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(54) **Remotely lockable seat belt arrangment**

Ferngesteuert schliessbare Sicherheitsgurtvorrichtung

Commande à distance de blocage de ceinture de sécurité

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Description

Field of the Invention

[0001] The present invention relates generally to the field of passenger restraints and, in particular, to a remotely lockable seat belt arrangement suitable for use in a passenger vehicle, such as a car or airplane.

Background

[0002] Fig. 1 shows an example of a conventional seat belt arrangement (or passenger restraint) 110 having a latch in the form of a latch plate 120 and a buckle 130. The latch plate 120 and buckle 130 are typically configured such that the latch plate 120 is received in a recess 150 of the buckle 130 and engages therein to form a locking relationship with respect to the buckle 130. The latch may take many other forms such as a latch pin, for example.

[0003] A problem with the above arrangement is that a release button 140 of the buckle 130 can be easily pressed, for example, by a child, to disengage the latch plate 120 from the buckle 130. This can be dangerous if a vehicle, which such a child is travelling in, stops suddenly whilst the child is unsecured. Further, such a conventional arrangement can be dangerous if a child releases themselves and then exits the vehicle whilst the vehicle is moving or exits the vehicle when stationary, into the path of another vehicle passing by.

[0004] In order to address the above problem, one known seat belt arrangement comprises a buckle cover (not shown) that attaches to a buckle such as the buckle 130 and covers the release button 140 in order to prevent a passenger, such as a child, from pressing the release button 140 and disengaging the latch plate 120.

[0005] A problem with the above buckle cover, however, is that the cover can sometimes be removed from the buckle 140 by a child, allowing the child access to the buckle 130 and the release button 140. Another disadvantage of the above buckle cover is that the cover remains on the buckle such that the buckle is still locked when a car engine is turned off and thus, potentially can become an impediment to the passenger being released in the event of an accident.

[0006] Another known seat belt arrangement is disclosed in US Patent No. 6,431,652. The seat belt arrangement of US Patent No. 6,431,652 comprises a main body and a plate and is configured to attach to and to cover a traditional buckle. The plate can only be operated by compressing two locking cylinders located on the lateral sides of the main body. The locking cylinders can be electrically connected to the door locking system of a vehicle. Whilst the doors of the vehicle are locked the plate is unable to be released from the buckle. However, when a door of the vehicle is unlocked, the plate is able to be released.

[0007] One disadvantage of the arrangement dis-

closed by US Patent No. 6,431,652 is that the main body and plate are configured to surround a traditional belt buckle and, are thus, cumbersome and bulky. Another disadvantage is that a second party or even the person restrained by the arrangement of US Patent No. 6,431,652 cannot release the latch plate whilst the doors are locked such that in the event that the car remains locked following an accident, for example, the person remains restrained. Still another disadvantage of the arrangement disclosed by US Patent No. 6,431,652 is that due to the configuration of the plate, a child may be injured by the plate if the plate remains undone and in a substantially upright position whilst the associated vehicle is in an accident, for example.

[0008] Another known seat belt arrangement comprises a buckle device that connects to the periphery of a conventional seat belt buckle such as the buckle 130 and provides a continuous alarm (e.g., visual and/or audible) if the buckle 130 is disconnected from the latch plate 120. One disadvantage of this arrangement is that the buckle device adds to the size of a traditional belt buckle and, is thus, cumbersome and bulky. Further, in recent times, some passenger vehicles provide a visual alarm to a driver if a passenger is sitting in a seat (e.g., the rear seat of a car) and a corresponding seat belt is disconnected. However, one disadvantage of both of these known arrangements is that if the alarm is overlooked by a driver, for example, the seat belt may still be disconnected without the driver being aware. Further, if the seat belt is disconnected (e.g., by a child), the driver must stop the vehicle and reconnect the seat belt. Stopping the vehicle may be difficult at times (e.g., on a freeway) and the passenger may remain unrestrained for some period of time. Still further, even if through such an alarm the driver is made aware that a seat belt has been disconnected but the driver is not able to reconnect the seat belt in a timely manner, the passenger (e.g., a child) may still exit the vehicle whilst the vehicle is moving or exit the vehicle when stationary, into the path of another vehicle passing by.

[0009] International Publication No. WO 99/55560, which is considered to be the closest prior art, discloses a seat belt control system wherein once the seat belt is buckled and the vehicle is in motion, a magnetic switch mechanism (magnetic cylinder) will activate a lock. When the seat belt is buckled, an opto-isolator switch will provide a means that will activate the lock that will keep the seat belt fixed end and the movable end in place, to prevent unbuckling of the seat belt while the vehicle is in motion.

[0010] U.K. Patent Publication No. 2 307 711 A discloses a seat belt child safety arrangement in which a clip of a rear seat belt is provided with a solenoid which, when actuated by a push-button switch in series with the vehicle battery, overcomes the action of a spring and attracts a slidable armature of magnetically soft material into a position in which it blocks a release button.

[0011] U.S. Patent Publication No. 2004/0068354 dis-

closes a seatbelt control system wherein when an occupant takes any of the seats, a switch for the occupied seat is closed thereby causing a latching relay circuit to be energized so that the seat belt for the occupied seat location is checked for buckling. The latching relay circuit is only energized when a counter circuit is closed. In addition, when the seat belt is latched, an arrangement of electrically conducting wires for an opto-isolator circuit to a magnetic cylinder will initiate a lock at the contact points of seat belt connectors when closed. When the seat belts are connected, metal connectors on the mobile end of the seat belt will trigger the circuit for the magnetic cylinder that will keep both ends locked while the vehicle is in motion.

[0012] Canadian Patent Publication No. 2 450 069 A discloses a safety buckle lock which operates by blocking a release button associated with the buckle lock. The buckle lock comprises a buckle release button, two small and two large clips that when activated block the buckle release button and movable screws that hold the small clips together at an approximate 20° angle. Once activated the small clips are forced apart to an approximate 45° angle of each other. The movement of the small clips opens one of the large clips so that said large clip blocks the release button. The other large clip is secured to a power connector within the buckle lock.

[0013] Thus, a need clearly exists for an improved seat belt arrangement that inhibits a restrained child or the like from removing the seat belt when such is not appropriate and that enables the seat belt to be removed when needed, such as in the event of an accident.

Summary

[0014] It is an object of the present invention to substantially overcome, or at least ameliorate, one or more disadvantages of existing arrangements.

[0015] According to one aspect of the present invention, there is provided a restraint arrangement comprising:

a buckle configured to secure a latch when said latch is engaged with said buckle;
upper and lower complementary locking E-pieces associated with said buckle, said locking E-pieces being configured such that one or more portions of each of said locking E-pieces engage with corresponding openings in said latch when said upper and lower complementary locking E-pieces are coupled together so as prevent release of said latch from engagement with said buckle, said locking E-pieces being further configured to allow release of said latch from engagement with said buckle when said upper and lower complementary locking E-pieces are uncoupled; and
electro-magnet associated with said buckle and said locking E-pieces, said electro-magnet being configured to prevent said upper and lower complementary

locking E-pieces from uncoupling when said electro-magnet is energised and to allow said upper and lower complementary locking E-pieces to uncouple when said electro-magnet is de-energised, said electro-magnet being energised upon a remote activator being activated.

[0016] In one embodiment of the restraint arrangement according to the invention, one or more override switches are associated with said electro-magnet, wherein upon activation of at least one of said override switches, said electro-magnet is de-energised to allow release of said latch from engagement with said buckle while said remote activator is activated.

[0017] In a further embodiment of the restraint arrangement according to the invention, said upper and lower complementary locking E-pieces are self-aligned such that no air exists between said locking E-pieces and electro-magnetic coupling is induced between said locking E-pieces when said electro-magnet is energised.

[0018] Preferably, said electro-magnetically coupled locking E-pieces engage said latch to secure said latch in said buckle.

[0019] In a further embodiment of the restraint arrangement according to the invention, said electro-magnet is mounted on a non-magnetic portion of said buckle.

[0020] In a further embodiment of the restraint arrangement according to the invention, the restraint arrangement comprises guides for aligning said complementary upper and lower complementary locking E-pieces.

[0021] Preferably, said guides are non-magnetic.

[0022] In a further embodiment of the restraint arrangement according to the invention, said remote activator is in the form of a remote switch configured within a vehicle that has the restraint arrangement installed.

[0023] In a further embodiment of the restraint arrangement according to the invention, said electro-magnet is de-energised upon opening an ignition switch of said vehicle.

[0024] In a further embodiment of the restraint arrangement according to the invention, said electro-magnet is de-energised when said vehicle is in a crash.

[0025] In a further embodiment of the restraint arrangement according to the invention, said electro-magnet is de-energised upon said remote activator being deactivated.

[0026] According to another aspect of the present invention there is provided a buckle configured to secure a latch when said latch is engaged with said buckle, said buckle comprising:

release means associated with said buckle and being configured to allow release of said latch from engagement with said buckle upon activation of said release means;

upper and lower complementary locking E-pieces associated with said buckle and said release means, said upper and lower complementary locking E-pieces

es being configured such that one or more portions of each of said locking E-pieces engage with corresponding openings in said latch when said upper and lower complementary locking E-pieces are coupled together so as to prevent release of said latch from engagement with said buckle when said upper and lower complementary locking E-pieces are coupled together, said locking E-pieces being further configured to allow release of said latch from engagement with said buckle when said upper and lower complementary locking E-pieces are uncoupled; and electro-magnet associated with said buckle and said locking E-pieces, said electro-magnet being configured to prevent said upper and lower complementary locking E-pieces from uncoupling when said electro-magnet is energised and to allow said upper and lower complementary locking E-pieces to uncouple when said electro-magnet is de-energised, said electro-magnet being energised upon a remote activator being activated.

[0027] In one embodiment of the buckle according to the invention, upon activation of one or more override switches associated with said electro-magnet, said electro-magnet is de-energised to allow release of said latch from engagement with said buckle while said remote activator is activated.

[0028] In a further embodiment of the buckle according to the invention, said upper and lower complementary locking E-pieces are self-aligned such that no air exists between said locking E-pieces and electro-magnetic coupling is induced between said locking E-pieces when said electro-magnet is energised.

[0029] Preferably, said electro-magnetically coupled locking E-pieces engage said latch to secure said latch in said buckle.

[0030] In a further embodiment of the buckle according to the invention, said electro-magnet is mounted on a non-magnetic portion of said buckle.

[0031] In a further embodiment of the buckle according to the invention, the buckle comprises guides for aligning said upper and lower complementary locking E-pieces.

[0032] Preferably, said guides are non-magnetic.

[0033] In a further embodiment of the buckle according to the invention, said remote activator is in the form of a remote switch configured within a vehicle that has the buckle installed.

[0034] In a further embodiment of the buckle according to the invention, said electro-magnet is de-energised upon opening an ignition switch of said vehicle.

[0035] In a further embodiment of the buckle according to the invention, said electro-magnet is de-energised when said vehicle is in a crash.

[0036] In a further embodiment of the buckle according to the invention, said electro-magnet is de-energised upon said remote activator being deactivated.

[0037] According to still another aspect of the present invention there is provided a seat belt arrangement com-

prising:

buckle means configured to secure a latch means when said latch is engaged with said buckle means; locking means associated with said buckle means and being configured to prevent release of said latch means from engagement with said buckle means in a. first position and to allow release of said latch means from engagement with said buckle means in a second position; and magnetic means associated with said buckle means and said locking means, said magnetic means being configured to prevent said locking means from being moved from said second position when said magnetic means is in a first state and to allow said locking means to be moved in a second state, said first state being determined through activation of a remote activator means.

[0038] According to still another aspect of the present invention there is provided a method of locking a restraint buckle, said method comprising :

securing a latch when said latch is engaged with said buckle, said buckle comprising an associated lock configured to prevent release of said latch from engagement with said buckle in a first position and to allow release of said latch from engagement with said buckle in a second position; and activating a remote activator to determine a first state for a electro-magnet associated with said buckle, said electro-magnet being configured to prevent said lock from being moved from said second position when said electro-magnet is in a first state, thereby locking said buckle, said electro-magnet being further configured to allow said lock to be moved in a second state.

[0039] According to another aspect of the present invention, there is provided a restraint comprising:

buckle configured to secure a latch when said latch is engaged with said buckle; release associated with said buckle and being configured to allow release of said latch from engagement with said buckle upon activation of said release; lock associated with said buckle and said release, said lock being configured to prevent activation of said release in a first state and to allow activation of said release in a second state, said first state being determined through activation of a remote activator; and override configured to allow activation of said release when said remote activator is activated.

[0040] According to a further aspect of the invention, there is provided a restraint comprising:

buckle configured to secure a latch when said latch is engaged with said buckle;
 release associated with said buckle and being configured to allow release of said latch from engagement with said buckle upon activation of said release;
 lock associated with said buckle and said release, said lock being configured to prevent activation of said release in a first position and to allow activation of said release in a second position, said first position being determined through activation of a remote activator; and
 override configured to allow activation of said release when said remote activator is activated.

[0041] According to a still further aspect of the invention, there is provided a seat belt arrangement comprising:

buckle means configured to secure a latch when said latch is engaged with said buckle;
 release means associated with said buckle and being configured to allow release of said latch from engagement with said buckle means upon activation of said release means;
 locking means operatively associated with said buckle means and said release means, said locking means being configured to prevent activation of said release means in a first state and to allow activation of said release means in a second state, said first state being determined through activation of a remote activation means; and
 override means configured to allow activation of said release means when said remote activation means is activated.

[0042] According to a still further aspect of the invention, there is provided a seat belt arrangement comprising:

a buckle configured to secure a latch when said latch is engaged with said buckle;
 a release button associated with said buckle and being configured to allow release of said latch from engagement with said buckle upon activation of said release button;
 a locking pin operatively associated with said buckle and said release button, said locking pin being configured to prevent release of said latch from engagement with said buckle in a first position and to allow release of said latch from engagement with said buckle in a second position;
 a magnet operatively associated with said buckle and said locking pin, said magnet being configured to retain said locking pin in said first position in a first state, said first state of said magnet being determined through activation of a remote switch; and
 a manual override button configured to move said locking pin to said second position, when said remote

switch is activated, to allow release of said latch from engagement with said buckle.

[0043] According to a still further aspect of the present invention, there is provided a method of locking a restraint buckle, said method comprising:

securing a latch When said latch is engaged with said buckle, said buckle comprising an associated release configured to allow release of said latch from engagement with said buckle upon activation of said release; and
 activating a remote activator to determine a first state for a lock associated with said buckle, said lock being configured to prevent activation of said release in said first state and to allow activation of said release in a second state, wherein an override associated with said buckle is selectable to allow activation of said release when said remote activator is activated.

[0044] According to yet another aspect of the present invention, there is provided a buckle configured to secure a latch when said latch is engaged with said buckle, said buckle comprising:

release associated with said buckle and being configured to allow release of said latch from engagement with said buckle upon activation of said release;
 lock associated with said buckle and said release, said lock being configured to prevent activation of said release in a first position and to allow activation of said release in a second position, said first position being determined through, activation of a remote activator; and
 override configured to allow activation of said release when said remote activator is activated.

Brief Description of the Drawings

[0045] Some aspects of the prior art and one or more embodiments of the present invention will now be described with reference to the drawings, in which:

Fig. 1 shows a prior art seat belt arrangement;
 Fig. 2 is a top view of a remotely electro-magnetically locked seat belt buckle;
 Fig. 3 is a cross-sectional side view of the seat belt buckle of Fig. 2 in a released state;
 Fig. 4A shows a side cross-sectional view of the seat belt buckle of Fig. 2 in a locked state;
 Fig. 4B shows an end-on cross-sectional view of the seat belt buckle of Fig. 2 in a locked state;
 Fig. 5 is an electrical schematic diagram showing a control circuit for use with the seat belt buckle of Fig. 2;
 Fig. 6 is a top view of a remotely electro-magnetically locked seat belt buckle;
 Fig. 7 is a cross-sectional side view of the seat belt

buckle of Fig. 6 in a released state;

Fig. 8 shows a cross-sectional view of the seat belt buckle of Fig. 6 in a locked state;

Fig. 9 is an electrical schematic diagram showing a control circuit for use with the seat belt buckle of Fig. 6;

Fig. 10 shows a perspective view of another seat belt buckle in a released state; and

Fig. 11 shows the seat belt buckle of Fig. 10 in a locked state;

Fig. 12 is a top view of a remotely lockable seat belt buckle;

Fig. 13 is a cross-sectional side view of the seat belt buckle of Fig. 12 in a released condition;

Fig. 14 shows a cross-sectional view of the seat belt buckle of Fig. 12 in a locked condition;

Fig. 15 is an electrical schematic diagram showing a control circuit; and

Fig. 16 is an electrical schematic diagram showing another implementation of the control circuit of Fig. 15,

Detailed Description including Best Mode

[0046] Disclosed herein is a seat belt arrangement that includes a buckle means having an electro-magnet and complementary locking pieces. In one arrangement, the electro-magnet is energised when a latch plate is inserted into the buckle means. The energisation of the electro-magnet induces a magnetic coupling between the locking pieces, wherein the locking plates are arranged such that at least one portion of at least one of the locking pieces engages the latch plate to secure the latch plate in the buckle means. The magnetic coupling induced between the locking pieces may include, for example, magnetic attraction between the locking pieces themselves. In a preferred embodiment, the locking pieces are arranged in a substantially self-aligning manner.

[0047] Figs. 2 and 3 show a buckle means in the form of a buckle 200 comprising a locking means or lock in the form of complementary upper and lower locking B-pieces 280a, 280b and a magnet or magnetic means in the form of an electro-magnet 385. The buckle 200 also comprises a release means in the form of a release button 210. A plastic casing 297, as shown by dashed lines, may be used to conceal any moving components of the buckle 200, including the E-pieces 280a and 280b. The buckle 200 further comprises a belt connecting piece 285 interposing a top plate 240 and a bottom plate 350, so as to form an opening 302 for accepting a latch plate such as the latch plate 120. The top and bottom plates 240, 350 and the connecting piece 285 may be secured together by a pressed rivet 275 or the like. A support member 270 is located adjacent to the pressed rivet 275 and is secured to the top plate 240. The connecting piece 285 is adapted to connect the buckle 200 to a portion of belt (not shown in Figs 2 and 3).

[0048] A flat spring 235 is attached to the support mem-

ber 270 at one end and to the upper E-piece 280a at the other so as to force the upper E-piece 280a downwards onto a latch plate guide 310 when the buckle 200 is in a released state (i.e., when the latch plate 120 is not inserted into the buckle 200), as shown in Figs. 2 and 3. The latch plate guide 310 is attached to a latch spring 320 and is configured to slide along a substantial length of the opening 302 of the buckle 200,

[0049] The latch spring 320 forms a biasing means for biasing the latch plate guide 310 to a position substantially underneath the upper E-piece 280a when the buckle 200 is in the released state. In this position, the latch plate guide 310 prevents the upper E-piece 280a from plunging into the opening 302 and blocking the insertion of the latch plate 120. In the arrangement shown, the bottom plate 350 comprises three (3) openings 372 for accepting three corresponding portions of the upper E-piece 280a or the lower E-piece 280b. The lower E-piece 280b is positioned substantially beneath the upper E-piece 280a. A retaining device 388 prevents the lower E-piece 280b from falling away from the bottom plate 350. The retaining device may take the form, for example, of a bracket or a spring. In the arrangement shown, the retaining device 388 is a bracket with a light spring 389 affixed thereto. The light spring 389 biases the lower E-piece 280b in a recessed position so that the lower E-piece 280b does not move into the opening 302 and obstruct the insertion of a latch plate into the buckle 200, when the buckle 200 is in a released state.

[0050] As seen in Fig. 4A, a latch plate, such as the latch plate 120, may be inserted into the buckle 200, thus forcing the latch plate guide 310 along the opening 302 against the extended direction of the latch spring 320. Once latch plate openings 121, 122 and 123 of the latch plate 120 are substantially under corresponding portions of the upper E-piece 280a, the flat spring 235 forces the upper E-piece 280a downwards. In this position, one or more portions of the upper E-piece 280a pass through the corresponding openings 121, 122 and 123 in the latch plate 120 to secure the latch plate 120 in the buckle 200.

[0051] As particularly shown in Figs. 3 and 4, the magnetic means in the form of the electro-magnet 385 is attached to the bottom plate 350. The electro-magnet 385 may be glued, welded, or otherwise attached to the bottom plate 350. Alternatively, the electro-magnet 385 may be loosely attached to the bottom plate. For example, the electro-magnet 385 may be floating within a plastic casing (not shown) attached to the bottom plate 350. When the buckle 200 is in a released state (i.e., when the latch plate 120 is not inserted into the buckle 200), the latch plate guide 310 sits in the opening 302 between the upper E-piece 280a and the lower E-piece 280b, as seen in Fig. 3, and the electro-magnet 385 is not energised,

[0052] However, when the buckle 200 is in a secured state (i.e., when the latch plate 120 is inserted into the buckle 200), the flat spring 235 forces the upper E-piece 280a downwards such that at least one lower portion of the upper E-piece 280a engages with the corresponding

openings 121, 122 and 123 in the latch plate 120. When electro-magnet 385 is energised, the electro-magnet 385 applies an attractive force between the upper and lower E-pieces 280a, 280b, such that the E-pieces 280a, 280b act as armatures. Consequently, the upper and lower E-pieces 280a, 280b are magnetically attracted and because the lower E-piece 280b is able to self-align to the upper E-piece 280a, no air gap exists between the upper and lower E-pieces 280a, 280b. The metal to metal contact between the upper and lower E-pieces 280a, 280b provides a strong magnetic coupling and consequently a high holding power. In one embodiment the E-pieces 280a and 280b are configured to be essentially self-aligning and unrestrained when magnetically coupled together. As described above, at least one lower portion of the upper E-piece 280a engages with the corresponding openings 121, 122 and 123 in the latch plate 120. The magnetic coupling of the upper and lower E-pieces 280a, 280b results in at least one lower portion of the upper E-piece 280a or at least one upper portion of the lower E-piece 280b engaging the openings 372 of the lower base plate 350. As will be described in detail below, the attractive force generated by the electro-magnetic may be adjusted so as to apply a stronger or weaker force to the E-pieces 280a, 280b (i.e., armatures).

[0053] Fig. 4B is an end-on cross-sectional view of the buckle 200 in a secured state with the latch plate 120 secured by the engagement of upper and lower E-pieces 280a, 280b. In the example shown, the upper E-piece 280a has a longer inner pole 410 and shorter outer poles 420, 430. Conversely, the lower E-piece 280b has a shorter inner pole 440 and longer outer poles 450, 460. It will be appreciated by a person skilled in the art that the locking pieces embodied by E-pieces 280a, 280b may take many forms and shapes, including E-pieces with inner and outer poles of matching lengths, without departing from the spirit and scope of the invention.

[0054] In the secured state shown in Fig. 4B, the upper and lower E-pieces 280a, 280b are magnetically coupled by the energised electro-magnet 385 (not shown in Fig. 4B). The inner pole 410 of the upper E-piece 280a and the inner pole 440 of the lower E-piece 280b are coupled and pass through the latch opening 122 of the latch plate 120. Similarly, the outer poles of the E-pieces 280a, 280b pass through the latch openings 121, 123 of the latch plate 120.

[0055] In one energised state, the attractive force applied to the E-pieces 280a, 280b is strong enough to retain the E-pieces 280a, 280b in the position shown in Fig. 4, so as to inhibit the latch plate 120 from being released from the buckle 200. When the electro-magnet 385 is in this energised state, the release button 210 may still be operated to some extent in the direction of the arrows 211. However, the release button 210 cannot be operated fully unless the attractive force of the energised electro-magnet 385 is overcome so as to allow removal of the E-pieces 280a, 280b from engagement with the latch plate 120 and bottom plate openings 372.

[0056] The bottom plate 350, upon which the electro-magnet 385 is mounted, and the upper plate 240 are preformed of a non-magnetic material (e.g., non-magnetic stainless steel) in order to ensure that the attractive force of the energised electro-magnet 385 is applied substantially to the E-pieces 280a, 280b (i.e., the armatures), when the E-pieces 280a, 280b are engaged with the bottom plate openings 372. Using a magnetic material for the bottom plate 350 will result in the magnetic flux of the energised electro-magnet 385 shorting out across the bottom plate 350 and not being applied fully to the E-pieces 280a, 280b. The material used to form the bottom plate 350 is strong enough so as not to jeopardize the safety of the passengers restrained using the buckle 200.

[0057] The release button 210 is configured to slide along a button guide 265, which is surrounded by a return spring 260 and is attached to the support member 270. The return spring 260 forms a biasing means for biasing the release button 210 away from the support member 270. The release button 210 is inter-connected to the upper E-piece 280a such that by pressing the release button 210 in the direction of the arrows 211 of Fig. 2, the upper E-piece 280a is no longer biased in a downward direction to engage the latch plate 120 and the corresponding openings 121, 122 and 123 of the latch plate 120.

[0058] In one arrangement, the release button 210 is not inter-connected to the electro-magnet 385. Thus, pressing the release button 210 in the direction of the arrows 211 of Fig. 2 releases the upper E-piece 280a, but does not de-energise the electro-magnet 385. The magnetic coupling of the upper and lower E-pieces 280a, 280b remains. Whilst some longitudinal movement of the coupled upper and lower E-pieces 280a, 280b is possible, the magnetic coupling of the lower portion of the upper E-piece 280a and the upper portion of the lower E-piece 280b through the openings 121, 122, and X2.3 of the latch plate 120 ensures that the latch plate 120 remains secured in the buckle 200. This arrangement ensures that a buckle is not released by accidentally pressing the release button, as may occur when the buckle is used to secure a child. In order to release the passenger, the electro-magnet 385 must be de-energised and the release button 210 must be pressed. The electro-magnetic 385 may be de-energised by a remote central locking switch or other device. For example, control of the electro-magnets of all seat belts in a passenger vehicle may be effected in a manner similar to the operation of central locking of the doors from a switch near the driver. Such an arrangement may be utilised to prevent children from releasing their seat belts in passenger vehicles. The arrangement may also be utilised for transferring prisoners, or unstable patients. Further, such an arrangement may be utilised in aircraft during periods of turbulence to ensure that the occupants remain secure in their seats.

[0059] In another arrangement, the release button 210 is inter-connected to the electro-magnet 385. Thus,

pressing the release button 210 in the direction of the arrows 211 of Fig. 2 releases the upper E-piece 280a, and de-energises the electro-magnet 385. The magnetic coupling of the upper and lower E-pieces 280a, 280b no longer remains and the upper E-piece 280a disengages from the latch plate 120 and the corresponding openings 121, 122, and 123 of the latch plate 123. Further, the spring 389 acts on the lower E-piece 280b to disengage the lower E-piece 280b from the latch plate 120. Thus, the latch plate is able to be removed from the buckle 200.

[0060] The attractive force of the electro-magnet 385 may be adjusted up or down to require more or less force, respectively, to be applied to the release button 210 in order to disengage the magnetic coupling between the upper and lower E-pieces 280a, 290b (i.e., the armatures). As will be described in detail below, the attractive force may be adjusted by adjusting the amount of current flowing through the electro-magnet 385. At full current, the attractive force provided by the electro-magnet 385 is preferably strong enough to substantially prevent anyone from fully operating the release button 210 so as to inhibit the removal of the E-pieces 280a, 280b from engagement with the latch plate 120 and bottom plate openings 372. As mentioned above, the metal to metal contact of the upper and lower E-pieces 280a, 280b provides high holding power when the electro-magnet 385 is energised. Consequently, it is possible to use a relatively small electro-magnet to provide the necessary coupling strength. In one example, an electro-magnet of approximately 1/2 W is used. The reduced size of the electro-magnet reduces the heat generated by the electro-magnet, and requires lower voltage and lower current, resulting in reduced power consumption.

[0061] As described above, in one arrangement the buckle 200 may also comprise a manual override switch (not shown). Such a manual override switch may be formed as an electrical spring return button switch mounted on the buckle 200. The manual override switch may be configured to de-energise the electro-magnet 385 when pressed, as will be explained in detail below.

[0062] The plastic casing 297 may be used to conceal the components of the buckle 200, including the electro-magnet 385 and the retaining device 388. Thus, the electro-magnet 385 and retaining device 388 do not protrude from the periphery of the casing 297. As such, the buckle 200 does not appear from the outside to be any different than a conventional buckle and is of a similar size.

[0063] In one arrangement, one or both of the upper and lower E-pieces 280a, 280b are provided with support guides to assist in the alignment of the E-pieces with the openings 372 in the bottom plate 350. In one example, the support guides are nylon, but other materials such as non-magnetic stainless steel could equally be used. It is preferable, but not essential, that any such support guides be made of non-magnetic material to maximise the strength of the magnetic coupling of the upper and lower E-pieces 280a, 280b.

[0064] Fig. 5 shows a control circuit 500 for controlling

multiple buckles 200a, 200b according to one arrangement. The circuit 500 comprises a battery 510 (e.g., the battery of a vehicle), an ignition switch 520, a remote activator in the form of a remote switch 530, and one or more emergency override switches 580. In one embodiment the remote activator switch 530 is a driver master switch located on a console within easy reach of the driver. In the embodiment shown, there are three emergency override switches 580 arranged in series, which may be located, for example, on one or more door handles located outside the vehicle. The emergency override switches 580, as shown, are normally closed to allow the circuit to operate. In the case of an emergency, one or more of the emergency override switches is opened, which breaks the circuit to electro-magnets that are associated with the buckles, as described below.

[0065] The battery 510 may be a 12 Volt battery. Alternatively, the battery 510 may be a 6 Volt, 24 Volt or any other suitable voltage battery. The battery voltage may be dictated by the arrangement of the buckles 200a, 200b. For example, if the buckles 200a, 200b are implemented in a passenger vehicle such as a car, then battery 510 may be a 12 Volt battery. However, any other power source other than a battery may also be used to supply power to the circuit 500.

[0066] A positive terminal of the battery 510 is electrically connected to the ignition switch 520 via a junction 511. The ignition switch 520 connects via junction 521 to the remote switch 530. The remote switch 530 is connected via junction 531 to the emergency release switches 580, which are in turn connected to a junction 541 a,

[0067] The embodiment shown in Fig. 5 is for controlling two buckles 200a and 200b. Associated with each buckle 200a, 200b is an indicator 540a, 540b that is also preferably located on a driver console to alert the driver, or person in control of the vehicle, whether a latch is inserted in each respective buckle 200a, 200b. In the circuit 500, the junction 521 is connected to the indicator 540a. The indicator 540a is embodied by a red light 545a arranged in series with a contact 535a, which is normally closed. The indicator 540a is further embodied by a green light 555a in series with a contact 565a, which is normally open. The red light 545a and contact 535a are arranged in parallel with the green light 555a and contact 565a. The indicator 540a is connected to a negative terminal of the battery 510 via a junction 551.

[0068] The indicator 540b is embodied in a similar manner to that described above with respect to the indicator 540a, and is parallel to the indicator 540a. Thus, junction 521 is connected to the indicator 540b. The indicator 540b contains a red light 545b in series with a contact 536a, which is normally closed. The indicator 540b is further embodied by a green light 555b in series with a contact 565b, which is normally open. The red light 545b and contact 535b are arranged in parallel with the green light 555b and contact 565b. The indicator 540b is connected to a negative terminal of the battery 510 via the junction 551,

[0069] An indicator circuit 575a is associated with the buckle 200a. From the junction 521, and in parallel with the indicators 540a, 540b described above, the indicator circuit 575a includes the buckle 200a arranged in series with a relay 595a, which in turn connects to a negative terminal of the battery 510 via junction 551. Arranged in parallel with the buckle 200a and the relay 595a is a sub-circuit relating to an indicator provided on, or in close proximity to the buckle 200a. The sub-circuit includes a contact 535b in series with a red light 545c. The contact 535b is normally closed. Arranged in parallel with the contact 535b and red light 545c is a contact 565c and a green light 555c. The contact 565c is normally open. Connected to the junction 541a is a drop resistor 590a in series with a contact 535c and an electro-magnet 385a. The contact 535c is normally open. The electro-magnet 385a is connected to a negative terminal of the battery 510 via the junction 551.

[0070] An indicator circuit 575b is associated with the buckle 200b, which appears in parallel to the indicator circuit 575a described above in respect of buckle 200a. From the junction 521, the indicator circuit 575b includes the buckle 200b arranged in series with a relay 595b, which in turn connects to a negative terminal of the battery 510 via junction 551. Arranged in parallel with the buckle 200b and the relay 595b is a sub-circuit relating to an indicator provided on, or in close proximity to the buckle 200b. The sub-circuit includes a contact 536b in series with a red light 545d. The contact 536b is normally closed. Arranged in parallel with the contact 536b and red light 545d is a contact 565d and a green light 555d. The contact 565d is normally open. Connected to the junction 541a is a drop resistor 590b in series with a contact 536c and an electro-magnet 385b. The contact 536c is normally open. The electro-magnet 385b is connected to a negative terminal of the battery 510 via the junction 551.

[0071] The contact 565a and contact 535a of the indicator 540a located on the driver console are coupled to the relay 595a and contacts 535b, 565c, 535e associated with the buckle 200a. When the ignition switch 520 is on, and the latch plate 120a is not located in the buckle 200a, the red lights 545a, 545c are illuminated and the green lights 555a, 555c are not illuminated. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that no latch plate is in the buckle 200a. When the latch plate 120a is inserted into the buckle 200a, the relay 595a becomes energised. The relay 595a is coupled to each of the contacts 535a, 535b, 535c, 565a, and 565c and thus the green lights 555a, 555c become illuminated and the red lights 545a, 545c are extinguished. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that the latch plate 120a is in the buckle 200a. Further, the energisation of the relay 595a from inserting the latch plate 120a into the buckle 200a causes the circuit from the drop resistor 590a to the magnetic coil 385a to be completed,

[0072] The contact 565b and contact 536a of the indicator 540b located on the driver console are coupled to the relay 595b and contacts 536b, 565d, 536c associated with the buckle 200d. When the ignition 520 is on, and the latch plate 120b is not located in the buckle 200b, the red lights 545b, 545d are illuminated and the green lights 555b, 555d are not illuminated. This provides an indication to the driver, and at the buckle itself or in close proximity thereof that no latch plate is in the buckle 200b. When the latch plate 120b is inserted into the buckle 200b, the relay 595b becomes energised. The relay 595b is coupled to each of the contacts 536a, 536b, 536c, 565b, and 565d and thus the green lights 555b, 555d become illuminated and the red lights 545b, 545d are extinguished. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that the latch plate 120b is in the buckle 200b. Further, the energisation of the relay 595b from inserting the latch plate 120b into the buckle 200b causes the circuit from the drop resistor 590b to the magnetic coil 385b to be completed.

[0073] When a driver switches on the ignition 520 and observes that all occupied seat positions have seat belts that are fastened, with corresponding green lights illuminated on the driver console, the driver operates the remote switch 530, which in this embodiment energises all of the seat belt magnetic coils 385a, 385b. The latch plates 120s, 120b can then only be removed from the buckles 200a, 200b by turning off the remote switch 530, or by turning off the ignition 520, or operating one of the emergency override switches 580.

[0074] Thus, the embodiment described above with respect to Fig. 5 provides a red and green light associated with each seat buckle, and a corresponding red and green light on a driver console. An alternate embodiment utilises a single light in the form of a light emitting diode (LED), wherein the LED is illuminated when a latch is not inserted in a buckle, and the LED is extinguished when a latch is inserted in the buckle. The indicator may be located only on the driver console, or only on the buckle. It will be appreciated by a person skilled in the art that the indicators may take different forms and be embodied in different colours, without departing from the spirit and scope of the invention.

[0075] The electro-magnets 385a, 385b are configured to have a polarity arrangement so that when the electro-magnets 385a, 385b are energised, the electro-magnets 385a, 385b apply an attractive force to complementary locking pieces 280a, 280b. In another arrangement, the electro-magnets 385a, 385b may be configured to repel a locking means or lock such as the E-pieces 280a, 280b (i.e., acting as the armatures). For example, with reference to Figs. 3 and 4, the electro-magnet 385 may be positioned in or near the position of the release button 210, such that when the electro-magnet 385 is energised, the resulting magnetic force forces the locking E-pieces 280a, 280b into a magnetic coupling with one another.

[0076] In the arrangement described herein, the electro-magnets 385a, 385b comprise sufficient ampere-turns to achieve a suitable magnetic effect and to provide a sufficient attractive force when the electro-magnets 385a, 385b are energised. The dropping resistors 590a, 590b may be formed of a zero (0) to ten (10) ohm slider resistor and may be set to five (5) ohms. This results in a current flowing through the electro-magnets 385a, 385b when the ignition switch 520 and the remote switch 530 are closed so that the electro-magnets 385a, 385b provide an attractive force. A person skilled in the art would appreciate that the electro-magnets 385a, 385b may comprise any suitable number of turns of wire and the wire may be of any suitable cross-sectional area in order to provide a magnetic force to the locking E-pieces 280a, 280b. The number of turns of wire and the cross-sectional diameter of the wire used in the electro-magnets 385a, 385b may change depending on the locking means used and the arrangement of the locking means.

[0077] When energised, the electro-magnets 385a, 385b substantially inhibit the latch plates 120a, 120b, respectively, from being removed from the buckles 200a, 200b by coupling the E-pieces 280a, 280b through the latch openings 121, 122, 123 of the latch plates 120a, 120b, as described above.

[0078] Conversely, when the remote switch 530 is opened, the electro-magnets 385a, 385b are de-energised. In this state, the upper E-piece 280a may be released by moving the release button 210 in the direction of the arrows 211 so as to allow the latch plates 120a, 120b to be removed from the buckles 200a, 200b.

[0079] Similarly, the electro-magnets 385a, 385b are de-energised when the emergency switch 580 is opened. The emergency switch 580 may be opened in response to the door handles of the vehicle (e.g., automobile) being activated from the outside. The emergency switch 580 may also be opened upon impact, if the vehicle is in a crash. In this instance, the emergency switch 580 may be formed by an impact sensor similar to those used for a conventional air bag system.

[0080] As described above, in one arrangement, the buckle 200 may also comprise a manual override switch. The manual override switch may be a normally closed series contact similar to the emergency release switch 580. Such a manual override switch may be located on the buckle. In this instance, opening the manual override switch deactivates the electro-magnet 385. The manual override switch may be spring loaded, so that the manual override switch closes upon release by a person operating the manual override switch. When pressed, the manual override switch may be configured to de-energise the electro-magnet 385. Thus, such a manual override switch acts as an advantageous safety device since, when the electro-magnet 385 is energised, a person is required to simultaneously press the manual override switch and the release button 210 so as to allow the latch plate 120 to be removed from the buckle 200. This arrangement provides some difficulty, particularly to a small child, in re-

lation to removing the latch plate 120. However, an adult or the like may release the latch plate 120 by simultaneously operating the manual override switch 250 and the release button 210 in the case of an emergency.

[0081] As another safety feature, if a small child or the like was able to simultaneously operate the manual override switch and the release button 210 when not appropriate, such will be indicated to a second party (such as the driver of the vehicle) by the "OFF" indication light 535a. The "OFF" indication light will operate when the closed contact 535a opens and the open contact 565a closes in response to de-energising the relay 595a. The difficulty of simultaneously operating the manual override switch and the release button 210 may be increased by adjusting the spring force constant within the manual override switch.

[0082] The remote switch 530 is preferably located in a driving console of a vehicle in which the buckle 200 is installed. A further switch similar to the remote switch 530 may be located near the buckle 200 such as on a car door. However, in this instance the further remote switch may be positioned out of reach of any passenger restrained by a seat belt arrangement or restraint device utilising the buckle 200. The remote switch 530 allows a person within the vehicle to choose when the latch plate 120 may be released from the buckle 200.

[0083] In another arrangement, the buckle 200 and circuit 500 may be installed in an aircraft, such as a passenger jet. In this instance, the remote switch 530 may be positioned so as to be operated by a flight attendant and/or by pilot of the aircraft.

[0084] A reminder mechanism may also be installed in a vehicle in which the buckle 200 is installed. This reminder mechanism may remind the driver audibly or visually (e.g., using a flashing light or a beeping sound), if there is a passenger in a seat in which the buckle 200 is installed and the remote switch 530 for that buckle 200 has not been closed.

[0085] A number of buckles 200 may also be controlled from the same centrally located remote switch 530 by having a number of electro-magnets 385a, 385b connected in a parallel arrangement, as shown in Fig. 5. In this instance, all of the buckles 200 installed in a vehicle may be operated in a similar manner to the conventional central locking of doors.

[0086] Preferably, the electro-magnet 385 is deactivated when the ignition switch 520 is turned off or, as described above, a further sensor (e.g., an impact sensor) mounted in the vehicle detects that the vehicle has crashed. Again, this allows the restrained passenger to be easily removed from the vehicle. Both the "ON" and "OFF" indication lights 535a, 565a will deactivate in this instance.

[0087] The configuration of the buckle 200 without the manual override switch 250 may be used to prevent an adult, such as a prisoner or an unstable person, restrained in the seat belt from operating the release button 210 and/or releasing the locking E-pieces 280a, 280b

from engagement with the bottom plate 350.

[0088] In one arrangement, the circuit 500 may be implemented using one or more integrated circuits. Such integrated circuits may include processors (e.g., digital signal processors), or one or more microprocessors and associated memories.

[0089] In another arrangement, the remote switch 530 may be operated by an infrared or radio frequency (RF) remote control (not shown). In this arrangement, the circuit 500 operates substantially as described above with reference to Fig. 5. However, in this arrangement, the circuit 500 comprises an infrared or RF receiver (not shown), such that the remote switch 530, infrared or RF remote control and infrared or RF receiver form a remote activator. The infrared or RF receiver may be located in a driving console of a vehicle in which the buckle 200 is installed, in the buckle 500 itself or any other suitable position. Using such an infra-red or RF receiver, the remote switch 530 may be operated using a remote control (i.e., infra-red or RF transmitter) such as a conventional remote control contained on a key-fob or the like. Upon receiving an infrared or Rf signal, the remote switch 530 may be opened or closed by a user in order to choose when the release button 210 is to be unlocked or locked.

[0090] Figs. 6 and 7 show a buckle means in the form of a buckle 1200 comprising a locking means or lock in the form of a locking E-piece 1280 and a magnet or magnetic means in the form of an electro-magnet 1385. The buckle 1200 also comprises a release means in the form of a release button 1210. A plastic casing 1297, as shown by dashed lines, may be used to conceal any moving components of the buckle 1200, including the E-piece 1280. The buckle 1200 further comprises a belt connecting piece 1285 interposing a top plate 1240 and a bottom plate 1350, so as to form an opening 1302 for accepting a latch plate such as the latch plate 1120. The top and bottom plates 1240, 1350 and the connecting piece 1285 may be secured together by a pressed rivet 1275 or the like. A support member 1270 is located adjacent to the pressed rivet 1275 and is secured to the top plate 1240. The connecting piece 1285 is adapted to connect the buckle 1200 to a portion of belt (not shown in Figs 8 and 9).

[0091] A flat spring 1235 is attached to the support member 1270 at one end and to the E-piece 1280 at the other so as to force the E-piece 1280 downwards onto a latch plate guide 1310 when the buckle 1200 is in a released state (i.e., when the latch plate 1120 is not inserted into the buckle 1204), as shown in Figs. 8 and 9. The latch plate guide 1310 is attached to a latch spring 1320 and is configured to slide along a substantial length of the opening 1302 of the buckle 1200.

[0092] The latch spring 1320 forms a biasing means for biasing the latch plate guide 1310 to a position substantially underneath the E-piece 1280 when the buckle 1200 is in the released state. In this position, the latch plate guide 1310 prevents the E-piece 1280 from plunging into bottom plate openings 1372 formed in the bottom

plate 1350. In one arrangement, the bottom plate 1350 may comprise three (3) openings 1372 for accepting three corresponding portions of the E-piece 1280.

[0093] As seen in Fig. 8, a latch plate, such as the latch plate 1120, may be inserted into the buckle 1200 thus forcing the latch plate guide 1310 along the opening 1302 against the extended direction of the latch spring 1320. Once latch plate openings 1121, 1122 and 1123 of the latch plate 1120 are substantially under corresponding portions of the E-piece 1280, the flat spring 1235 forces the E-piece 1280 downwards. In this position, one or more portions of the E-piece 1280 pass through the corresponding openings 1121, 1122 and 1123 in the latch plate 1120, and engage with the bottom plate openings 1372 so as to secure the latch plate 1120 in the buckle 1200.

[0094] The release button 1210 is configured to slide along a button guide 1265, which is surrounded by a return spring 1260 and is attached to the support member 1270. The return spring 1260 forms a biasing means for biasing the release button 210 away from the support member 1270. The release button 1210 is inter-connected to the E-piece 1280 such that by pressing the release button 1210 in the direction of the arrows 1211 of Fig. 8, the E-piece 1280 disengages from the latch plate 1120 and the corresponding openings 1121, 1122 and 1123 of the latch plate 1120. Disengaging the E-piece 1280 allows the latch plate 1120 to be removed from the buckle 1200,

[0095] As particularly shown in Figs. 7 and 8, the magnetic means in the form of the electro-magnet 1385 is fixed to the bottom plate 1350. When the buckle 1200 is in a released state (i.e., when the latch plate 1120 is not inserted into the buckle 1200), the latch plate guide 1310 sits between the E-piece 1280 and the electro-magnet 1395, as seen in Fig. 9.

[0096] However, when the buckle 1200 is in a secured state (i.e., when the latch plate 1120 is inserted into the buckle 1200), the flat spring 1235 forces the E-piece 1280 downwards such that at least one lower portion of the E-piece 1280 engages with the bottom plate openings 1372, and the lower portion of the E-piece 1280 is separated from the electro-magnet 1385 only by a small air gap 1386,

[0097] The electro-magnet 1385 applies an attractive force to the E-piece 1280 when the electro-magnet 1385 is energised, such that the E-piece 1280 acts as an armature. As will be described in detail below, this attractive force may be adjusted so as to apply a stronger or weaker force to the E-piece 1280 (i.e., armature). In one energised state, the attractive force applied to the E-piece 1280 is strong enough to retain the E-piece 1280 in the position shown in Fig. 8, so as to inhibit the latch plate 120 from being released from the buckle 1200. When the electro-magnet 1385 is in this energised state, the release button 1210 may still be operated to some extent in the direction of the arrows 1211. However, the release button 1210 cannot be operated fully unless the attractive

force of the energised electro-magnet 1385 is overcome so as to allow removal of the E-piece 1280 from engagement with the latch plate 1120 and bottom plate openings 1372. The portions of the E-piece 1280 that engage with the bottom plate openings 1372 may be lengthened in the arrangement described herein (over a similar conventional type locking E-piece) in order to strengthen the magnetic contact between the portions of the E-piece 1280 and the electro-magnet 1385.

[0098] The bottom plate 1350, upon which the electro-magnet 1385 is mounted, is preferably formed of a non-magnetic material (e.g., non-magnetic stainless steel) in order to ensure that the attractive force of the energised electro-magnet 1385 is applied to the E-piece 1280 (i.e., the armature), when the E-piece 1280 is engaged with the bottom plate openings 1372. Using a magnetic material for the bottom plate 1350 will result in the magnetic flux of the energised electro-magnet 1385 shorting out across the bottom plate 1350 and not being applied fully to the E-piece 1280. The material used to form the bottom plate 1350 is strong enough so as not to jeopardize the safety of the passengers restrained using the buckle 1200.

[0099] The attractive force of the electro-magnet 1385 may be adjusted up or down to require more or less force, respectively, to be applied to the release button 1210 in order to disengage the E-piece 1280 (i.e., the armature) from the openings 1372. As will be described in detail below, the attractive force may be adjusted by adjusting the amount of current flowing through the electro-magnet 1385. At full current, the attractive force provided by the electro-magnet 1385 is preferably strong enough to substantially prevent anyone from fully operating the release button 1210 so as to inhibit the removal of the E-piece 1280 from engagement with the latch plate 1120 and bottom plate openings 1372.

[0100] As described above, in one arrangement, the buckle 1200 may also comprise a manual override switch (not shown). Such a manual override switch may be formed as an electrical spring return button switch mounted on the buckle 1200. The manual override switch may be configured to de-energise the electro-magnet 1385 when pressed, as will be explained in detail below.

[0101] The plastic casing 1297 may be used to conceal the components of the buckle 1200, including the electro-magnet 1385. Thus, the electro-magnet 1385 does not protrude from the periphery of the casing 1297. As such, the buckle 1200 does not appear from the outside to be any different than a conventional buckle and is of a similar size.

[0102] Fig. 9 shows a control circuit 1500 for controlling multiple buckles 200a, 200b according to one arrangement. The circuit 1500 comprises a battery 1510 (e.g., the battery of a vehicle), an ignition switch 1520, a remote activator in the form of a remote switch 1530, and one or more emergency override switches 1580. In one embodiment, the remote activator switch 1530 is a driver master switch located on a console within easy reach of the driv-

er. In the embodiment shown, there are three emergency override switches 1580 arranged in series, which may be located, for example, on one or more door handles located outside the vehicle. The emergency override switches 580, as shown, are normally closed to allow the circuit to operate. In the case of an emergency, one or more of the emergency override switches is opened, which breaks the circuit to electro-magnets that are associated with the buckles, as described below.

[0103] The battery 1510 may be a 12 Volt battery. Alternatively, the battery 1510 may be a 6 Volt, 24 Volt or any other suitable voltage battery. The battery voltage may be dictated by the arrangement of the buckles 1200a, 1200b. For example, if the buckles 1200a, 1200b are implemented in a passenger vehicle such as a car, then battery 1510 may be a 12 Volt battery. However, any other power source other than a battery may also be used to supply power to the circuit 1500.

[0104] A positive terminal of the battery 1510 is electrically connected to the ignition switch 1520 via a junction 1511. The ignition switch 1520 connects via junction 1521 to the remote switch 1530. The remote switch 1530 is connected via junction 1531 to the emergency release switches 1580, which are in turn connected to a junction 1541a.

[0105] The embodiment shown in Fig. 9 is for controlling two buckles 1200a and 1200b. Associated with each buckle 1200a, 1200b is an indicator 1540a, 1540b that is also preferably located on a driver console to alert the driver, or person in control of the vehicle, whether a latch is inserted in each respective buckle 1200a, 1200b. In the circuit 1500, the junction 1521 is connected to the indicator 1540a. The indicator 1540a is embodied by a red light 1545a arranged in series with a contact 1535a, which is normally closed. The indicator 1540a is further embodied by a green light 1555a in series with a contact 1565a, which is normally open. The red light 1545a and contact 1535a are arranged in parallel with the green light 1555a and contact 1565a. The indicator 1540a is connected to a negative terminal of the battery 1510 via a junction 1551.

[0106] The indicator 1540b is embodied in a similar manner to that described above with respect to the indicator 1540a, and is parallel to the indicator 1540a. Thus, junction 1521 is connected to the indicator 1540b. The indicator 1540b contains a red light 1545b in series with a contact 1536a, which is normally closed. The indicator 1540b is further embodied by a green light 1555b in series with a contact 1565b, which is normally open. The red light 1545b and contact 1535b are arranged in parallel with the green light 1555b and contact 1565b. The indicator 1540b is connected to a negative terminal of the battery 1510 via the junction 1551.

[0107] An indicator circuit 1575a associated with the buckle 1200a. From the junction 1521, and in parallel with the indicators 1540a, 1540b described above, the indicator circuit 1575a includes the buckle 1200a arranged in series with a relay 1595a, which in turn con-

nects to a negative terminal of the battery 1510 via junction 1551. Arranged in parallel with the buckle 1200a and the relay 1595a is a sub-circuit relating to an indicator provided on, or in close proximity to the buckle 1200a. The sub-circuit includes a contact 1535b in series with a red light 1545c. The contact 1535b is normally closed. Arranged in parallel with the contact 1535b and red light 1545c is a contact 1565c and a green light 1555c. The contact 565 is normally open. Connected to the junction 1541a is a drop resistor 1590a in series with a contact 1535c and an electro-magnet 1385a. The contact 1535c is normally open. The electro-magnet 1385a is connected to a negative terminal of the battery 1510 via the junction 1551.

[0108] An indicator circuit 1575b is associated with the buckle 1200b, which appears in parallel to the indicator circuit 1575a described above in respect of buckle 1200a. From the junction 1521, the indicator circuit 1575b includes the buckle 1200b arranged in series with a relay 1595b, which in turn connects to a negative terminal of the battery 1510 via junction 1551. Arranged in parallel with the buckle 1200b and the relay 1595b is a sub-circuit relating to an indicator provided on, or in close proximity to the buckle 1200b. The sub-circuit includes a contact 1536b in series with a red light 1545d. The contact 2536b is normally closed. Arranged in parallel with the contact 1536b and red light 1545d is a contact 1565d and a green light 1555d. The contact 1565d is normally open. Connected to the junction 1541a is a drop resistor 1590b in series with a contact 1536c and an electro-magnet 1385b. The contact 1536c is normally open. The electro-magnet 1385b is connected to a negative terminal of the battery 1510 via the junction 1551.

[0109] The contact 1565a and contact 1535a of the indicator 1540a located on the driver console are coupled to the relay 1595a and contacts 1535b, 1565c, 1535c associated with the buckle 1200a. When the ignition switch 1520 is on, and the latch plate 1120a is not located in the buckle 1200a, the red lights 1545a, 1545c are illuminated and the green lights 1555a, 1555c are not illuminated. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that no latch plate is in the buckle 1200a. When the latch plate 1120a is inserted into the buckle 1200a, the relay 1595a becomes energised. The relay 1595a is coupled to each of the contacts 1535a, 1535b, 1535c, 1565a, and 1565c and thus the green lights 1555a, 1555c become illuminated and the red lights 1545a, 1545c are extinguished. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that the latch plate 1120a is in the buckle 1200a. Further the energisation of the relay 1595a from inserting the latch plate 1120a into the buckle 1200a causes the circuit from the drop resistor 1590a to the magnetic coil 1385a to be completed.

[0110] The contact 1563b and contact 1536a of the indicator 1540b located on the driver console are coupled to the relay 1595b and contacts 1536b, 1565d, 1536c

associated with the buckle 1200b. When the ignition 1520 is on, and the latch plate 1120b is not located in the buckle 1200b, the red lights 1545b, 1545d are illuminated and the green lights 1555b, 1555d are not illuminated. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that no latch plate is in the buckle 1200b. When the latch plate 1120b is inserted into the buckle 1200b, the relay 1595b becomes energised. The relay 1595b is coupled to each of the contacts 1536a, 536b, 1536c, 1565b, and 1565d and thus the green lights 1555b, 1555d become illuminated and the red lights 1545b, 1545d are extinguished. This provides an indication to the driver, and at the buckle itself or in close proximity thereof, that the latch plate 1120b is in the buckle 1200b. Further, the energisation of the relay 1595b from inserting the latch plate 1120b into the buckle 1200b causes the circuit from the drop resistor 1590b to the magnetic coil 1385b to be completed.

[0111] When a driver switches on the ignition 1520 and observes that all occupied seat positions have seat belts that are fastened, with corresponding green lights illuminated on the driver console, the driver operates the remote switch 1530, which in this embodiment energises all of the seat belt magnetic coils 1385a, 1385b. The latch plates 1120a, 1120b can then only be removed from the buckles 1200a, 1200b by turning off the remote switch 1530, or by turning off the ignition 1520, or operating one of the emergency override switches 1580.

[0112] Thus, the embodiment described above with respect to Fig. 9 provides a red and green light associated with each seat buckle, and a corresponding red and green light on a driver console. An alternate embodiment utilises a single light in the form of a light emitting diode (LED), wherein the LED is illuminated when a latch is not inserted in a buckle and the LED is extinguished when a latch is inserted in the buckle. The indicator may be located only on the driver console, or only on the buckle. It will be appreciated by a person skilled in the art that the indicators may take different forms and be embodied in different colours, without departing from the spirit and scope of the invention.

[0113] The electro-magnets 1385a, 1385b are configured to have a polarity arrangement so that when the electro-magnets 1385a, 1385b are energised, the electro-magnets 1385a, 1385b apply an attractive force to complementary locking pieces 1280a, 1280b. In another arrangement, the electro-magnets 1385a, 1385b may be configured to repel a locking means or lock such as the E-pieces 1280a, 1280b (i.e., acting as the armatures). For example, with reference to Figs. 7 and 8, the electro-magnet 1385 may be positioned in or near the position of the release button 1210, such that when the electro-magnet 1385 is energised, the resulting magnetic force forces the locking E-pieces 1280a, 1280b into a magnetic coupling with one another.

[0114] In the arrangement described herein, the electro-magnets 1385a, 1385b comprise sufficient ampere-

turns to achieve a suitable magnetic effect and to provide a sufficient attractive force when the electro-magnets 1385a, 1385b are energised. The dropping resistors 1590a, 1590b may be formed of a zero (0) to ten (10) ohm slider resistor and may be set to five (5) ohms. This results in a current flowing through the electro-magnets 1385a, 1385b when the ignition switch 1520 and the remote switch 1530 are closed so that the electro-magnets 1385a, 1385b provide an attractive force. A person skilled in the art would appreciate that the electro-magnets 1385a, 1385b may comprise any suitable number of turns of wire and the wire may be of any suitable cross-sectional, area in order to provide a magnetic force to the locking E-pieces 1280a, 1280b. The number of turns of wire and the cross-sectional diameter of the wire used in the electro-magnets 1385a, 1385b may change depending on the locking means used and the arrangement of the locking means.

[0115] When energised, the electro-magnets 1385a, 1385b substantially inhibit the latch plates 1120a, 1120b, respectively, from being removed from the buckles 1200a, 1200b by coupling the E-pieces 1280a, 1280b through the latch openings 1121, 1122, 1123 of the latch plates 1120a, 1120b, as described above.

[0116] Conversely, when the remote switch 1530 is opened, the electro-magnets 1385a, 1385b are de-energised. In this state, the upper E-piece 1280a may be released by moving the release button 1210 in the direction of the arrows 1211 so as to allow the latch plates 1120a, 1120b to be removed from the buckles 1200a, 1200b.

[0117] Similarly, the electro-magnets 1385a, 1385b are de-energised when the emergency switch 1580 is opened. The emergency switch 1580 may be opened in response to the door handles of the vehicle (e.g., automobile) being activated from the outside. The emergency switch 1580 may also be opened upon impact, if the vehicle is in a crash. In this instance, the emergency switch 1580 may be formed by an impact sensor similar to those used for a conventional air bag system.

[0118] As described above, in one arrangement, the buckle 1200 may also comprise a manual override switch. The manual override switch may be a normally closed series contact similar to the emergency release switch 1580. Such a manual override switch may be located on the buckle. In this instance, opening the manual override switch deactivates the electro-magnet 1385. The manual override switch may be spring loaded, so that the manual override switch closes upon release by a person operating the manual override switch. When pressed, the manual override switch may be configured to de-energise the electro-magnet 1385. Thus, such a manual override switch acts as an advantageous safety device since, when the electro-magnet 1385 is energised, a person is required to simultaneously press the manual override switch and the release button 1210 so as to allow the latch plate 1120 to be removed from the buckle 1200. This arrangement provides some difficulty,

particularly to a small child, in relation to removing the latch plate 1120. However, an adult or the like may release the latch plate 1120 by simultaneously operating the manual override switch 1250 and the release button 1210 in the case of an emergency.

[0119] As another safety feature, if a small child or the like was able to simultaneously operate the manual override switch and the release button 1210 when not appropriate, such will be indicated to a second party (such as the driver of the vehicle) by the "OFF" indication light 1535a. The "OFF" indication light will operate when the closed contact 1535a opens and the closed contact 565a opens in response to de-energising the relay 1595a. The difficulty of simultaneously operating the manual override switch and the release button 210 may be increased by adjusting the spring force constant within the manual override switch.

[0120] The remote switch 1530 is preferably located in a driving console of a vehicle in which the buckle 1200 is installed. A further switch similar to the remote switch 1530 may be located near the buckle 1200 such as on a car door. However, in this instance the further remote switch may be positioned out of reach of any passenger restrained by a seat belt arrangement or restraint device utilising the buckle 1200. The remote switch 1530 allows a person within the vehicle to choose when the latch plate 1120 may be released from the buckle 1200.

[0121] In another arrangement, the buckle 1200 and circuit 1500 may be installed in an aircraft, such as a passenger jet. In this instance, the remote switch 1530 may be positioned so as to be operated by a flight attendant and/or by pilot of the aircraft.

[0122] A reminder mechanism may also be installed in a vehicle in which the buckle 1200 is installed. This reminder mechanism may remind the driver audibly or visually (e.g., using a flashing light or a beeping sound), if there is a passenger in a seat in which the buckle 1200 is installed and the remote switch 1530 for that buckle 1200 has not been closed.

[0123] A number of buckles 1200 may also be controlled from the same centrally located remote switch 1530 by having a number of electro-magnets 1385a, 1385b connected in a parallel arrangement, as shown in Fig. 9. In this instance, all of the buckles 1200 installed in a vehicle may be operated in a similar manner to the conventional central locking of doors.

[0124] Preferably, the electro-magnet 1385 is deactivated when the ignition switch 1520 is turned off or, as described above, a further sensor (e.g., an impact sensor) mounted in the vehicle detects that the vehicle has crashed. Again, this allows the restrained passenger to be easily removed from the vehicle. Both the "ON" and "OFF" indication lights 1535a, 1565a will deactivate in this instance.

[0125] The configuration of the buckle 1200 without the manual override switch 1250 may be used to prevent an adult, such as a prisoner or an unstable person, restrained in the seat belt from operating the release button

1210 and/or releasing the locking E-pieces 1280a, 1280b from engagement with the bottom plate 1350.

[0126] In one arrangement, the circuit 1500 may be implemented using one or more integrated circuits. Such integrated circuits may include processors (e.g., digital signal processors), or one or more microprocessors and associated memories.

[0127] In another arrangement, the remote switch 1530 may be operated by an infrared or radio frequency (RF) remote control (not shown). In this arrangement, the circuit 1500 operates substantially as described above with reference to Fig. 9. However, in this arrangement, the circuit 1500 comprises an infrared or RF receiver (not shown), such that the remote switch 1530, infrared or RF remote control and infrared or RF receiver form a remote activator. The infrared or RF receiver may be located in a driving console of a vehicle in which the buckle 1200 is installed, in the buckle 1500 itself or any other suitable position. Using such an infra-red or RF receiver, the remote switch 1530 may be operated using a remote control (i.e., infra-red or RF transmitter) such as a conventional remote control contained on a key-fob or the like. Upon receiving an infrared or RF signal, the remote switch 1530 may be opened or closed by a user in order to choose when the release button 1210 is to be unlocked or locked.

[0128] Figs. 10 and 11 show another buckle means in the form of a buckle 1700. The buckle 1700 is suitable for use with a conventional lap belt, for example, as used in most passenger aircrafts. The buckle 1700 again comprises a magnet or magnetic means in the form of an electro-magnet 1785. The electro-magnet 1785 is fixed to a bottom plate 1710 of the buckle 1700. The bottom plate 1710 also comprises a piece of belt 1715 connected to the bottom plate 1710. The buckle 1700 comprises a locking means or lock in, the form of a locking plate 1780. The locking plate 1780 and the bottom plate 1710 are pivotally connected at either side 1704 and 1706 of the bottom plate 1710 to form an opening 1702 for accepting a latch plate 1720. In Fig. 12, the buckle 1700 is shown in a released state.

[0129] Fig. 11 shows the latch plate 1720 engaged with the buckle 1700 with the locking plate 1780 closed so that the latch plate 1780 is substantially parallel with the bottom plate 1710 of the buckle 1700. In this position, a securing portion 1708 of the locking plate 1780 engages with an opening 1712 in the latch plate 1720 so as to secure the latch plate 1720 in the buckle 1700.

[0130] When the buckle 1700 is in a released state (i.e., when the latch plate 1720 is not inserted into the buckle 1700), the locking plate 1780 may be moved freely through approximately ninety degrees (90°) movement. However, when the buckle 1700 is in a secured state (i.e., when the latch plate 1720 is inserted into the buckle 1700 and the locking plate 1780 is closed) the electro-magnet 1785 may be energised so as to apply an attractive force to the locking plate 1780. This attractive force is preferably strong enough to retain the locking plate

1780 in the position shown in Fig. 11, so as to inhibit the latch plate 1720 from being released from the buckle 1700.

[0131] When the electro-magnet 1785 is energised, the locking plate 1780 may still be operated to some extent in the direction of the arrow 1711. However, the attractive force of the energised electro-magnet 1785 needs to be overcome in order to allow the locking plate 1780 to be opened fully so as to allow removal of the securing portion 1708 from engagement with the opening 1712 of the latch plate 1720.

[0132] Again, the buckle 1700 may be controlled using the circuit 1500. The attractive force of the electro-magnet 1785 may be adjusted up or down to require more or less force, respectively, to be applied to the locking plate 1780 in order to disengage the securing portion 1708 of the locking plate 1780 with the opening 1712. As described above, the attractive force may be adjusted by adjusting the amount of current flowing through the electro-magnet 1785. At full current, the attractive force provided by the electro-magnet 1785 is preferably strong enough to substantially prevent anyone from fully operating the locking plate 1780 so as to inhibit the removal of the latch plate 1720 from engagement with the buckle 1700.

[0133] The buckle 1700 may be formed from either magnetic (e.g., stainless steel) or non-magnetic material (e.g., plastic). In the instance that the buckle 1700 is formed from a non-magnetic material, then a suitable portion of magnetic material may be fixed to an inner face of the locking plate 1780. The electro-magnetic may then apply an attractive force to the portion of magnetic material so as to prevent anyone from releasing the latch plate 1720 when the electro-magnetic is energised.

[0134] As seen in Figs. 12 and 13, a buckle means in the form of a buckle 2200 comprises a release means or release in the form of a release button 2210, a magnetic projection in the form of a locking pin 2230 and an override in the form of a manual override switch 2250. A plastic casing 2297, as shown by dashed lines, may be used to conceal any moving components of the buckle 2200, including the locking pin 2230. The buckle 2200 further comprises a belt connecting piece 2285 interposing a top plate 2240 and a bottom plate 2350, so as to form an opening 2302 for accepting a latch plate such as the latch plate 2120. The top and bottom plates 2240, 2350 and the connecting piece 2285 are secured together by a pressed rivet 2275. The connecting piece 2285 is adapted to connect the buckle 2200 to a portion of belt (not shown in Figs 12 and 13).

[0135] Preferably, a support member 2270 is located adjacent to the pressed rivet 2275 and is secured to the top plate 2240.

[0136] A resilient plate 2235 is attached to the support member 2270 at one end and to a retention block 2380 at the other so as to force the retention block 2380 downwards onto a latch plate guide 2310 when the buckle 2200 is in a released condition (i.e., when the latch plate

2120 is not inserted into the buckle 2200), as shown in Fig. 12.

[0137] The latch plate guide 2310 is attached to a latch spring 2320 and is configured to slide along a substantial length of the opening 2302 of the buckle 2200.

[0138] The latch spring 2320 forms a biasing means for biasing the latch plate guide 2310 to a position substantially underneath the retention block 2380 when the buckle 2200 is in the released condition, so as to prevent the retention block 2380 from plunging into bottom plate openings 2372 formed in the bottom plate 2350.

[0139] As seen in Fig. 14, a latch plate, such as the latch plate 2120, may be inserted into the buckle 2200 thus forcing the latch plate guide 2310 along the opening 2302 against the extended direction of the latch spring 2320. Once the latch plate opening of the latch plate 2120 is substantially under the retention block 2380, the resilient plate 2235 forces the retention block 2380 downwards such that at least a lower portion of the retention block 2380 engages with the bottom plate openings 2372, so as to secure the latch plate 2120 in the buckle 2200.

[0140] The release button 2210 is configured to slide along a button guide 2265, which is surrounded by a return spring 2260 and is attached to the support member 2270. The return spring 2260 forms a biasing means for biasing the release button 2210 away from the support member 2270. The release button 2210 is inter-connected to the retention block 380 such that by pressing the release button 2210 in the direction of the dashed arrows 2211 of Fig. 12, the retention block 2380 disengages. Disengaging the retention block 2380 allows the latch plate 2120 to be removed from the buckle 2200.

[0141] As shown in Figs. 13 and 15, a magnet or magnetic means in the form of a magnetic coil 2395 is configured within a recess 2396 of the top plate 2240. A further biasing means in the form of a retaining spring 2390 is attached to the magnetic coil 2395 at one end and to a magnetic locking pin 2230 at the other, such that the magnetic locking pin 2230 may move up and down within the recess 2396 through operation of the retaining spring 2390, as will be explained in detail below. A person skilled in the relevant art would appreciate that the magnetic locking pin 2230 may be any suitable shape, depending on the shape of the recess 2396 of the top plate 2240. The magnetic coil 2395, locking pin 2230 and spring 2290 together form a locking means or lock.

[0142] The retaining spring 2390 is configured to prevent the magnetic locking pin 2230 from being removed from the recess 2396 of the top plate 2240.

[0143] As seen in Fig. 13, the retaining spring 2390 biases the locking pin towards the magnetic coil 2395 such that when the spring 2390 is in a normal retracted state, the locking pin 2230 is totally within the periphery of the recess 2396 and the release button 2210 may be moved in the direction of the arrows 2211 so as to allow the latch 2120 to be removed from the buckle 2200. Conversely, as shown in Fig. 14, when the spring 2390 is

extended in a direction opposed to the bias of the retaining spring 2390, the locking pin 2230 projects out from the top plate 2240. In this position, the locking pin 2230 substantially inhibits movement of the release button 2210 in the direction of the arrows 2211 so as to stop the release button 2210 from being operated and thus to stop the latch 2120 from being removed.

[0144] As shown in Fig. 12, the manual override switch 2250 is preferably an electrical spring return button switch that is located adjacent the pressed rivet 2275, which is configured to de-energise the magnetic coil 2395 when pressed, as will be explained in detail below. Alternatively, the manual override switch 2250 may be configured as a mechanical switch suitable for forcing the locking pin 2230 within the recess 2396 so as to allow the release button 2210 to be operated.

[0145] As described above, the plastic casing 2297 may be used to conceal the moving components of the buckle 2200, including the locking pin 2230. Thus, the locking pin 2230 does not protrude from the periphery of the casing 2297. As such, the buckle 2200 does not appear from the outside to be any different than a conventional buckle and is of a similar size.

[0146] Fig. 15 shows a control circuit 2500 for controlling the buckle 2200 according one implementation of the invention. The circuit 2500 comprises a battery 2510 (e.g., the battery of a vehicle) an ignition switch 2520, a remote activator in the form of a remote switch 2530, the manual override switch 2250, an open contact 2580, a close contact 2560, an "ON" indication light (or indicator) 2550, an "OFF" indication light (or indicator) 2570 and the magnetic coil 2395. The battery 2510 may be a 12 Volt battery. Alternatively, the battery 2510 may be a 6 Volt, 24 Volt or any other suitable voltage battery. The battery voltage may be dictated by the implementation of the buckle 2200. For example, if the buckle 2200 is implemented in a passenger vehicle such as a car then battery 2510 may be a 12 Volt battery. However, any other DC power source other than a battery (e.g., mains power) may also be used to supply power to the circuit 2500.

[0147] A positive terminal of the battery 2510 is electrically connected to the ignition switch 2520 via a junction 2511. The ignition switch 2520 also connects via junction 2521 to the remote switch 2530. The remote switch 2530 is also connected via junction 2531 to the manual override switch 2250 which in turn is connected to the magnetic coil 2395 via junction 2541. The magnetic coil 2395 connects to a negative terminal of the battery 2510 via junction 2551.

[0148] Preferably, as indicated by the dashed arrows of Fig. 15, the open contact 2580 is electrically connected to the ignition switch 2520 via the junction 2521 and to the "ON" indication light 2550 via junction 2581. The open contact 2580 is operatively associated with the magnetic coil 2395 such that the open contact 2580 closes when the magnetic coil 2395 is energised.

[0149] The closed contact 2560 is connected to both

the ignition switch 2520 via junction 2521 and the "OFF" indication light 2570 via junction 2561. The closed contact 2560 is operatively associated with the magnetic coil 2395 such that the closed contact 2560 opens when the magnetic coil 2395 is energised.

[0150] As shown in Fig. 15, closing the ignition switch 2520 and the remote switch 2530 energises the magnetic coil 2395, thus causing the open contact 2580 to close and the "ON" indication light 2550 to illuminate. The "OFF" indication light is deactivated at this point. The magnetic locking pin 2230 is configured to have a polarity arrangement so that when the magnetic coil 2395 is energised the pole at the bottom face 2397 of the pin 2230 is the same as the pole at the top face 2398 of the magnetic coil 2395. Thus, in this energised state, the magnetic locking pin 2230 is forced out of the recess 2396 and the spring 2390 extends. In this position, the locking pin 2230 substantially inhibits movement of the release button 2210 in the direction of the arrows 2211 so as to stop the release button 2210 from being operated and thus stopping the latch 2120 from being removed, as described above.

[0151] Conversely, when the remote switch 2530 is opened the spring retracts to its normal relaxed state and the locking pin 2230 is retracted so as to be totally within the periphery of the recess 2396. In this position, the release button 2210 may be moved in the direction of the arrows 2211 so as to allow the latch 2120 to be removed from the buckle 2200.

[0152] Preferably, the manual override switch 2250 is located on the buckle 2200 and opening the manual override switch 2250 deactivates the magnetic coil 2395. The manual override switch 2250 is spring loaded so that the manual override switch 2250 will close upon release by a person operating the manual override switch 2250. When pressed, the manual override switch 2250 is configured to de-energise the magnetic coil 2395 so as to retract the spring to its normal relaxed state and the locking pin 2230 is retracted so as to be totally within the periphery of the recess 2396. Thus, the manual override switch 2250 acts as an advantageous safety device since, when the magnetic coil 2395 is energised, a person is required to simultaneously press the manual override switch 2250 and the release button 2210 so as to allow the latch 2120 to be removed. This arrangement provides some difficulty, particularly to a small child, in relation to removing the latch 2120. However, an adult or the like may release the latch 2120 by simultaneously operating the manual override switch 2250 and the release button 2210 in the case of an emergency.

[0153] As a secondary safety feature, if a small child or the like was able to simultaneously operate the manual override switch 2250 and the release button 2210 when not appropriate, such will be indicated to a second party (such as the driver of the vehicle) by the "OFF" indication light 2570. The "OFF" indication light will operate when the closed contact 2560 opens in response to de-energising the magnetic coil 2395. The difficulty of simulta-

neously operating the manual override switch 2250 and the release button 2210 may be increased by adjusting the spring force constant within the manual override switch 2250.

[0154] The remote switch 2530 is preferably located where it cannot be reached by the restrained person, such as in a diving console of a vehicle in which the buckle 2200 is installed. A further switch similar to the remote switch 2530 may be located near the buckle 2200 such as on a door, but may only be active if the door has been opened by an external handle. However, in this instance the further remote switch may be positioned out of reach of any passenger restrained by a seat belt arrangement or restraint device utilising the buckle 2200. The remote switch 2530 allows a person within the vehicle, such as the driver or controller of the vehicle, to choose when the release button 2210 is to be locked.

[0155] Preferably, the magnetic coil 2395 is deactivated when the ignition switch 2520 is turned off or a further sensor mounted in the vehicle detects that the vehicle has crashed. Both the "ON" and "OFF" indication lights 2550, 2570 will deactivate in this instance.

[0156] The buckle 2200 may also be configured so that the manual override switch 2250 does not deactivate the locking pin 2230 and allow the release button 2210 to be pressed. This configuration is to prevent an adult, such as a prisoner or an unstable person, secured in the belt from operating the release button 2210. Alternatively, the manual override button 2250 may be removed,

[0157] In one implementation, the locking means may be configured as a solenoid (not shown). Such a solenoid operates in substantially the same manner as the magnetic coil 2395, retaining spring 2390 and locking pin 2230 described above. When the solenoid is energised a magnetic projection in the form of a solenoid pin, is forced out of a body of the solenoid. In this position, the solenoid pin substantially inhibits movement of the release button 2210 in the direction of the arrows 2211 so as to stop the release button 2210 from being operated and thus stopping the latch 2120 from being removed, as described above. Conversely, when the remote switch 2530 is opened the solenoid is de-energised and the solenoid pin retracts so as to be substantially within a periphery of the solenoid body allowing the release button 2210 to be operated.

[0158] In another implementation, the magnetic coil 2395 or solenoid may be a two-stage device, which is configured to ensure that full voltage is applied to the magnet coil initially, when the air gap between its armature pole is at a maximum requiring maximum attractive force, and that this voltage is automatically reduced, once the armature has moved in response to the magnetic force and when only a lesser voltage (or current) is required in order to hold the armature in its closed position. In this instance, closing the ignition switch 2520 and the remote switch 2530 energises the magnetic coil 2395 or solenoid with full battery voltage (e.g., 12 Volts) being seen across the magnetic coil 2395 or solenoid. After a

predetermined time (e.g., set by a user or installer of the control circuit), which allows the locking pin 2230 to magnetic locking pin. 2230 or solenoid pin to be forced out of the recess 2396, the amount of voltage seen across the magnetic coil 2395 or solenoid is reduced (e.g., halved). Reducing the amount of voltage seen across the magnetic coil 2395 or solenoid whilst the magnetic coil 2395 or solenoid remains energised stops the magnetic coil 2395 or solenoid from heating up too much, when the magnetic coil 2395 or solenoid is energised for a long period of time. This allows the magnetic coil 2395 or solenoid to be housed within the buckle 2200. Such two stage magnetic coils or solenoids typically comprise an internal resistor/capacitor timing circuit which dictates the time that the magnetic coil 2395 or solenoid will be energised with full battery voltage or alternatively a switch can be activated once the air gap is reduced, which inserts a current reducing resistor into the circuit in order to reduce the current heating.

[0159] In one implementation, as shown in Fig. 16, the control circuit 2500 may comprise two mechanically associated conventional delay contacts 2610 and 2620, and a series resistor 2630. In this implementation, closing the ignition switch 2520 and the remote switch 2530 energises the magnetic coil 2395, thus causing the magnetic locking pin 2230 or solenoid pin to be forced out of the recess 2396 and the spring 2390 to be extended. As such the full battery voltage (e.g., 12 Volts) is seen across the magnetic coil 2395 or solenoid. After a predetermined time, the delay contact 2610 opens and the delay contact 2620 closes such that the resistor 2630 is switched into series with the magnetic coil 2395. The circuit 2500 is configured so that the magnetic coil 2395 is not de-energised at any point during the switching of the contacts 2610 and 2620. The resistor 2630 therefore reduces (e.g., halves to 6 Volts) the amount of voltage seen across the magnetic coil 2395 or solenoid whilst still allowing the magnetic coil 2395 to remain energised. The circuit 2500 may also include one or more further electronic components (e.g., capacitors) to ensure that the magnetic coil 2395 does not de-energise, whilst the delay contacts 2610 and 2620 are switching.

[0160] The circuits described above with reference to Figs 5 and 9 could equally be used to control the buckle 2200.

[0161] In one implementation, the circuit 2500 may be implemented using one or more integrated circuits. Such integrated circuits may include processors (e.g., digital signal processors), or one or more microprocessors and associated memories. In such an implementation, the delay contacts 2610 and 2620 may be implemented using a resistor/capacitor circuit or the like in order to provide the timing function in order to reduce the voltage across the magnetic coil 2395 whilst the coil is energised.

[0162] In another implementation, the remote switch 2530 may be operated by an infrared remote control (not shown). In this implementation, the circuit 2500 operates substantially as described above with reference to Figs.

15 and 16. However, in this implementation, the circuit 2500 comprises an infrared receiver (not shown), such that the remote switch 2530, infrared remote control and infrared receiver form a remote activator. The infrared receiver may be located in a driving console of a vehicle in which the buckle 2200 is installed, in the buckle 2500 itself or any other suitable position. Using such an infrared receiver, the remote switch 2530 may be operated using a remote control (i.e., infra-red transmitter) such as a conventional remote control contained on a key-fob or the like. Upon receiving an infrared signal the remote switch 2530 may be opened or closed by a user in order to choose when the release button 2210 is to be unlocked or locked.

[0163] Where reference is made in any one or more of the accompanying drawings to steps and/or features, which have the same reference numerals, those steps and/or features have for the purposes of this description the same function(s) or operation(s), unless the contrary intention appears.

Industrial Applicability

[0164] The foregoing describes only some embodiments of the present invention, and modifications and/or changes can be made thereto without departing from the scope of the invention, the embodiments being illustrative and not restrictive. For example, different types of vehicles may be suitable for installation of the seat belt arrangement described above, such as cars, buses, trucks, trains, and aeroplanes. Alternatively, the seat belt arrangement described above may be in a variety of shapes and have a number of configurations.

[0165] In the context of this specification, the word "comprising" means "including principally but not necessarily solely" or "having" or "including", and not "consisting only of". Variations of the word "comprising", such as "comprise" and "comprises" have correspondingly varied meanings.

Claims

1. A restraint arrangement comprising:

buckle (200) configured to secure a latch (120) when said latch (120) is engaged with said buckle (200);

upper and lower complementary locking E-pieces (280a, 280b) associated with said buckle (200), said locking E-pieces (280a, 280b) being configured such that one or more portions of each of said locking E-pieces (280a, 280b) engage with corresponding openings (121, 122, 123) in said latch (120) when said upper and lower complementary locking E-pieces (280a, 280b) are coupled together so as prevent release of said latch (120) from engagement with

- said buckle (200), said locking E-pieces (280a, 280b) being further configured to allow release of said latch (120) from engagement with said buckle (200) when said upper and lower complementary locking E-pieces (280a, 280b) are uncoupled; and
electro-magnet (385) associated with said buckle (200) and said locking E-pieces (280a, 280b), said electro-magnet (385) being configured to prevent said upper and lower complementary locking E-pieces (280a, 280b) from uncoupling when said electro-magnet (385) is energised and to allow said upper and lower complementary locking E-pieces (280a, 280b) to uncouple when said electro-magnet is de-energised, said electro-magnet (385) being energised upon a remote activator being activated.
2. The restraint arrangement according to claim 1, further comprising one or more override switches associated with said electro-magnet, wherein upon activation of at least one of said override switches, said electro-magnet (385) is de-energised to allow release of said latch (120) from engagement with said buckle (200) while said remote activator (530) is activated.
 3. The restraint arrangement according to claim 1 or 2, wherein said upper and lower complementary locking E-pieces (280a, 280b) are self-aligned such that no air exists between said locking E-pieces (280a, 280b) and electro-magnetic coupling is induced between said locking E-pieces (280a, 280b) when said electro-magnet (385) is energised.
 4. The restraint arrangement according to claim 3, wherein said electro-magnetically coupled locking E-pieces (280a, 280b) engage said latch (120) to secure said latch (120) in said buckle (200).
 5. The restraint arrangement according to any preceding claim, wherein said electro-magnet (385) is mounted on a non-magnetic portion of said buckle (200).
 6. The restraint arrangement according to any one of claims 3-5, further comprising guides for aligning said complementary upper and lower complementary locking E-pieces (280a, 280b).
 7. The restraint arrangement according to claim 6, wherein said guides are non-magnetic.
 8. A restraint arrangement according to any preceding claim, wherein said remote activator (530) is in the form of a remote switch configured within a vehicle that has the restraint arrangement installed.
 9. A restraint arrangement according to any preceding claim, wherein said electro-magnet (385) is de-energised upon opening an ignition switch (520) of said vehicle.
 10. A restraint arrangement according to any preceding claim, wherein said electro-magnet (385) is de-energised when said vehicle is in a crash.
 11. A restraint arrangement according to any preceding claim, wherein said electro-magnet (385) is de-energised upon said remote activator (530) being deactivated.
 12. A buckle (200) configured to secure a latch (120) when said latch (120) is engaged with said buckle (200), said buckle (200) comprising:
release means (210) associated with said buckle (200) and being configured to allow release of said latch (120) from engagement with said buckle (200) upon activation of said release means (120);
upper and lower complementary locking E-pieces (280a, 280b) associated with said buckle (200) and said release means (210), said upper and lower complementary locking E-pieces (280a, 280b) being configured such that one or more portions of each of said locking E-pieces (280a, 280b) engage with corresponding openings (121, 122, 123) in said latch (120) when said upper and lower complementary locking E-pieces (280a, 280b) are coupled together so as to prevent release of said latch (120) from engagement with said buckle (200) when said upper and lower complementary locking E-pieces (280a, 280b) are coupled together, said locking E-pieces (280a, 280b) being further configured to allow release of said latch (120) from engagement with said buckle (200) when said upper and lower complementary locking E-pieces (280a, 280b) are uncoupled; and
electro-magnet (385) associated with said buckle (200) and said locking E-pieces (280a, 280b), said electro-magnet (385) being configured to prevent said upper and lower complementary locking E-pieces (280a, 280b) from uncoupling when said electro-magnet (385) is energised and to allow said upper and lower complementary locking E-pieces (280a, 280b) to uncouple when said electro-magnet (385) is de-energised, said electro-magnet (385) being energised upon a remote activator (530) being activated.
 13. A buckle (200) according to claim 12, wherein upon activation of one or more override switches associated with said electro-magnet (385), said electro-

magnet (385) is de-energised to allow release of said latch (120) from engagement with said buckle (200) while said remote activator (530) is activated.

14. The buckle (200) according to claim 12 or 13, wherein said upper and lower complementary locking E-pieces (280a, 280b) are self-aligned such that no air exists between said locking E-pieces (280a, 280b) and electro-magnetic coupling is induced between said locking E-pieces (280a, 280b) when said electro-magnet (385) is energised. 5
15. The buckle (200) according to claim 14, wherein said electro-magnetically coupled locking E-pieces (280a, 280b) engage said latch (120) to secure said latch (120) in said buckle (200). 10
16. The buckle (200) according to any one of claims 12-15, wherein said electro-magnet is mounted on a non-magnetic portion of said buckle (120). 20
17. The buckle (200) according to any one of claims 14-16, further comprising guides for aligning said upper and lower complementary locking E-pieces (280a, 280b). 25
18. The buckle (200) according to claim 16, wherein said guides are non-magnetic.
19. A buckle according to any one of claims 12-18, wherein said remote activator (530) is in the form of a remote switch configured within a vehicle that has the buckle is installed. 30
20. A buckle according to any one of claims 12-19, wherein said electro-magnet (385) is de-energised upon opening an ignition switch (520) of said vehicle. 35
21. A buckle according to any one of claims 12-20, wherein said said electro-magnet (385) is de-energised when said vehicle is in a crash. 40
22. A buckle according to any one of claims 12-21, wherein said electro-magnet (385) is de-energised upon said remote activator (530) being deactivated. 45

Patentansprüche

1. Rückhalteanordnung mit einem Gurtschloss (200), das so konfiguriert ist, dass es einen Verschluss (120) befestigt, wenn der Verschluss (120) mit dem Gurtschloss (200) in Eingriff steht; oberen und unteren komplementären Verriegelungs-E-Stücken (280a, 280b), die dem Gurtschloss (200) zugeordnet sind, wobei die Verriegelungs-E-Stücke (280a, 280b) so konfiguriert sind, dass ein 50

oder mehrere Abschnitte jedes der Verriegelungs-E-Stücke (280a, 280b) in entsprechenden Öffnungen (121, 122, 123) in dem Verschluss (120) einrastet, wenn die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) miteinander gekoppelt werden, um eine Lösung des Verschlusses (120) aus dem Eingriff in dem Gurtschloss (200) zu verhindern, wobei die Verriegelungs-E-Stücke (280a, 280b) ferner so konfiguriert sind, dass sie eine Lösung des Verschlusses (120) aus dem Eingriff in dem Gurtschloss (200) ermöglichen, wenn die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) entkoppelt werden; und einem dem Gurtschloss (200) und den Verriegelungs-E-Stücken (280a, 280b) zugeordneten Elektromagneten (385), wobei der Elektromagnet (385) so konfiguriert ist, dass er eine Entkopplung der oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) verhindert, wenn der Elektromagnet (385) erregt wird, und eine Entkopplung der oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) ermöglicht, wenn der Elektromagnet nicht erregt wird, wobei der Elektromagnet (385) bei einer Aktivierung eines Fernauslösers erregt wird.

2. Rückhalteanordnung nach Anspruch 1, die ferner einen oder mehrere dem Elektromagneten zugeordnete Überbrückungsschalter umfasst, wobei der Elektromagnet (385) bei einer Aktivierung mindestens eines der Überbrückungsschalter abgeschaltet wird, um eine Lösung des Verschlusses (120) aus dem Eingriff mit dem Gurtschloss (200) zu ermöglichen, während der Fernauslöser (530) aktiviert ist.
3. Rückhalteanordnung nach Anspruch 1 oder 2, bei der die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) selbstausrichtend sind, so dass sich keine Luft zwischen den Verriegelungs-E-Stücken (280a, 280b) befindet, und eine elektromagnetische Kopplung zwischen den Verriegelungs-E-Stücken (280a, 280b) induziert wird, wenn der Elektromagnet (385) erregt wird.
4. Rückhalteanordnung nach Anspruch 3, bei der die elektromagnetisch gekoppelten Verriegelungs-E-Stücke (280a, 280b) mit dem Verschluss (120) in Eingriff treten, um den Verschluss (120) in dem Gurtschloss (200) zu befestigen.
5. Rückhalteanordnung nach einem der vorhergehenden Ansprüche, bei der der Elektromagnet (385) auf einem nicht magnetischen Abschnitt des Gurtschlusses (200) montiert ist.
6. Rückhalteanordnung nach einem der Ansprüche 3 - 5, die ferner Führungen zum Ausrichten der kom-

plementären oberen und unteren Verriegelungs-E-Stücke (280a, 280b) umfasst.

7. Rückhalteanordnung nach Anspruch 6, bei der die Führungen nicht magnetisch sind. 5
8. Rückhalteanordnung nach einem der vorhergehenden Ansprüche, bei der der Fernauslöser (530) die Form eines Fernschalters aufweist, der in einem Fahrzeug ausgebildet ist, in dem die Rückhalteanordnung installiert ist. 10
9. Rückhalteanordnung nach einem der vorhergehenden Ansprüche, bei der der Elektromagnet (385) beim Öffnen eines Zündschalters (520) des Fahrzeugs abgeschaltet wird. 15
10. Rückhalteanordnung nach einem der vorhergehenden Ansprüche, bei der der Elektromagnet (385) abgeschaltet wird, wenn das Fahrzeug in einen Zusammenstoß verwickelt ist. 20
11. Rückhalteanordnung nach einem der vorhergehenden Ansprüche, bei der der Elektromagnet (385) bei einer Deaktivierung des Fernauslösers (530) abgeschaltet wird. 25
12. Gurtschloss (200), das so konfiguriert ist, dass es einen Verschluss (120) befestigt, wenn der Verschluss (120) mit dem Gurtschloss (200) in Eingriff steht, wobei das Gurtschloss (200) umfasst:

eine dem Gurtschloss (200) zugeordnete Freigabeeinrichtung (210), die so konfiguriert ist, dass sie bei einer Aktivierung der Freigabeeinrichtung (210) eine Lösung des Verschlusses (120) aus dem Eingriff mit dem Gurtschloss (200) ermöglicht; 35

obere und untere komplementäre Verriegelungs-E-Stücke (280a, 280b), die dem Gurtschloss (200) und der Freigabeeinrichtung (210) zugeordnet sind, wobei die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) so konfiguriert sind, dass ein oder mehrere Abschnitte jedes der Verriegelungs-E-Stücke (280a, 280b) mit entsprechenden Öffnungen (121, 122, 123) in dem Verschluss (120) in Eingriff treten, wenn die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) miteinander gekoppelt sind, um eine Lösung des Verschlusses (120) aus dem Eingriff mit dem Gurtschloss (200) zu verhindern, wenn die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) miteinander gekoppelt sind, wobei die Verriegelungs-E-Stücke (280a, 280b) ferner so konfiguriert sind, dass sie eine Lösung des Verschlusses (120) aus dem Eingriff mit dem Gurtschloss (200) er-

möglichen, wenn die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) entkoppelt werden; und

einen dem Gurtschloss (200) und den Verriegelungs-E-Stücken (280a, 280b) zugeordneten Elektromagneten (385), wobei der Elektromagnet (385) so konfiguriert ist, dass er eine Entkopplung der oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) verhindert, wenn der Elektromagnet (385) erregt wird, und eine Entkopplung der oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) ermöglicht, wenn der Elektromagnet (385) abgeschaltet wird, wobei der Elektromagnet (385) bei einer Aktivierung eines Fernauslösers (530) erregt wird.

13. Gurtschloss (200) nach Anspruch 12, bei dem der Elektromagnet (385) bei einer Aktivierung eines oder mehrerer dem Elektromagneten (385) zugeordneter Überbrückungsschalter abgeschaltet wird, um eine Lösung des Verschlusses (120) aus dem Eingriff mit dem Gurtschloss (200) zu ermöglichen, während der Fernauslöser (530) aktiviert ist.
14. Gurtschloss (200) nach Anspruch 12 oder 13, bei dem die oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) selbstausrichtend sind, so dass zwischen den Verriegelungs-E-Stücken (280a, 280b) keine Luft vorhanden ist, und eine elektromagnetische Kopplung zwischen den Verriegelungs-E-Stücken (280a, 280b) induziert wird, wenn der Elektromagnet (385) erregt wird.
15. Gurtschloss (200) nach Anspruch 14, bei dem die elektromagnetisch gekoppelten Verriegelungs-E-Stücke (280a, 280b) mit dem Verschluss (120) in Eingriff treten, um den Verschluss (120) in dem Gurtschloss (200) zu befestigen. 40
16. Gurtschloss (200) nach einem der Ansprüche 12 - 15, bei dem der Elektromagnet auf einem nicht magnetischen Abschnitt des Verschlusses (120) montiert ist. 45
17. Gurtschloss (200) nach einem der Ansprüche 14 - 16, das ferner Führungen zum Ausrichten der oberen und unteren komplementären Verriegelungs-E-Stücke (280a, 280b) umfasst. 50
18. Gurtschloss (200) nach Anspruch 16, bei dem die Führungen nicht magnetisch sind.
19. Gurtschloss (200) nach einem der Ansprüche 12 - 18, bei dem der Fernauslöser (530) die Form eines Fernschalters aufweist, der in einem Fahrzeug konfiguriert ist, in dem das Gurtschloss (200) installiert ist. 55

20. Gurtschloss (200) nach einem der Ansprüche 12 - 19, bei dem der Elektromagnet (385) beim Öffnen eines Zündschalters (520) des Fahrzeugs abgeschaltet wird.
21. Gurtschloss (200) nach einem der Ansprüche 12 - 20, bei dem der Elektromagnet (385) abgeschaltet wird, wenn das Fahrzeug in einen Zusammenstoß verwickelt wird.
22. Gurtschloss (200) nach einem der Ansprüche 12 - 21, bei dem der Elektromagnet (385) bei einer Deaktivierung des Fernauslösers (530) abgeschaltet wird.

Revendications

1. Agencement de retenue comprenant :

une boucle (200) configurée pour fixer une attache (120) lorsque ladite attache (120) est engagée dans ladite boucle (200), des pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) associées à ladite boucle (200), lesdites pièces en E de verrouillage (280a, 280b) étant configurées de telle sorte qu'une ou plusieurs parties de chacune desdites pièces en E de verrouillage (280a, 280b) s'engagent dans des ouvertures correspondantes (121, 122, 123) dans ladite attache (120) lorsque lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont accouplées ensemble de façon à empêcher une libération de ladite attache (120) d'un engagement dans ladite boucle (200), lesdites pièces en E de verrouillage (280a, 280b) étant en outre configurées pour permettre une libération de ladite attache (120) d'un engagement dans ladite boucle (200) lorsque lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont désaccouplées, et un électroaimant (385) associé à ladite boucle (200) et auxdites pièces en E de verrouillage (280a, 280b), ledit électroaimant (385) étant configuré pour empêcher lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) de se désaccoupler lorsque ledit électroaimant (385) est excité et pour permettre auxdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) de se désaccoupler lorsque ledit électroaimant (385) n'est plus excité, ledit électroaimant (385) étant excité lors de l'activation d'un dispositif d'activation à distance.

2. Agencement de retenue selon la revendication 1,

comprenant en outre un ou plusieurs interrupteurs de dérivation associés audit électroaimant (385), dans lequel lors de l'activation d'au moins un desdits interrupteurs de dérivation, ledit électroaimant (385) n'est plus excité pour permettre la libération de ladite attache (120) d'un engagement dans ladite boucle (200) alors que ledit dispositif d'activation à distance (530) est activé.

3. Agencement de retenue selon la revendication 1 ou 2, dans lequel lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont alignées automatiquement de sorte qu'aucune présence d'air n'existe entre lesdites pièces en E de verrouillage (280a, 280b) et l'accouplement électromagnétique est induit entre lesdites pièces en E de verrouillage (280a, 280b) lorsque ledit électroaimant (385) est excité.

4. Agencement de retenue selon la revendication 3, dans lequel lesdites pièces en E de verrouillage (280a, 280b) accouplées électromagnétiquement s'engagent avec ladite attache (120) pour fixer ladite attache (120) dans ladite boucle (200).

5. Agencement de retenue selon l'une quelconque des revendications précédentes, dans lequel ledit électroaimant (385) est installé sur une partie non magnétique de ladite boucle (200).

6. Agencement de retenue selon l'une quelconque des revendications 3 à 5, comprenant en outre des guides destinés à aligner lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b).

7. Agencement de retenue selon la revendication 6, dans lequel lesdits guides ne sont pas magnétiques.

8. Agencement de retenue selon l'une quelconque des revendications précédentes, dans lequel ledit dispositif d'activation à distance (530) se présente sous la forme d'un commutateur à distance configuré à l'intérieur d'un véhicule qui comporte l'agencement de retenue installé dans celui-ci.

9. Agencement de retenue selon l'une quelconque des revendications précédentes, dans lequel ledit électroaimant (385) n'est plus excité lors de l'ouverture d'un commutateur d'allumage (520) dudit véhicule.

10. Agencement de retenue selon l'une quelconque des revendications précédentes, dans lequel ledit électroaimant (385) n'est plus excité lorsque ledit véhicule connaît un accident.

11. Agencement de retenue selon l'une quelconque des revendications précédentes, dans lequel ledit élec-

troaimant (385) n'est plus excité lors de la désactivation dudit dispositif d'activation à distance (530).

- 12.** Boucle (200) configurée pour fixer une attache (120) lorsque ladite attache (120) est engagée dans ladite boucle (200), ladite boucle (200) comprenant :

un moyen de libération (210) associé à ladite boucle (200) et étant configuré pour permettre la libération de ladite attache (120) d'un engagement dans ladite boucle (200) lors de l'activation dudit moyen de libération (210), des pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) associées à ladite boucle (200) et audit moyen de libération (210), lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) étant configurées de telle sorte qu'une ou plusieurs parties de chacune desdites pièces en E de verrouillage (280a, 280b) s'engagent dans des ouvertures correspondantes (121, 122, 123) dans ladite attache (120) lorsque lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont accouplées ensemble de façon à empêcher une libération de ladite attache (120) d'un engagement dans ladite boucle (200) lorsque lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont accouplées ensemble, lesdites pièces en E de verrouillage (280a, 280b) étant en outre configurées pour permettre une libération de ladite attache (120) d'un engagement dans ladite boucle (200) lorsque lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont désaccouplées, et un électroaimant (385) associé à ladite boucle (200) et auxdites pièces en E de verrouillage (280a, 280b), ledit électroaimant (385) étant configuré pour empêcher lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) de se désaccoupler lorsque ledit électroaimant (385) est excité et pour permettre aux dites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) de se désaccoupler lorsque ledit électroaimant (385) n'est plus excité, ledit électroaimant (385) étant excité lors de l'activation d'un dispositif d'activation à distance (530).

- 13.** Boucle (200) selon la revendication 12, dans laquelle lors de l'activation d'un ou de plusieurs interrupteurs de dérivation associés audit électroaimant (385), ledit électroaimant (385) n'est plus excité pour permettre la libération de ladite attache (120) d'un engagement dans ladite boucle (200) alors que ledit dispositif d'activation à distance (530) est activé.

- 14.** Boucle (200) selon la revendication 12 ou 13, dans laquelle lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b) sont alignées automatiquement de sorte qu'aucune présence d'air n'existe entre lesdites pièces en E de verrouillage (280a, 280b) et l'accouplement électromagnétique est induit entre lesdites pièces en E de verrouillage (280a, 280b) lorsque ledit électroaimant (385) est excité.

- 15.** Boucle (200) selon la revendication 14, dans laquelle lesdites pièces en E de verrouillage (280a, 280b) accouplées électromagnétiquement s'engagent avec ladite attache (120) pour fixer ladite attache (120) dans ladite boucle (200).

- 16.** Boucle (200) selon l'une quelconque des revendications 12 à 15, dans laquelle ledit électroaimant est installé sur une partie non magnétique de ladite boucle (120).

- 17.** Boucle (200) selon l'une quelconque des revendications 14 à 16, comprenant en outre des guides destinés à aligner lesdites pièces en E de verrouillage complémentaire supérieure et inférieure (280a, 280b).

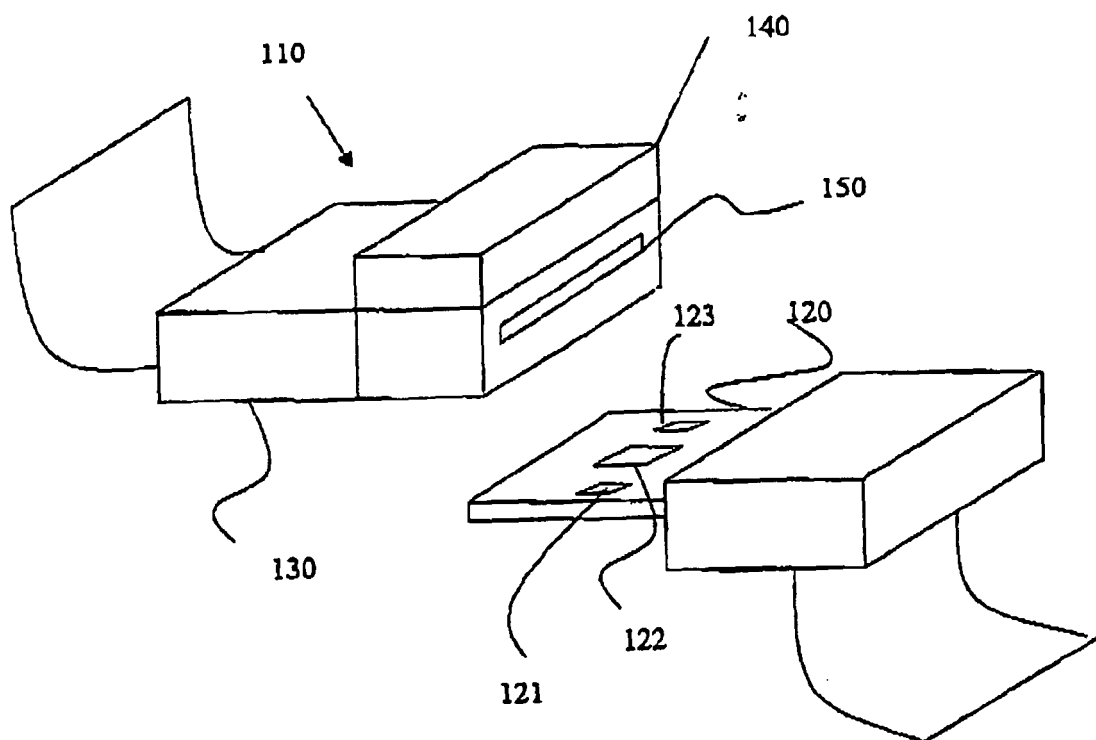
- 18.** Boucle (200) selon la revendication 16, dans laquelle lesdits guides ne sont pas magnétiques.

- 19.** Boucle selon l'une quelconque des revendications 12 à 18, dans laquelle ledit dispositif d'activation à distance (530) se présente sous la forme d'un commutateur à distance configuré à l'intérieur d'un véhicule qui comporte la boucle installée dans celui-ci.

- 20.** Boucle selon l'une quelconque des revendications 12 à 19, dans laquelle ledit électroaimant (385) n'est plus excité lors de l'ouverture d'un commutateur d'allumage (520) dudit véhicule.

- 21.** Boucle selon l'une quelconque des revendications 12 à 20, dans laquelle ledit électroaimant (385) n'est plus excité lorsque ledit véhicule connaît un accident.

- 22.** Boucle selon l'une quelconque des revendications 12 à 21, dans laquelle ledit électroaimant (385) n'est plus excité lors de la désactivation dudit dispositif d'activation à distance (530).



Prior Art

Fig. 1

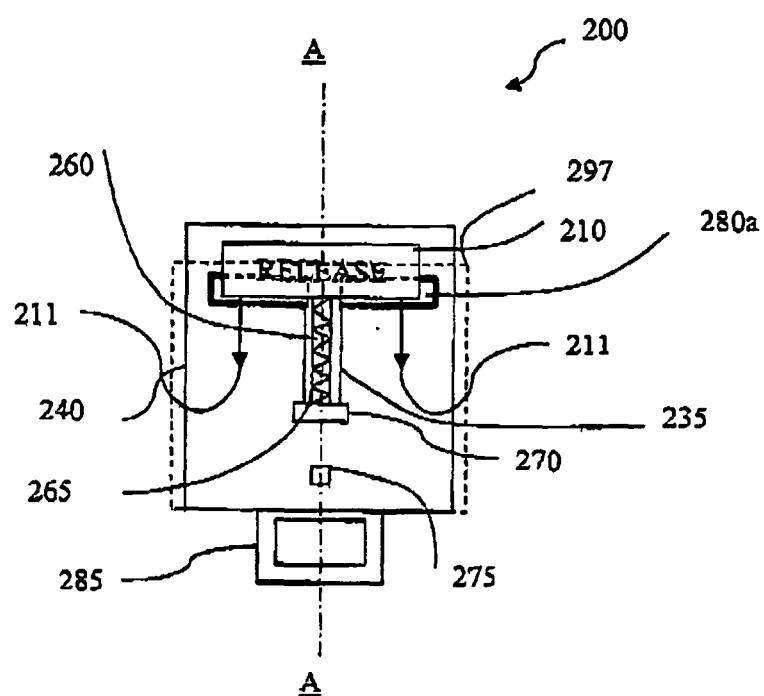


Fig. 2

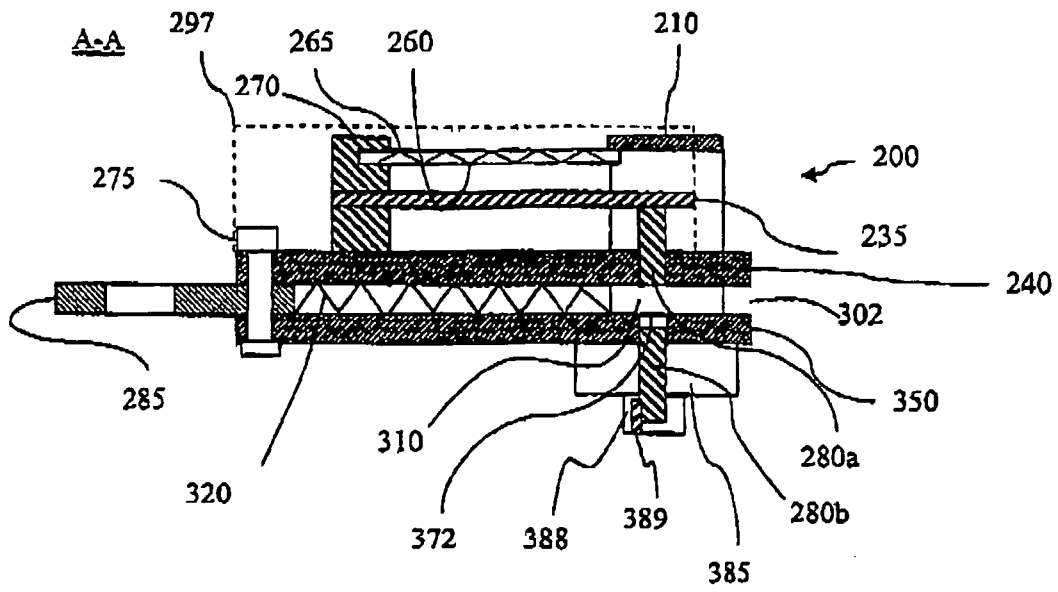


Fig. 3

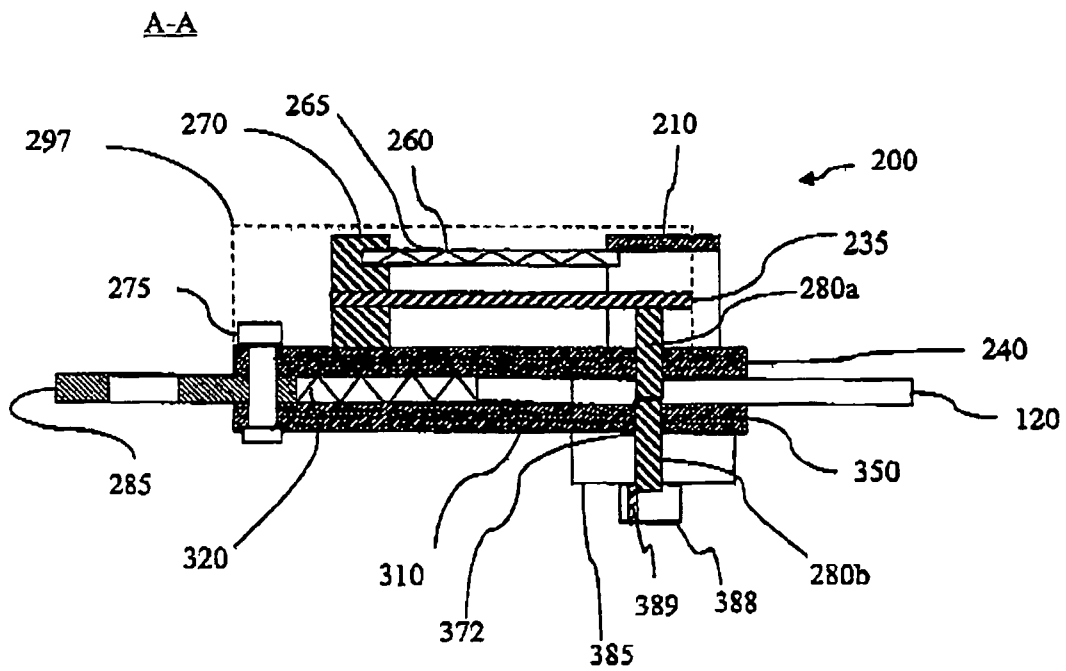


Fig. 4A

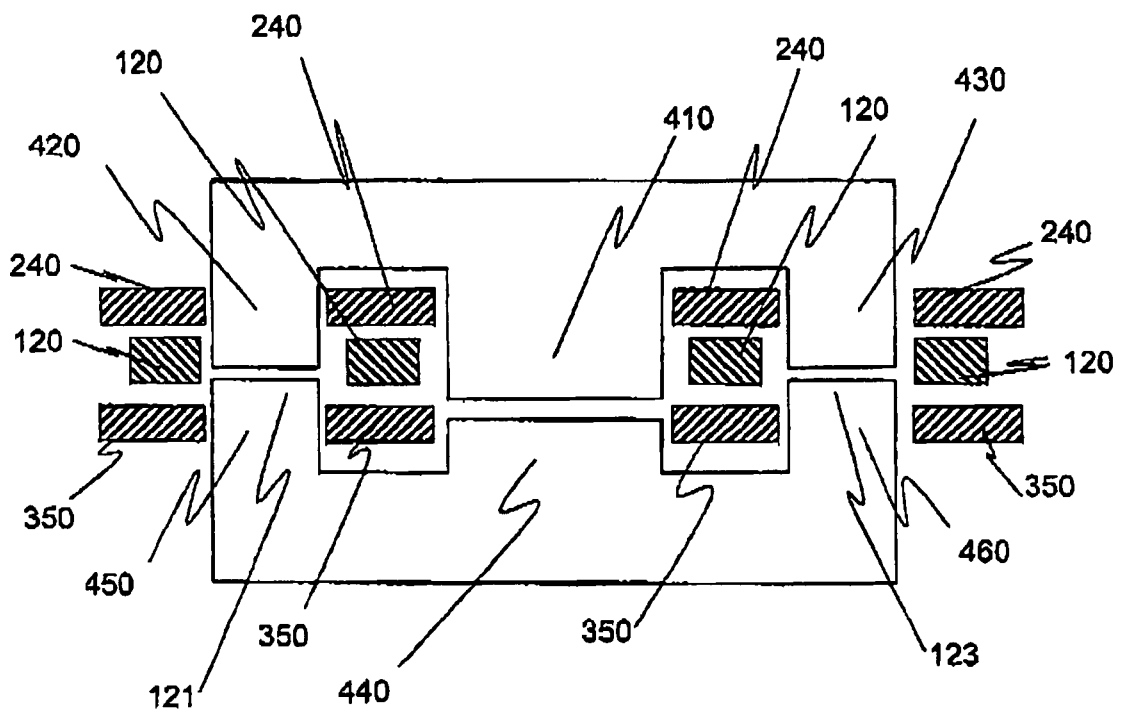


Fig. 4B

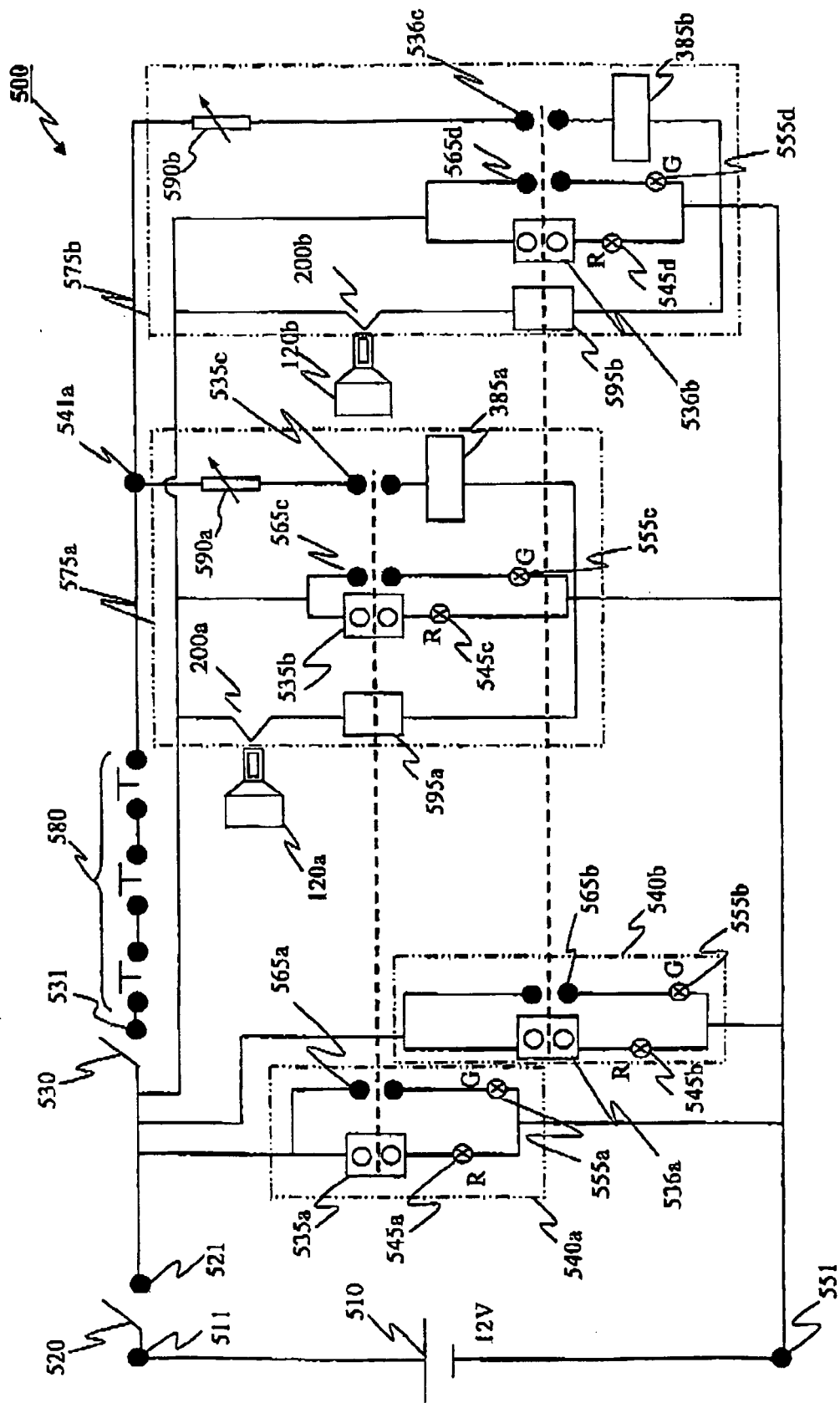


Fig. 5

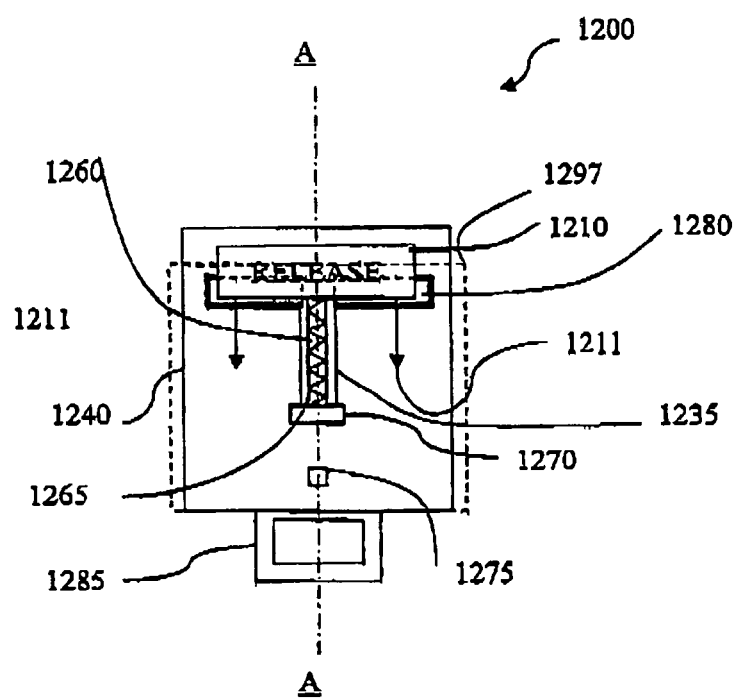


Fig. 6

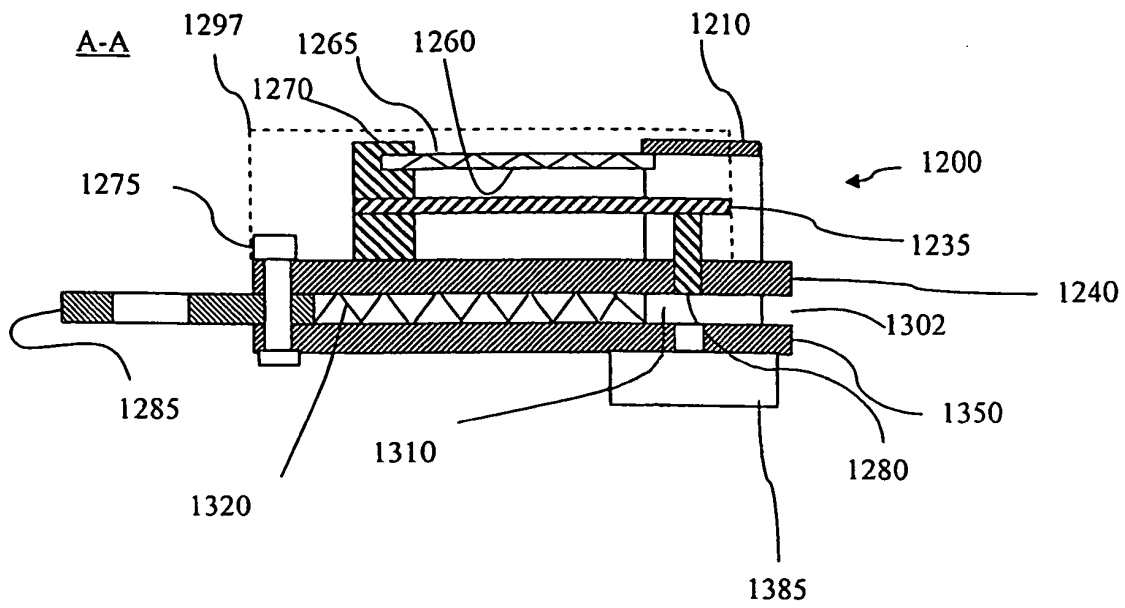


Fig. 7

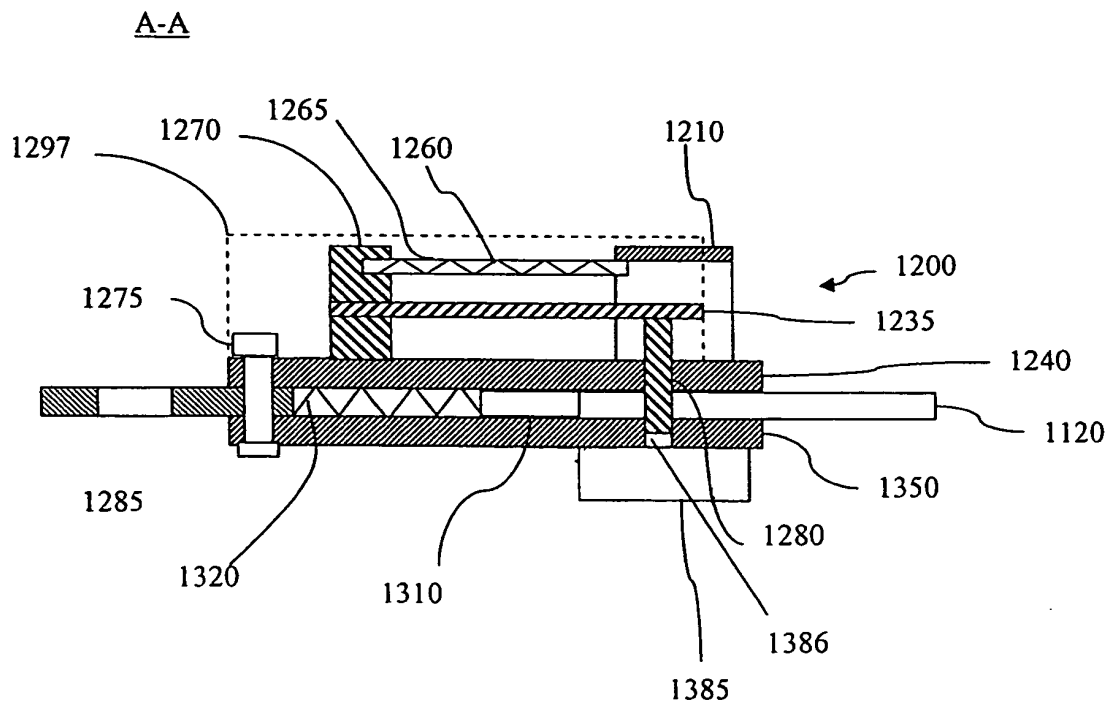


Fig. 8

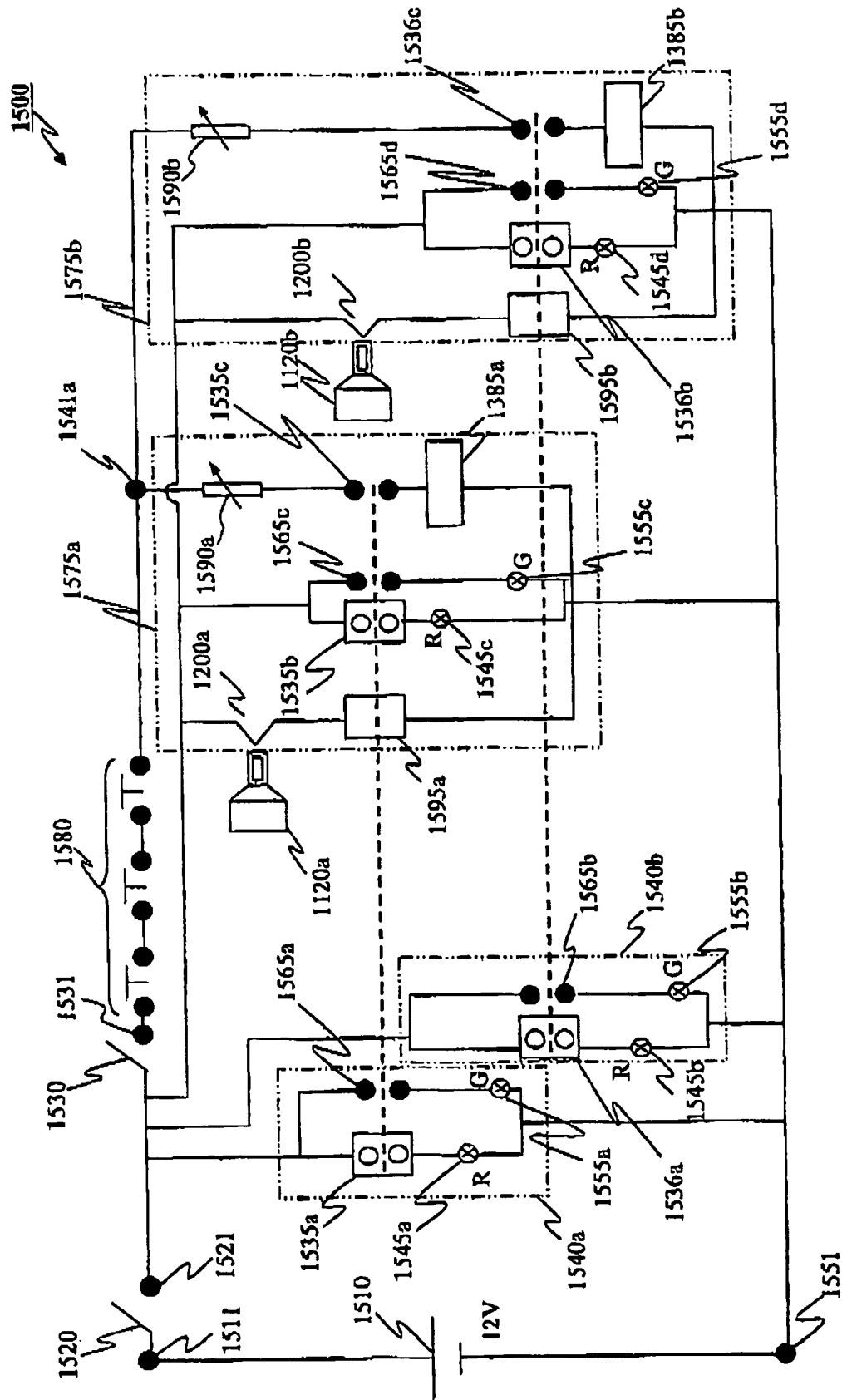


Fig. 9

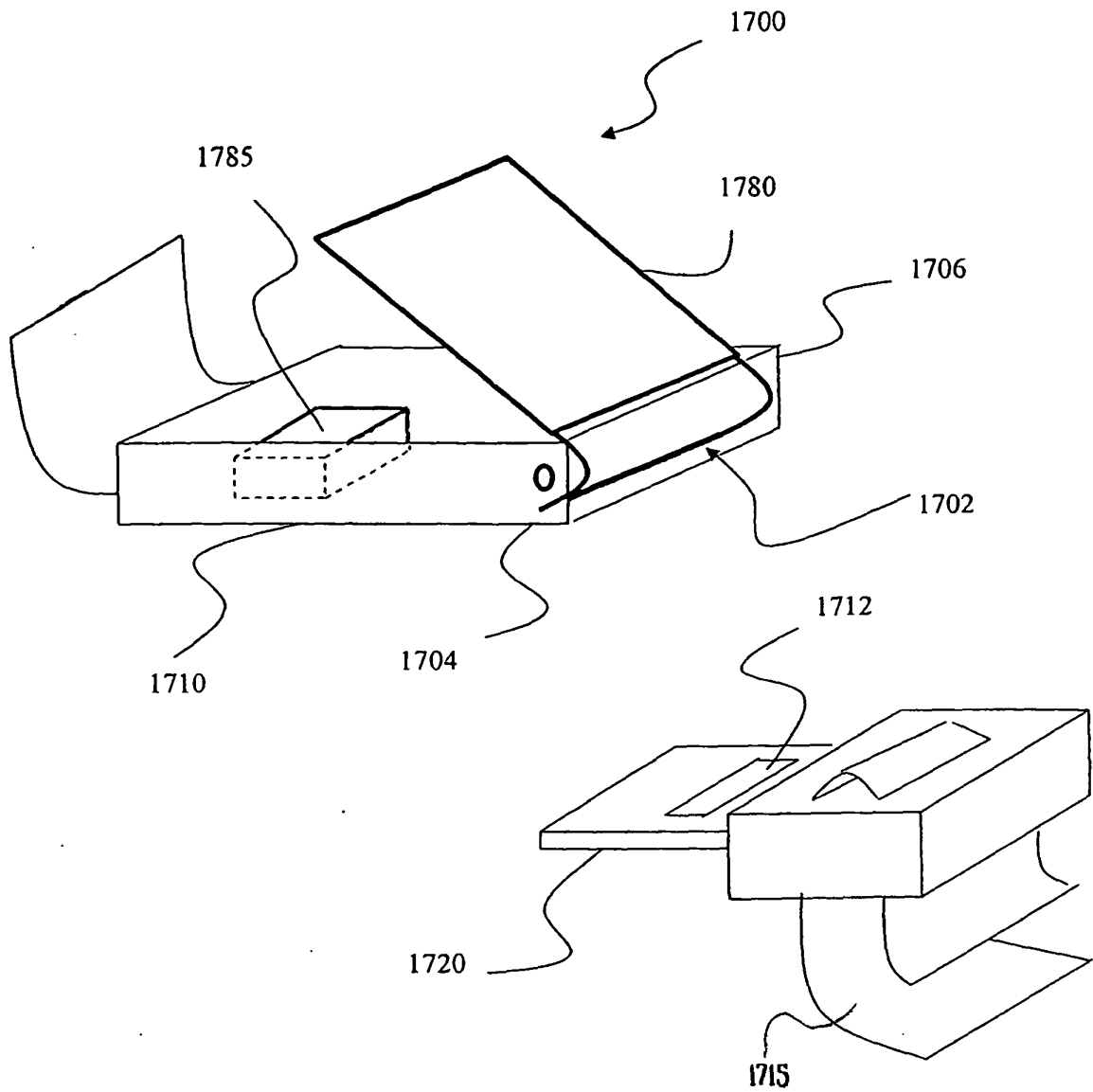


Fig. 10

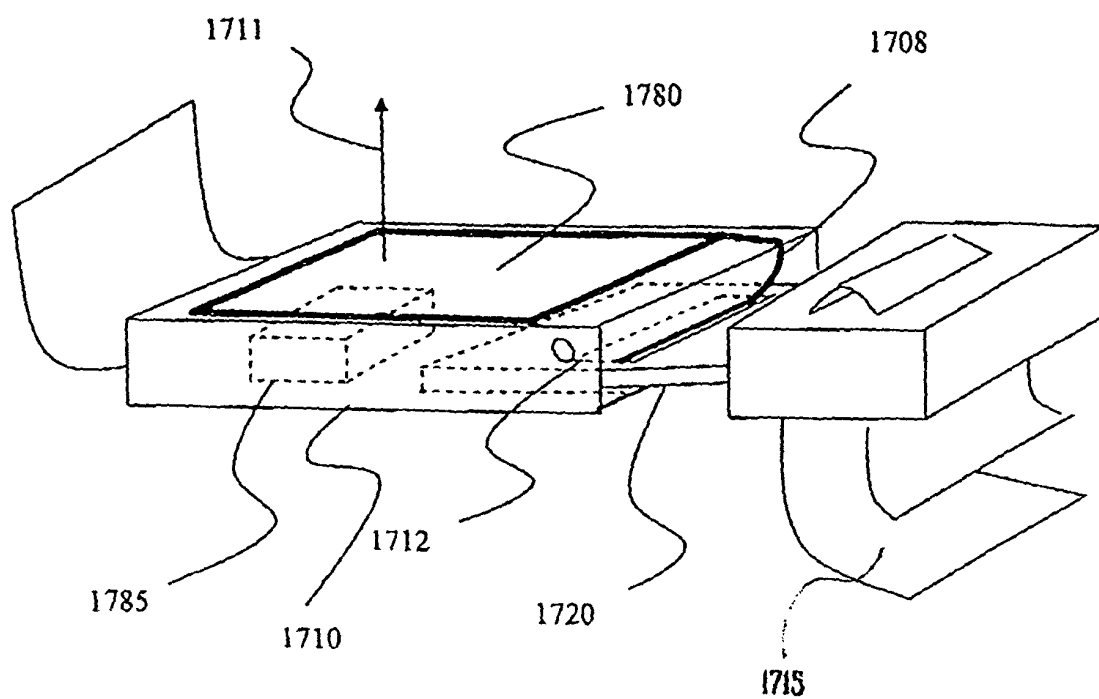


Fig. 11

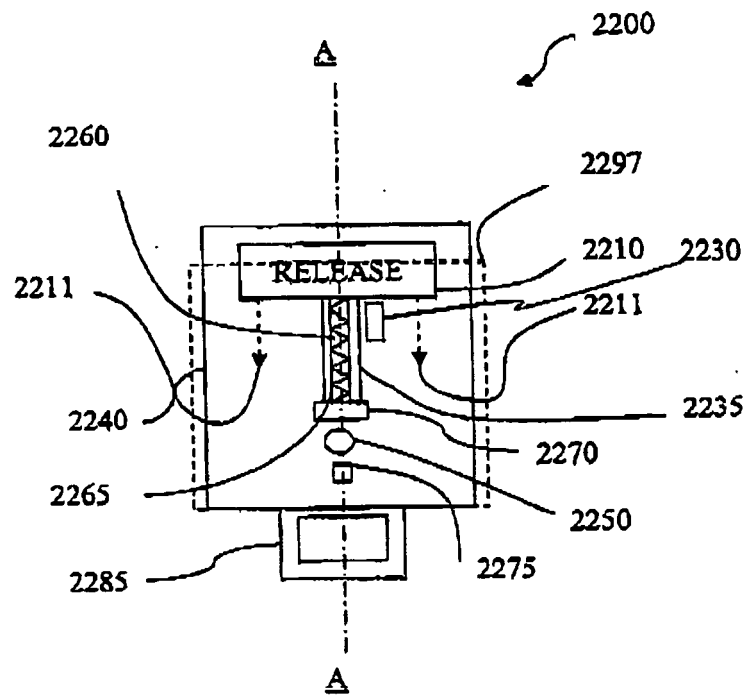


Fig. 12

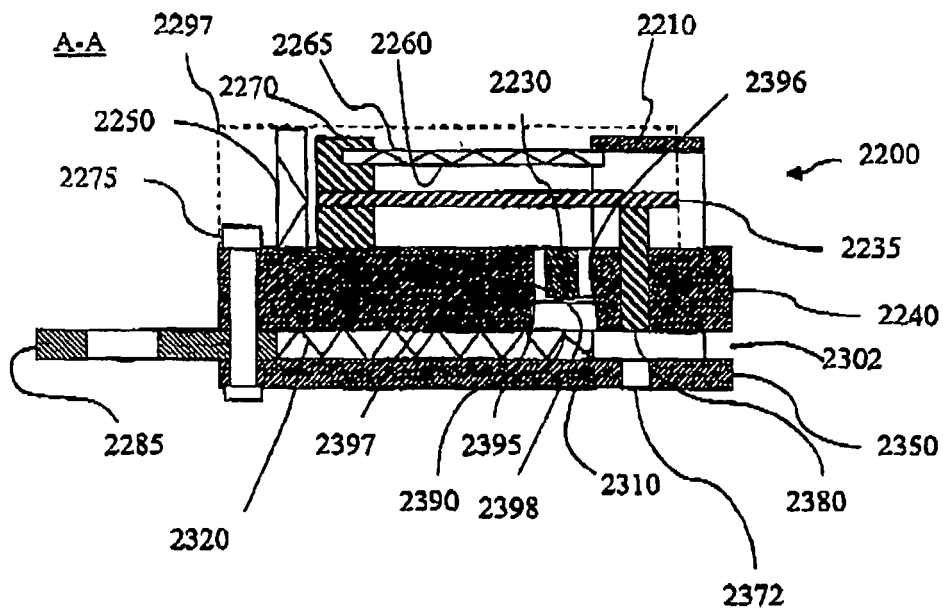


Fig. 13

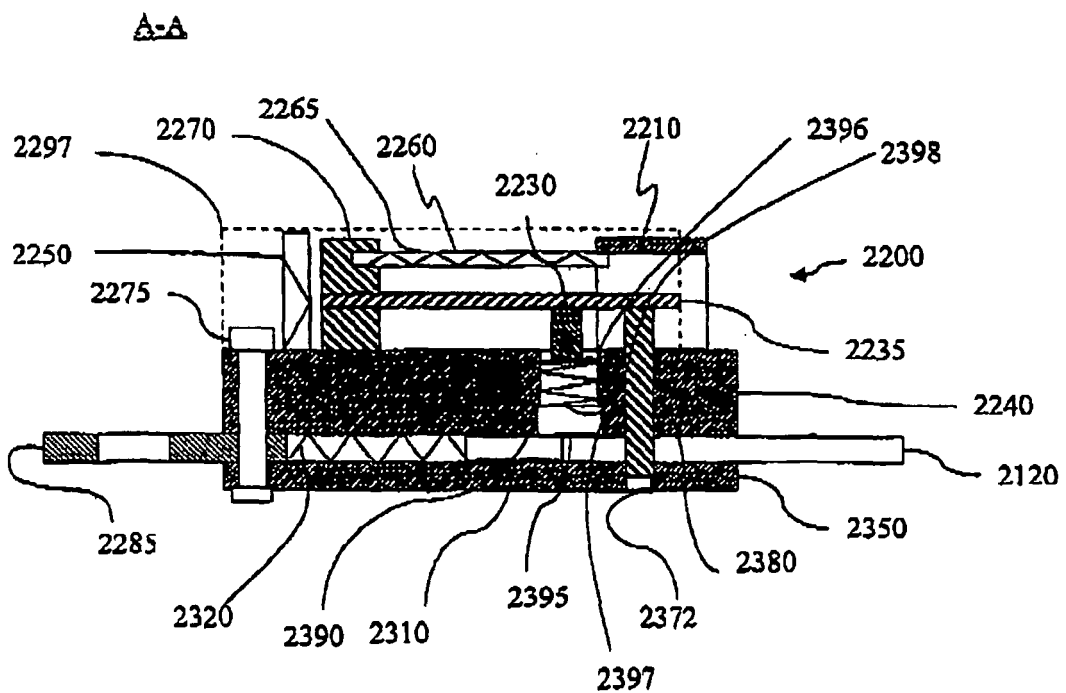


Fig. 14

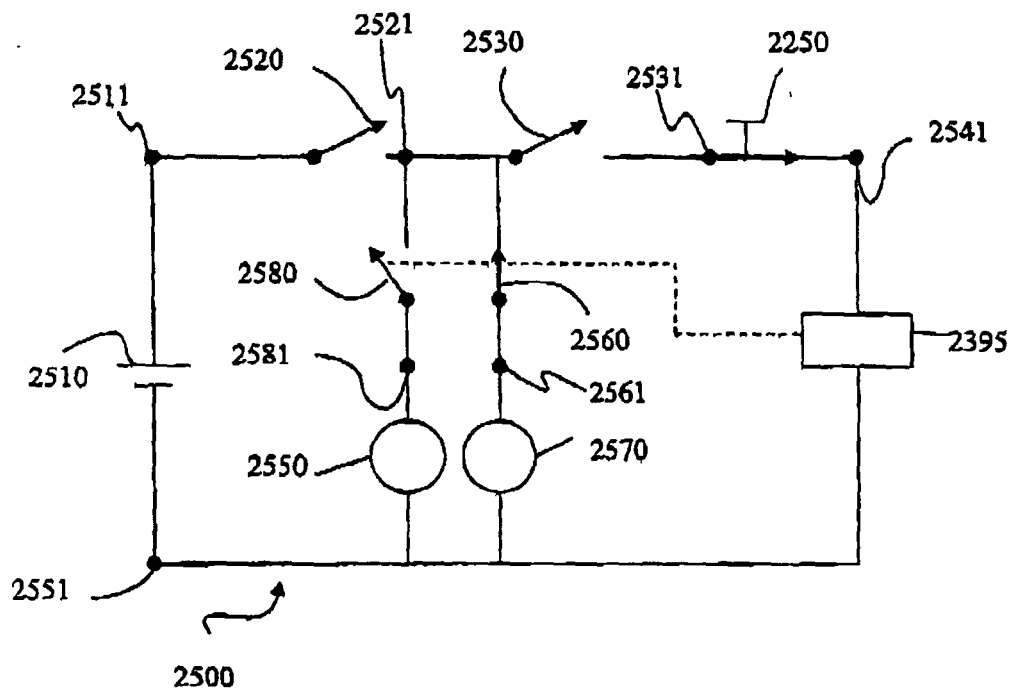


Fig. 15

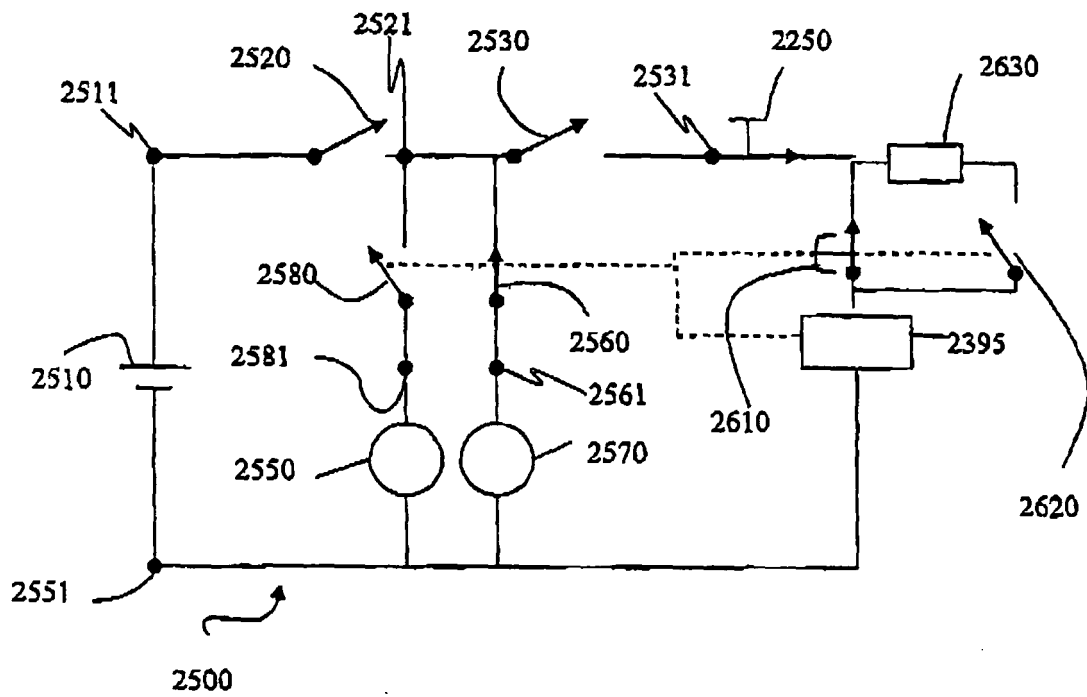


Fig. 16

REFERENCES CITED IN THE DESCRIPTION

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