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(54) **FLOOD PROTECTION GATE FOR VEHICULAR & PEDESTRIAN TRAFFIC**

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(57) **ABSTRACT**

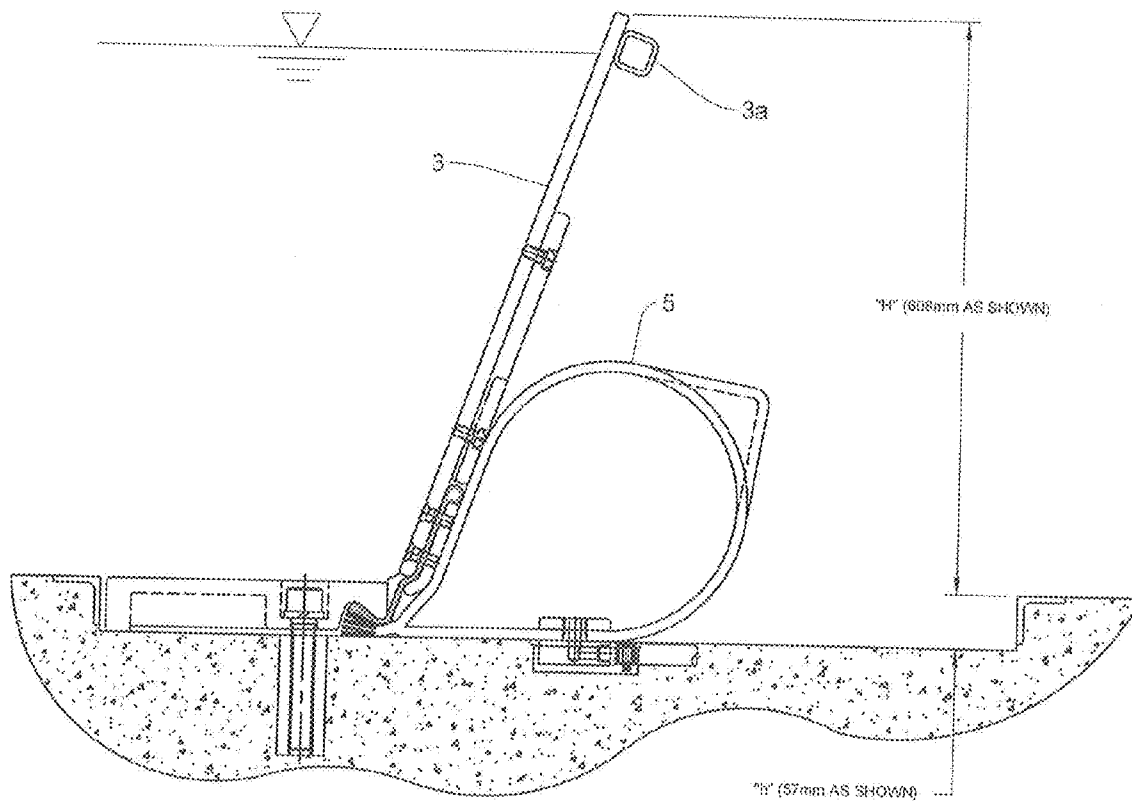
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§ 371 (c)(1),  
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The invention relates to a roadway flood protection and traffic barrier which provides a smooth upper surface for vehicles, pedestrians, etc. and is thin enough to be mounted to the surface of an existing roadway or parking garage ramp, for example. A hinge mechanism is disclosed which facilitates the provision of a smooth roadway surface as well as a tight seal. A locking strut is provided that keeps the gate panels raised even in case of air pressure loss and which is remotely controllable.

**Related U.S. Application Data**

(60) Provisional application No. 61/402,756, filed on Sep. 2, 2010.



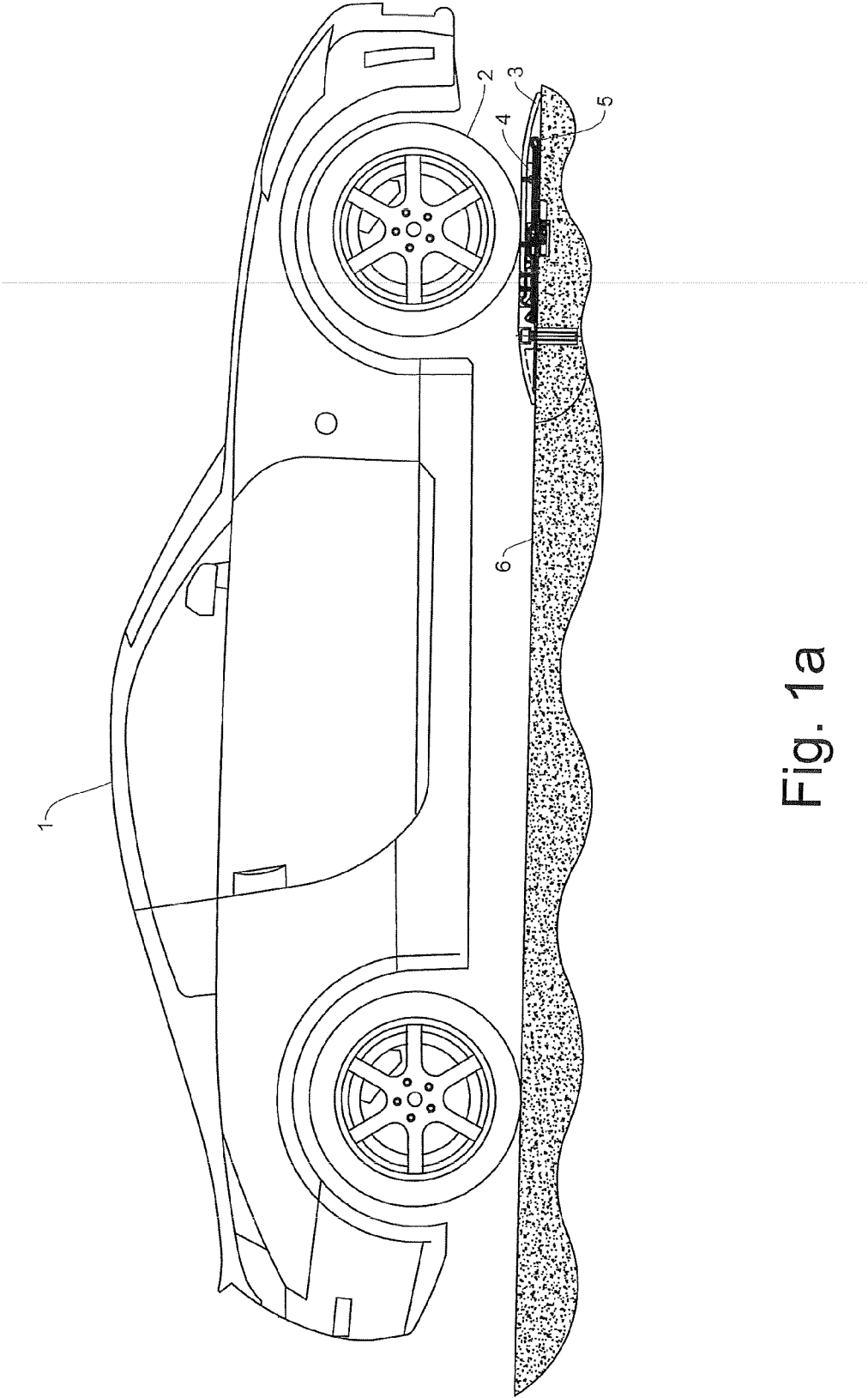


Fig. 1a

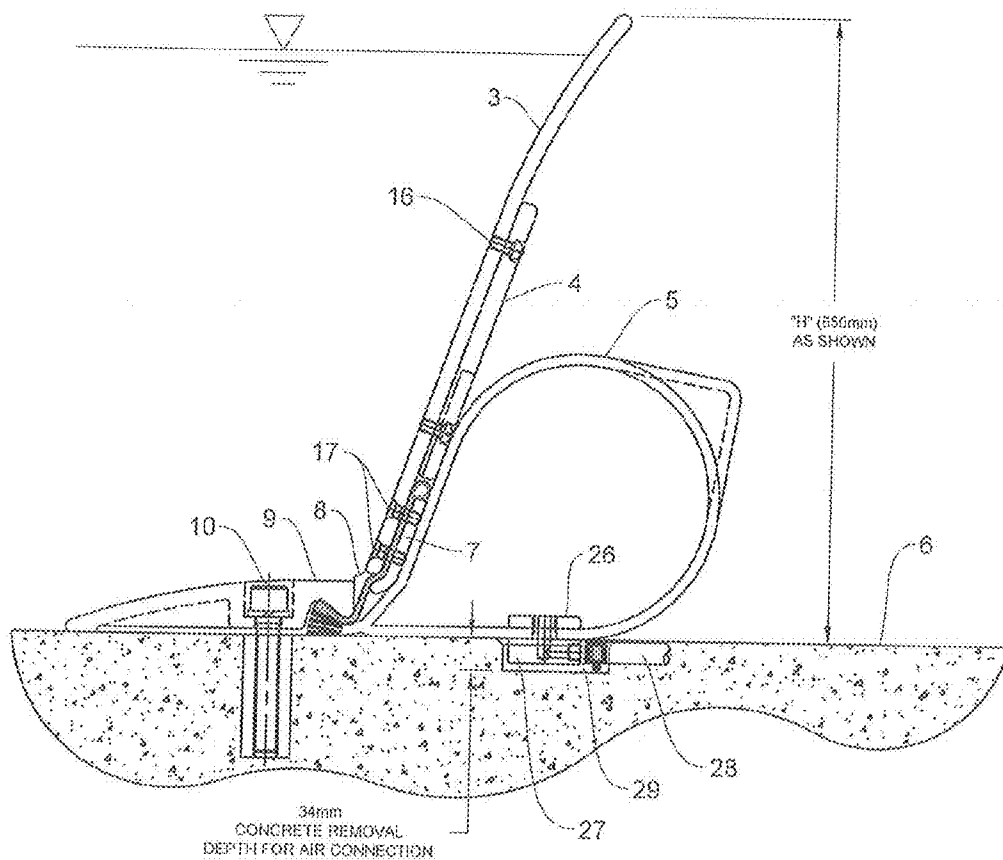


Fig. 1b

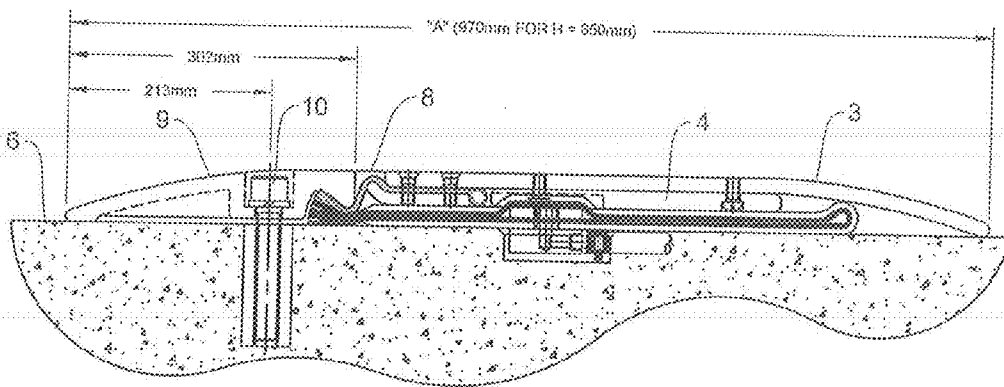


Fig. 1c

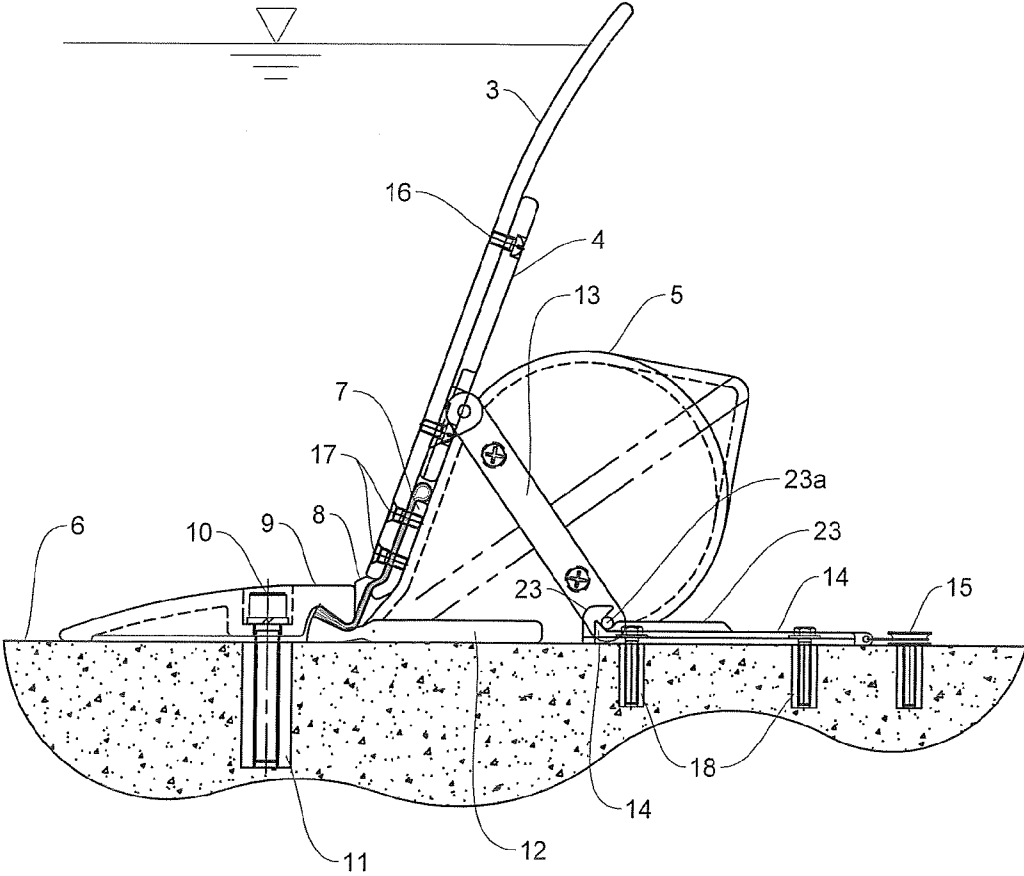


Fig. 1d

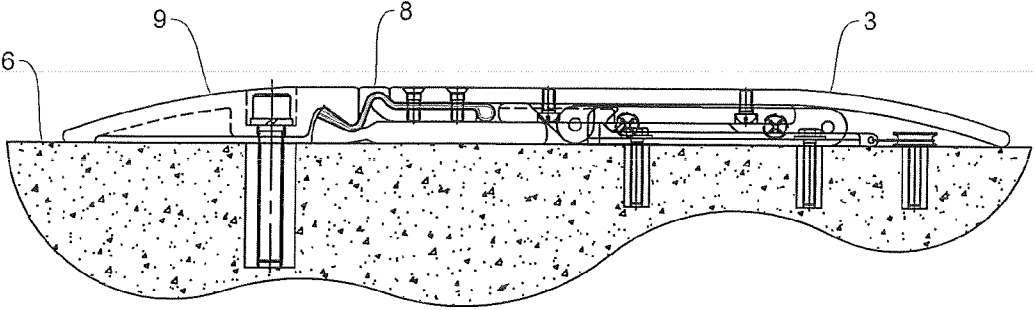


Fig. 1e

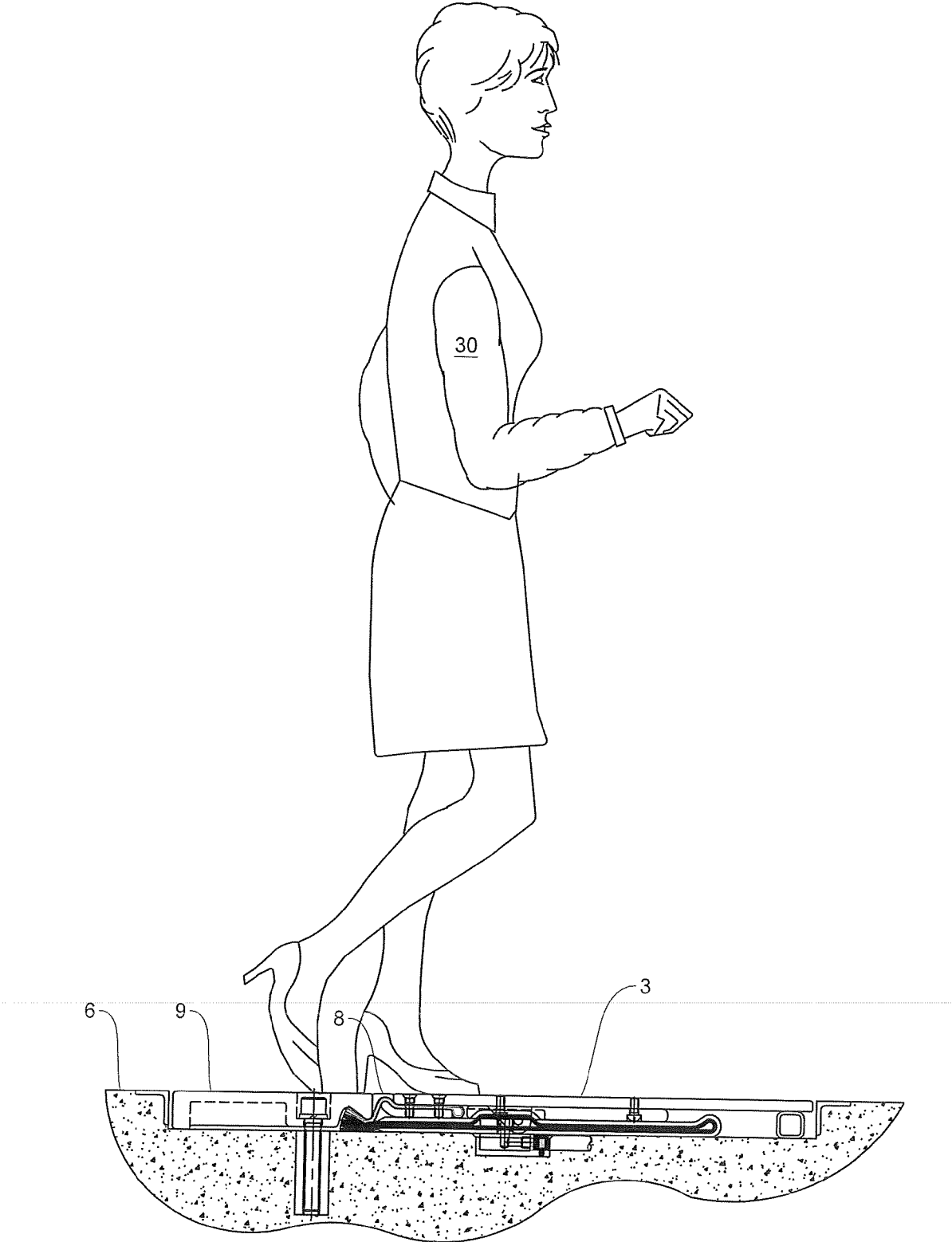


Fig. 2a

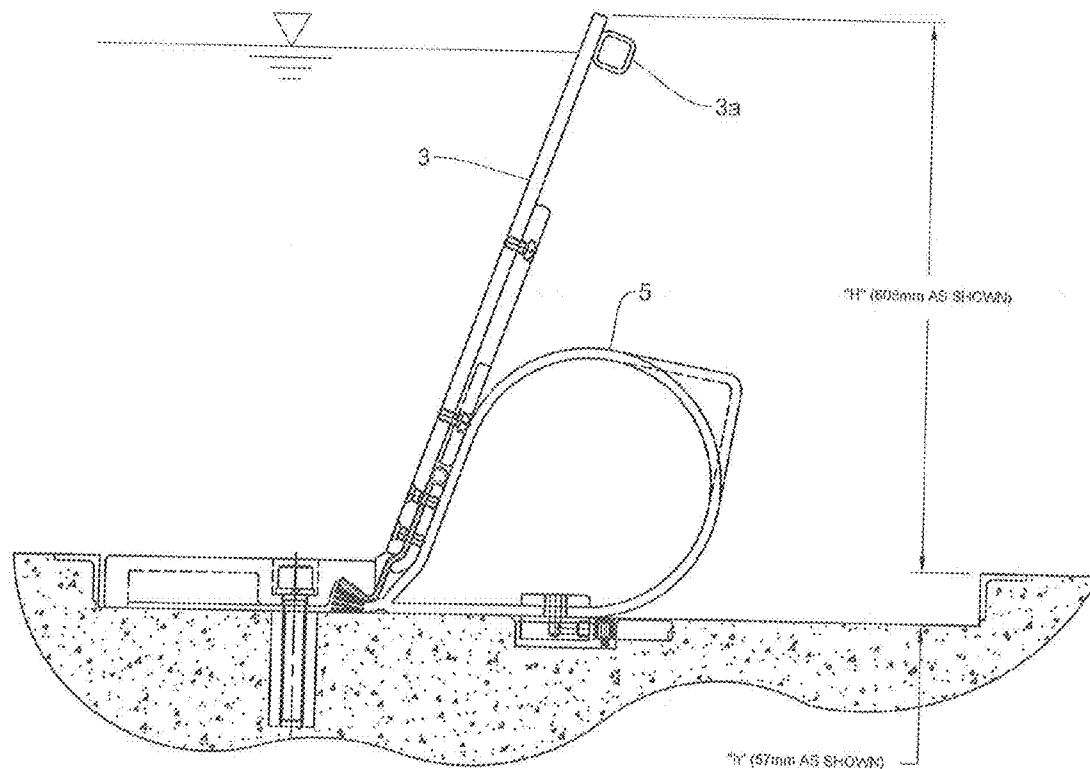


Fig. 2b

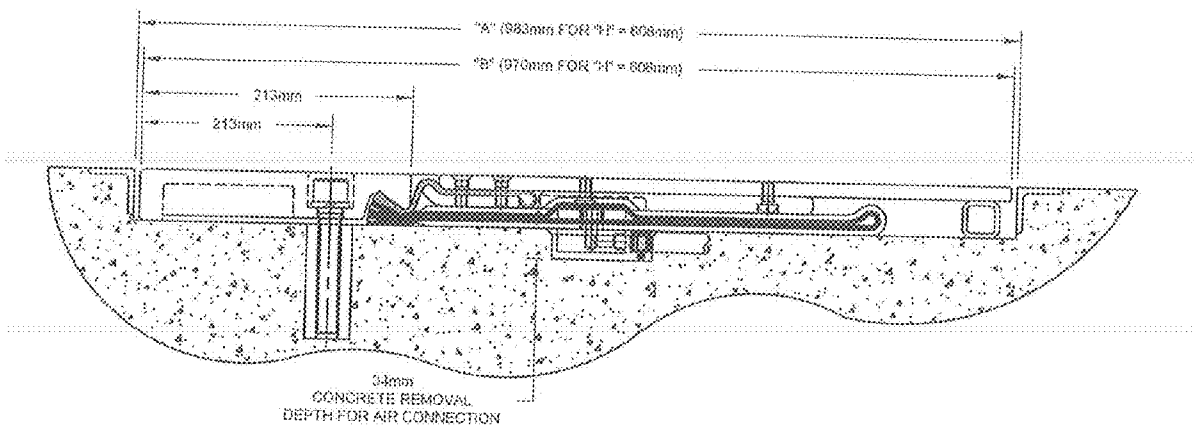


Fig. 2c

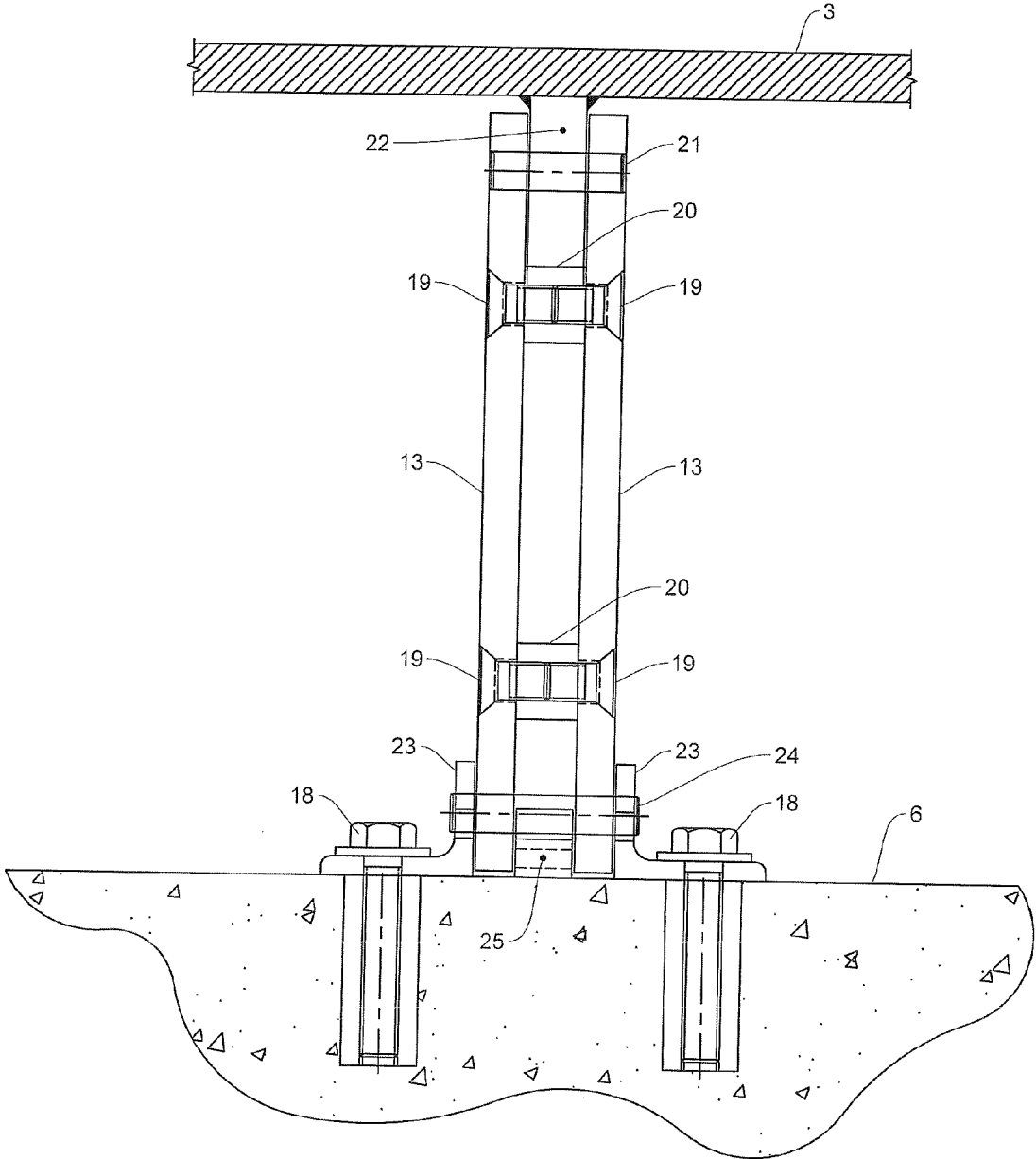


Fig. 3

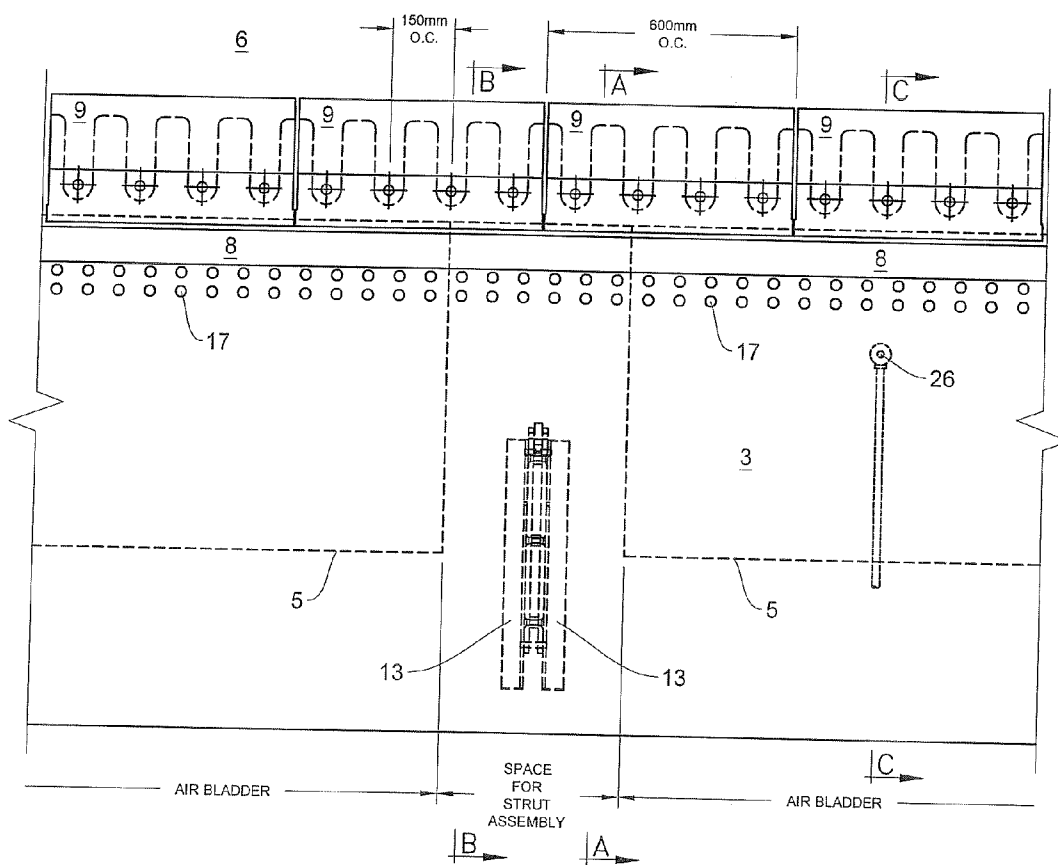


Fig. 4



## FLOOD PROTECTION GATE FOR VEHICULAR & PEDESTRIAN TRAFFIC

### FIELD OF THE INVENTION

**[0001]** This system relates to bottom hinged gates which may act as a barrier to water flow or may, alternatively or additionally be used as a barrier to vehicles. The gate in its lowered position provides may be configured to provide a smooth weight bearing continuation of the roadway surface or, alternatively, may be configured to mount on an existing roadway surface.

### PRIOR ART

**[0002]** Conventional bottom hinged water control gates are fitted with irregularly shaped hinges and reinforcing ribs which do not obstruct water flow but do pose a hazard or even a barrier to vehicular or pedestrian traffic. Conventional bottom hinged traffic barriers have utilized mechanical hinges which are subject to leakage of water and corrosion and mechanical actuators which are subject to corrosion. Prior disclosures by this inventor have required deeper excavation depths and have not incorporated wedge connected air bladders and hinge flaps which provide superior economy and durability. Additionally, the present invention incorporates a novel strut mechanism that serves both to limit gate height and actuation angle while also serving to lock the gate in its raised position, even with loss of air bladder pressure. The locking mechanism is configured to facilitate simultaneous unlocking of multiple struts, and optionally, unlocking of struts by remote and/or automatic control.

### SUMMARY OF THE INVENTION

**[0003]** Accordingly, it is the object of this invention to provide a water control gate system that provides for easy and reliable pneumatic actuation yet also provides a smooth and an upper surface safe for vehicle and pedestrian traffic.

**[0004]** It is the further object of this invention to provide a method of construction that is economical for a wide range of gate heights.

**[0005]** It is a further object of this invention to provide gate panels that may be constructed of steel plate, for example, with minimal requirements for welds that add cost and might distort the gate panel or result in additional tooling or straightening costs.

**[0006]** It is also the object of this invention to provide a gate hinge mechanism that has a high load rating without the requirement for precision rotating bearings requiring time consuming and expensive field alignment procedures. It is a further object of this invention to provide a hinge mechanism that also serves as a seal which prevents fluids, particles or contaminants from passing through the hinge assembly. It is a further object of this invention to provide a flexible barrier which protects the hinge mechanism from corrosive fluids or gasses and protects the hinge mechanism from abrasive or damaging particles. It is the further object of this invention to provide a hinge that allows shear loads between the two hinged objects to be transmitted from the flexible cable, cord or fibrous elements to the rigid elements by a bonded chemical connection. It is the further object of this invention that said bonded chemical connection provide an elastic connection which serves to reduce stress concentrations and optimize the ability of the assembly to accommodate misalignment and absorb dynamic loads without damage. Such an

elastic connection may be manufactured using a vulcanizable elastomer such as EPDM, Butyl rubber, natural rubber, styrene butadiene rubber, nitrile rubber, chloroprene rubber or blends thereof. It is the further object of this invention to configure flexible and preferably twisted cords, cables or other means so as to resist loads in any direction in the plane normal to the hinge axis and to be able to resist shear loads parallel to the hinge axis, while providing little resistance to rotation about the hinge axis within the angular design limits of the hinge. It is the further object of this invention to utilize pre-assembled groups of cords such as strips of unidirectional tire cord fabric, preferable embedded in rubber or other elastomer. A still further object of this invention is to provide a low friction gate panel surface which is acted upon by the inflatable air bladder.

**[0007]** A still further object of this invention is to provide the lowered gate panels with mechanical support through transmission of compressive bearing loads through spacer elements and in turn through the deflated air bladders. A further object of this invention is to provide a smooth upper surface in conjunction with a water control gate so as to prevent the entrapment of sediment, debris or other solids which could hinder the free flow of water. A further object of this invention is to provide a smooth surface which does not present a danger to recreational water uses such as raft, kayak, and canoe passage. A further object of this invention is to provide a smooth and safe surface for users of swimming facilities and amusement park water features. The smooth surface may be metal or may be a metal or other surface coated with vulcanizable elastomers such as EPDM, Butyl rubber, natural rubber, styrene butadiene rubber, nitrile rubber, or blends thereof, for example. A still further object of this invention is to provide a compact enclosed hinge mechanism which requires no sliding surfaces subject to contamination by abrasives and wear.

**[0008]** A further object of this invention is to provide a smooth low friction hinge retainer under the upstream edge of the gate panel around which the inflated air bladder can slide without excessive friction or wear.

**[0009]** A further object of this invention is to provide a locking means capable of supporting the gate panels against the force of water even with loss of air bladder pressure. It is a further object of this invention that said locking means also serve as a gate actuation angle limiting means. Gate angle actuation limiting is desirable in order to not tip the gates over in the upstream direction under conditions of no water loads and to establish a uniform gate position between a plurality of gate panels that must be sealed to each other and to abutment mounted seals, if used.

**[0010]** The inflatable actuators may be shimmed after installation to transmit compressive loads from the lowered gate panels downward to the foundation slab.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0011]** Other objects, advantages and capabilities of the present invention will become apparent as the description proceeds taken in conjunction with the following drawings in which:

**[0012]** FIG. 1a is a sectional elevation of a traffic compatible roadway flood protection barrier shown in the lowered position;

**[0013]** FIG. 1b is a detailed sectional elevation (C-C in FIG. 4) of the gate shown in FIG. 1a, in its raised position, showing the details of the hinge and air bladder connections;

[0014] FIG. 1c is a sectional elevation (C-C in FIG. 4) of the present invention showing a gate in its lowered position in association with the actuating air bladder deflated;

[0015] FIG. 1d is a sectional elevation (B-B of FIG. 4) of the present invention showing the gate of FIG. 1 in its raised position with the actuating air bladder inflated and the locking strut locked;

[0016] FIG. 1e is a sectional elevation (B-B of FIG. 4) of the gate of FIG. 1 in its lowered position;

[0017] FIG. 2a is a sectional elevation of a flush mounted gate in juxtaposition with a pedestrian in high-heeled shoes;

[0018] FIG. 2B is a sectional elevation of the gate of FIG. 2a in its raised position and with water upstream;

[0019] FIG. 2c is the gate of FIG. 2a in its lowered position;

[0020] FIG. 3 is an elevation view facing upstream of a locking strut supporting a gate panel.

DETAILED DESCRIPTION OF THE INVENTION AND SPECIFIC EMBODIMENTS THEREOF

[0021] Referring now to FIG. 1a, automobile 1 transmits by its tire 2 a portion of its weight to gate panel 3 which in turn compresses spacer 4 onto air bladder 5 which in turn transmits its load to roadway surface 6.

[0022] Referring now to FIG. 1b, a detailed cross section is shown, in the gate-raised position, of the gate assembly of FIG. 1a. Hinge flap 8 is clamped to gate panel 3 by means of hinge retainer 7 and hinge retainer bolts 17. Hinge flap 8 is secured on its upstream end by clamp 9.

[0023] Referring to FIG. 1c, hinge flap 8 is preferably molded in its gate-lowered configuration in which position it presents a flush flat surface to pedestrian and vehicular traffic. Clamp 9 is secured to roadway 6 by means of anchors 10. Spacer 4 is bolted to gate panel 3 by means of bolts 16. The air connection to the air bladder 5 is comprised of upper fitting portion 26 and lower fitting portion 27. The air connection is connected to air supply hose 28.

[0024] Referring to FIG. 1d, locking strut 13 serves to prevent gate panel 3 from rising to far and also prevents gate collapse in case of air pressure loss. Lock release cam 14, when pulled downstream (to the right), lifts strut 13 out of guides 23. Lock release cam 14 may be actuated by cable 15 or, alternatively, by a spring retracted air cylinder (not shown).

[0025] Referring to FIG. 2a, a flush mounted gate assembly is shown, wherein gate panel 3 is flush with roadway surface 6, hinge flap 8, clamp 9. Pedestrian 30 may walk over the gate assembly without inconvenience or risk of tripping.

[0026] Referring now to FIG. 2b, the gate assembly of FIG. 2a is shown in its raised and water controlling position. Stiffener 3a of gate panel 3 provides bending stiffness otherwise provided by the bend in gate panel 3 of FIGS. 1a, 1b, 1c, 1d, and 1e.

[0027] Referring now to FIG. 3, struts 13 are spaced apart by spacers 20 and are held to spacers 20 by bolts 19. Pin 24 engages slots 23a in guides 23. Anchors 18 secure guides 23 to roadway surface 6. Gate panel 3 is pivotably connected to struts 13 by pin 21 and bracket 22. Pin 24 may be raised and disengaged by cam 25.

[0028] Referring now to FIG. 4, a plan view is shown showing gate panel 3 supported by air bladders 5. Gate panel 3 is connected to hinge flap 8 which is in turn secured by clamps 9. Clamps 9 are anchored to the roadway 6 by anchor bolts 10. Struts 13 (hidden lines) are located between bladders 3 (hidden lines).

What is claimed is:

1) A flood control gate with a generally smooth upper surface mounted to a roadway with a gate panel secured by a hinge flap, and actuated by one or more air bladders, wherein the hinge flap and air bladders are secured at their upstream marginal edges by clamping means in conjunction with wedge shaped inserts between reinforcing plies.

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