a way, that, when
30 the gate is opened, liquid will flow partly through the check valve (21c) to the negative side of the cylinder (D) and partly because of an equalization of the differential area to the accumulator (B), in that after a manual opening of the gate the gate will be closed automatically, because the same pressure exists on both sides of the piston in the cylinder (D), in that the force of the spring (V) and the area difference in the cylinder (D) will result in the closing, and in that, when a manual opening
35 is carried out, the force, required for an automatic closing, will be loaded.

13. An apparatus according to claims 11 and 12, characterized in that for an automatic opening, when the cylinder (A) is run over by a car, pressure and flow will pass through the check valve (21a), in that the gate will start its opening through the choking (Ha), in that the effect will be loaded into the accumulator (C), at the same time as pressure and flow start decreasing through the choking (Hb), the choking (Ha) having a dimension so much larger than (Hb), that a complete opening of the gate will have time to occur and will remain for a certain time, before the discharge will have an effect, and in that at the same time as the gate is opened, the cylinder (D) will enter into a negative position, the hydraulic medium on the positive side of the cylinder jointly with the accumulator (B) being designed to fill the cylinder (A), in that the pilot valve (25) then is kept open by the pressure from the negative side, in that the apparatus also comprises an overload protection, since the valve (23) will be opened at a pressure above 10 bars, and in that a repeated load on the cylinder (A), before the operative cycle has been concluded, will result in, that the overpressure and the excess liquid will be emptied through the valve (23).

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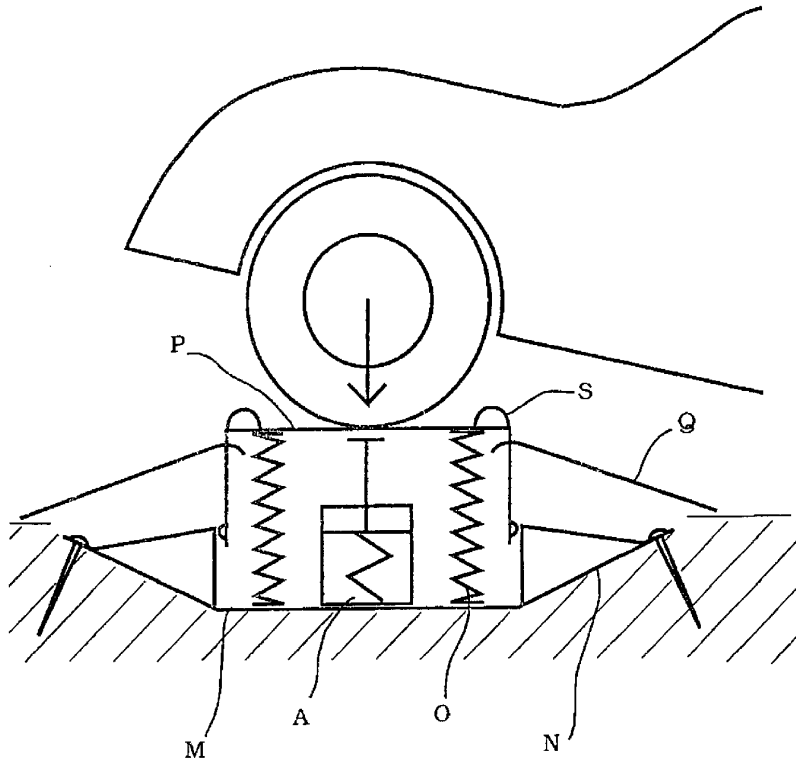
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Fig. 1



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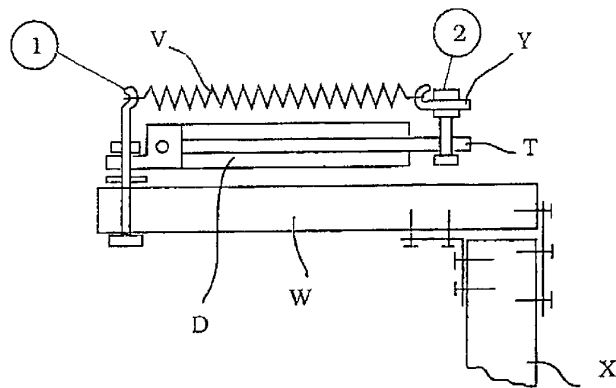


Fig 2

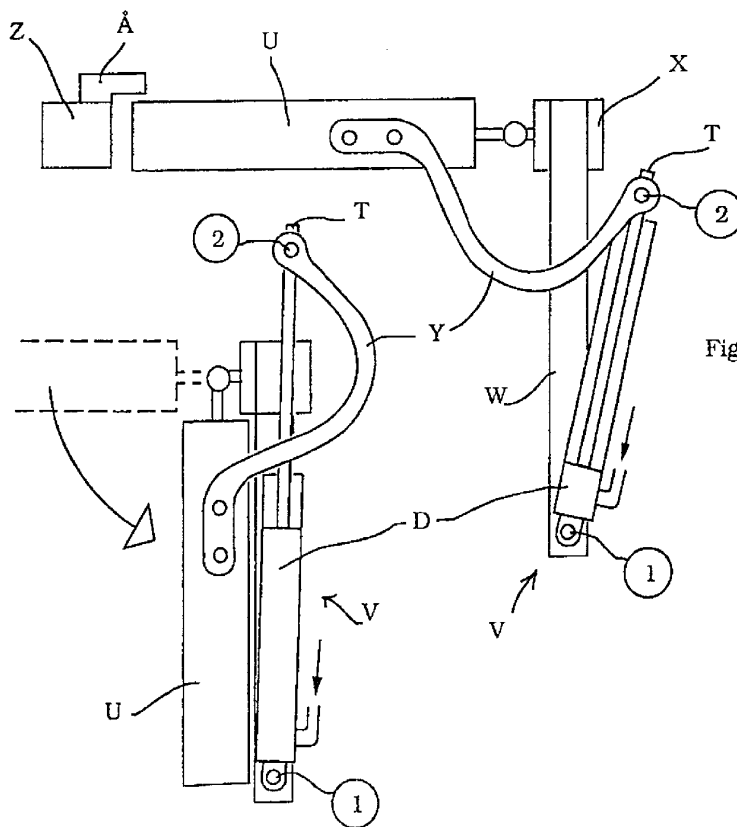
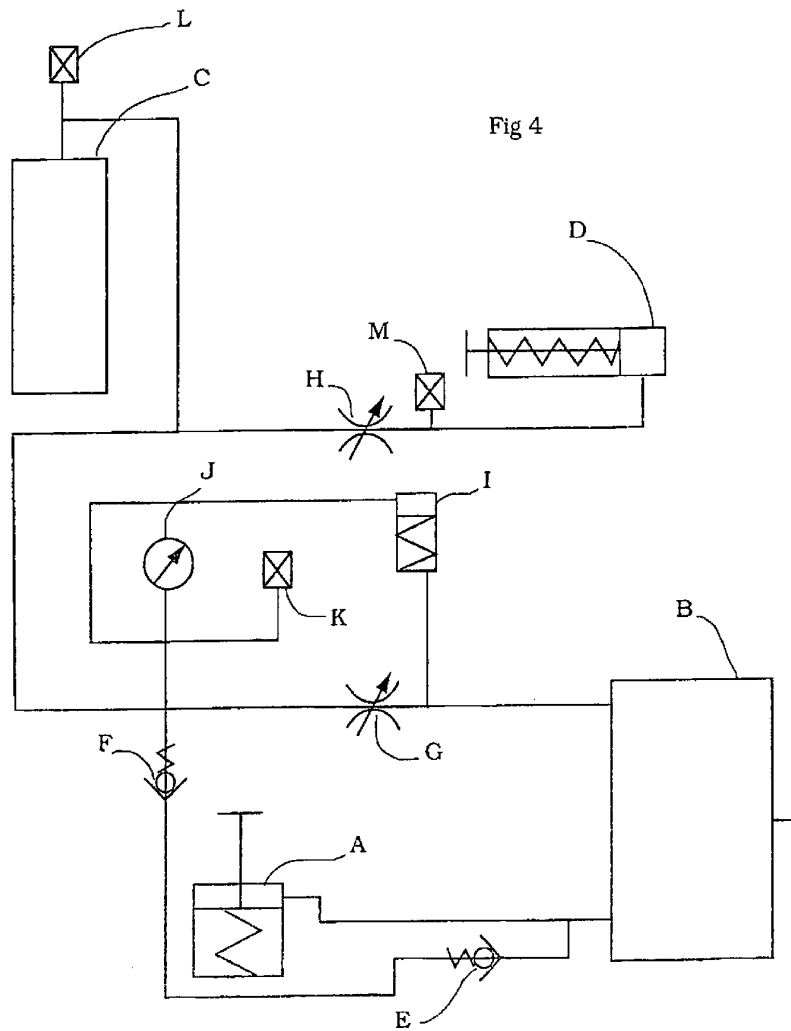


Fig 3

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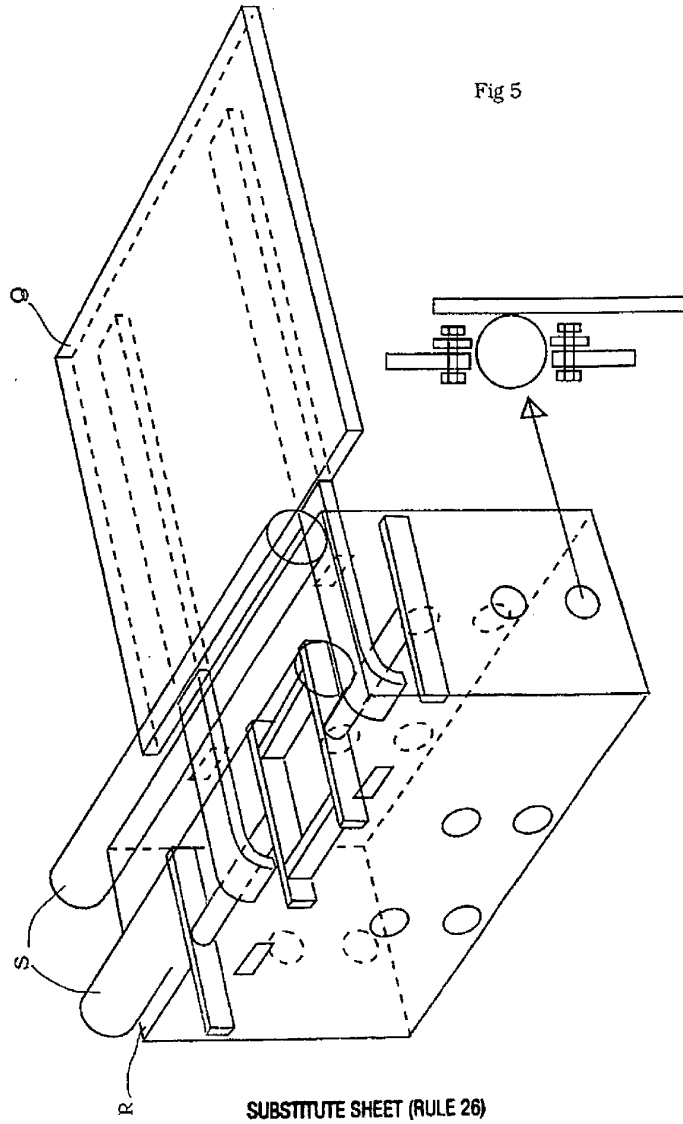
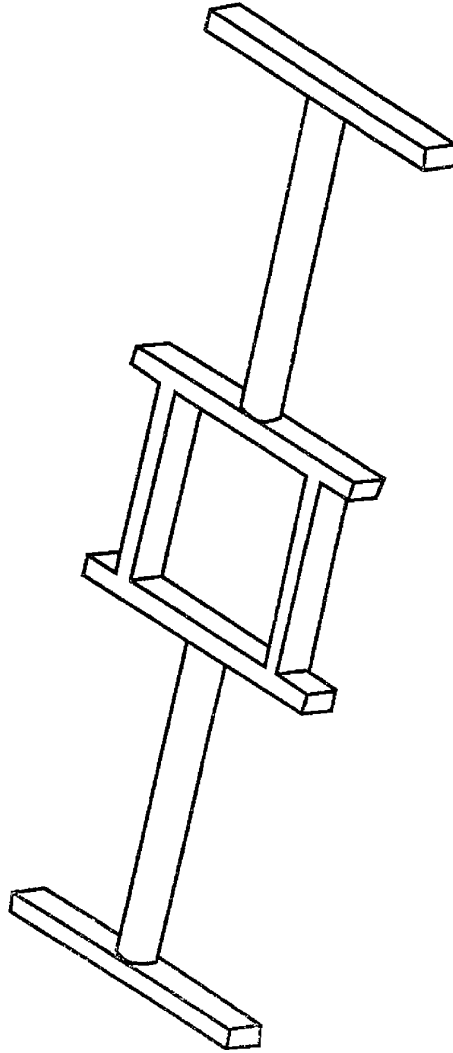
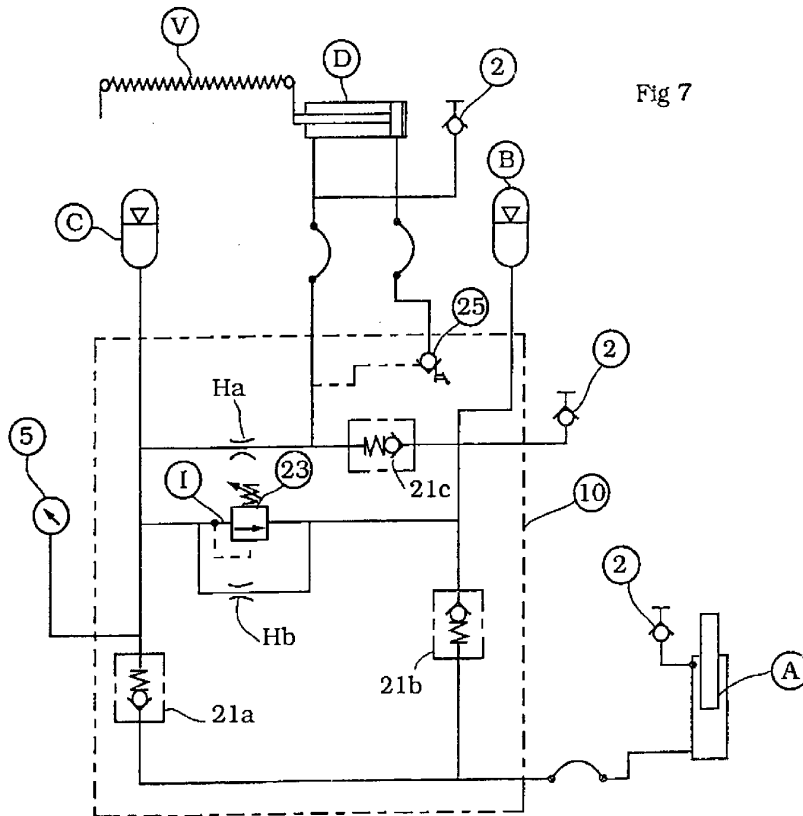


Fig 6



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