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• **Aoki, Shiho**
Ono-cho
Ibi-gun, Gifu 5010524 (JP)

(71) Applicants:
• **Aoki, Hiroshi**
Ibi-gun
Gifu 5010524 (JP)
• **Aoki, Sakae**
Ono-cho
Ibi-gun, Gifu 5010524 (JP)
• **Aoki, Mai**
Ono-cho
Ibi-gun, Gifu 5010524 (JP)

(72) Inventor: **AOKI, Hiroshi**
5010524 (JP)

(74) Representative: **Khan, Mohammed Saiful Azam**
Eric Potter Clarkson LLP
Park View House
58 The Ropewalk
Nottingham, NG1 5DD (GB)

(54) **TRAFFIC LANE SEPARATION UNIT, COMPONENT MEMBER THEREOF, AND MOBILE TRAFFIC LANE SEPARATION DEVICE**

(57) Traffic lane separation units (U1) to (U4), comprising one or more protective wall blocks (B1) to (B3) fixedly covered on protective wall movement devices (K1) to (K4).

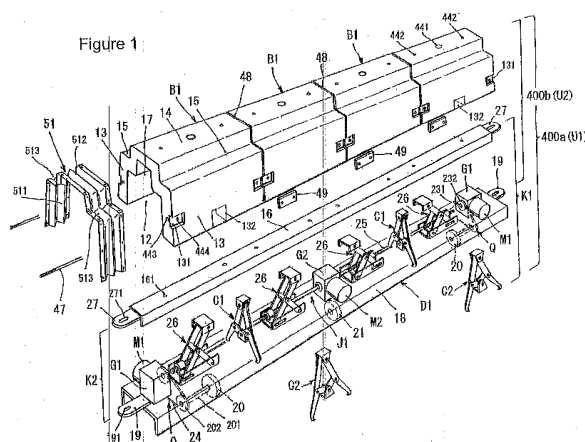
For the movement device (K3), lifting devices (J1) to (J3) raising and lowering the blocks (B1) to (B3) are assembled in a transverse motion capable vehicle (D1) with running devices (Q) reciprocatingly moving in a traffic lane transverse direction.

For the movement devices (K1) and (K2), the lifting devices raising and lowering the blocks and clamping devices (C1) and (C2) fixing the blocks to a roadway surface (11) are assembled in the transverse motion capable vehicle with the running devices reciprocatingly moving in the traffic lane transverse direction.

For the movement device (K4), the lifting devices raising and lowering the blocks are assembled in the transverse motion capable vehicle (D2) moving in the traffic lane transverse direction.

By organizing these self-running units (U1) to (U3) and the non-self-running unit (U4) according to circumstances, a mobile traffic lane separation device of practical use capable of coping with a variety of road circumstances and a variety of long and short traffic congestion can be provided to contribute to the ease and elimination of traffic congestion at bottlenecks such as level inter-

sections and interchanges.



Description

TECHNICAL FIELD

[0001] This invention relates to a self-running and non self-running traffic lane separation unit, a protective wall block and a protective wall movement device as components of the traffic lane separation unit, and a fixing device and a guiding fixing device of the unit, and a mobile traffic lane separation device forming the unit movably.

BACKGROUND ART

[0002] Conventionally, to alleviate/solve the issue of traffic congestion, to effectively use the limited width and the limited lane number of driveways, there have been provided quite a few traffic lane separation devices, which comprise flexible fences such as guard rails and guard fences, and/or fences comprises a concrete protective wall blocks (hereinafter these are also called traffic banter), and placed along a lane line to move by approximately one lane to make a reversible lane.

[0003] Firstly, there is a transverse groove type, wherein "a groove is formed within a reversible lane section in a direction transverse to the lane, or a guide-rail is placed so that the traffic barrier is moved along the rail from one of the lane lines to the other" (for-example, the following references 1-6).

[0004] Secondly, there is a transfer type, wherein "a plurality of protective wall blocks are joined on a lane line, and lifted and moved to the other line by a transfer vehicle (for example, the following reference 4, Figs. 10A and 10B, references 7-12).

[0005] There is a report of successful example for solving traffic congestions by using a device called "Quick-change Movable Barrier" (QMB), and its applicability in Japan (for example, the following publications 1,2).

[0006] This device belongs to the category of the above transfer type, and is a device based on "a movable traffic lane separation device" as shown in the following patent publication 11 (same as patent publication 8) (hereinafter referred to as existing device). This device comprises a traffic lane separation device Sp having a plurality of protective wall blocks B on one of lane lines V1, V2, and a transfer vehicle 10 of the lane separation device Sp. This device further has a S-shaped guiding frame on diagonal lines of the transfer vehicle 10, the frame having a roller and rotatingly guiding the block B by catching the neck of the block B.

[0007] The neck of the block B placed on the lane line V1 is faced to the guiding frame of the transfer vehicle 10, which runs on the reversible lane Fa, and the neck is lifted, rotatingly guided along the frame and lowered to the lane line V2 so that the lane is shifted.

[0008] This device is useful for roadways having a wide width, for example having 5-6 lanes, and has a traffic congestion section of several km, has a highway occupancy vehicle (HOV) lane having several km in length in

the center or side of the roadway, or has a bus lane.

A list of prior art publications

[0009]

Patent Publication 1. U.S. Patent No. 2143433
 Patent Publication 2. U.S. Patent No. 3391620
 Patent Publication 3. U.S. Patent No. 4004857
 Patent Publication 4. U.S. Patent No. 4629357
 Patent Publication 5. JP Utility Model Laid-Open Publication No. S64-42312
 Patent Publication 6. JP Utility Model Laid-Open Publication No. H06-56119
 Patent Publication 7. U.S. Patent No. 4474503
 Patent Publication 8. U.S. Patent No. 4500225
 Patent Publication 9. U.S. Patent No. 4653954
 Patent Publication 10 U.S. Patent No. 4881845
 Patent Publication 11. JP Patent Publication No. H04-17246
 Patent Publication 12. JP Patent Publication No. H07-886
 Non-patent publication 1. "Solution for traffic congestion in the U.S.- Search report regarding the traffic operation of highways" by Shosei Miyauchi, Yukio Kurosaki (P 39-42, No. 39-8, Highways and cars, by Highway search committee, published on August 1, 1996).
 Non-patent Publication 2. "Application of mobile protective fence made from concrete" by Kenji Tsuiki (P 25-28, No. 43-4, Highways and cars, by Highway search committee, published on April 1, 2000). Non-patent Publication 3. Web page, "Moveable Medians Congestion relief on the move", [online], BARRIER SYSTEMS Inc. <URL: <http://www.barriersystem-sinc.com/#>> [Searched on July 19, 2002].

DISCLOSURE OF THE INVENTION

Problems to be Solved by the Invention

[0010] In the conventional traffic lane separation device, gaps of half a lane - one lane are formed between the ends of a reversible traffic lane section and normal sections every time the traffic barrier moves to shift the lane.

[0011] Therefore it causes the complication of traffic near gaps, and prevents smooth traffic flow into and from the reversible lane section.

[0012] In the existing device, every time the transfer vehicle runs, it is required to place or replace traffic cones or portable protective fences, and to pay attention to the safety.

[0013] It is required to transfer the transfer vehicle itself to the upstream or downstream of the roadway, and then transfer it to a vehicle shed after the operation.

[0014] It is necessary to temporarily stop the traffic flow, or temporarily regulate the traffic flow to prevent

cars from hitting the transfer vehicle traversing the roadway.

[0015] The existing devices engage the neck of the block with the guiding frame at both sides of the transfer vehicle to lift the block, and slide the block to the other line and lower it to the ground. As such, the front and rear end on the diagonal lines of the transfer vehicle or one side of the vehicle body protrude toward the adjacent lane when the transfer vehicle is running.

[0016] Therefore, cars (in particular cars having a wide width) running on a lane adjacent to the lane where the transfer vehicle runs need to change lanes to avoid contacting with the transfer vehicle.

[0017] Therefore, the existing devices require at least 5 lanes to exert the advantage of them. It is difficult to apply the existing devices for most of the driveways having 3-4 lanes or driveways normally having 2 lanes, and having 3 lanes near intersections.

[0018] Traffic congestions in a range of several tens of meters - several hundreds of meters where a plane intersection of ordinary roads are a bottleneck commonly occur not only in Japan, but also other countries, and the length of the congestion varies a lot during the rush hour.

[0019] It is not efficient or labor-saving to dispatch workers including the operator of the transfer vehicle at every congestion point.

[0020] Further, it is difficult to deal with the sudden traffic congestion other than the rush hour.

[0021] In the existing device, the overall length of the device is 1km for a short and 16km for a long (disclosed in the aforementioned non-patent publications 1, 2), the transfer vehicle is operated in a speed of 4-8 km/h to shift a lane of mere 3m width.

[0022] It is not efficient to move the overall device uniformly every time, because the level of traffic congestions varies from day to date, time to time, and season to season.

[0023] As such, the existing devices have some problems as mentioned above, and cannot deal with a variety of traffic conditions or congesting conditions almightily.

[0024] On the other hand, in a transverse groove type, the traffic barrier is formed mainly as a flexible protective fence, which is used for separating directions. It does not function enough to prevent collided, uncontrolled cars from getting into an opposite lane, or keep the collided car in a proper direction.

[0025] It is demonstrated that the existing device serves as a half-rigid protective fence having the properties of both rigid protective fence and flexible protective fence by making the protective wall block long (refer to the aforementioned non-patent publication 2); however, it is vulnerable to car collisions against the ends of the device, and traffic cones or portable fences used for separating the lanes between the normal section and the ends of the existing device are useless against car collisions.

[0026] The plane shapes of roadways are made from a combination of lines, circles, curves, while the sectional

shapes of the roadway includes plane, slope up-and-down, inclination in a direction transverse to the traffic lane.

[0027] Therefore, this invention provides a mobile traffic lane separation device (hereinafter referred to as device) to solve at least one of the above technical problems, and a traffic lane separation unit (hereinafter referred to as the unit) to deal with the congesting condition appropriately to the variety of occasions.

[0028] Further, there are provided a protective wall block (hereinafter referred to as block) for lane separators or lane lines as a single product having compatibility, and a protective wall movement device (hereinafter referred to as movement device), which can be sold individually as a component of the unit. Further, there are provided a fixing device of the unit immovably fixed on the roadway surface, and a guiding fixing device suitable for guiding the unit from one of a lane line to the other and fixing the unit on the lines at the movable ends of the unit.

[0029] There are provided several embodiments of the device, wherein the unit and its components are installed on a lane line of a reversible lane section to make the unit movable.

MEANS OF SOLVING THE PROBLEMS

Invention of Traffic Lane Separation Unit of and its Effect

[0030] According to a first invention of a traffic lane separation unit there is provided a self-running unit U3, wherein at least one protective wall blocks B1-B3 fixedly cover on a protective wall movement device K1-K4; a lifting device J1 - J3 lifting and lowering the block B1 - B3 is incorporated in a transverse vehicle D1 having a running device Q, which is reciprocatingly moves in a traffic lane transverse direction; and, by activating the lifting device J1 - J3, the block B 1 - B3 is floated from a roadway surface 11 or is placed on the roadway surface 11, and the movable device K3 is lifted or lowered in the inside of the block B 1 - B3.

[0031] According to a second invention of the traffic lane separation unit, there is provided a traffic lane separation unit U1, U2, wherein: one or more protective wall blocks B1-B3 fixedly covers on a protective wall movement device K1-K3, in the movement device K1, K2, a lifting device J1-J3 lifting and lowering the block B1-B3 and a clamping device C1, C2 fixing a block B1-B3 on a roadway surface 11 are incorporated in a traverse vehicle D1 having a running device Q, which reciprocatingly moves in a traffic lane traverse direction, and by activating the lifting device J1 - J3, the block B1 - B3 is floated from a roadway surface 11 or is placed on the roadway surface 11, and the movable device K3 is lifted or lowered in the inside of the block B1 - B3.

[0032] According to a third invention of the traffic lane separation unit, there is provided a traffic lane separation unit U4, wherein: a protective wall block B 1-B3 fixedly covers a protective wall movement device K1-K4; in the

movement device K4, a lifting device J1-J3 lifting and lowering the block B1-B3 is incorporated in a transverse vehicle D2 moving in a traffic lane transverse direction; and, by activating the lifting device J1-J3, the block B1-B3 is floated from a roadway surface 11 or is placed on the roadway surface 11, and turningly moves or transversely moves depending on a traverse movement of either or both of a traffic lane separation unit U3 of claim 1 and a traffic lane separation unit U1, U2 of claim 2.

[0033] By assembling the unit U1-U4 of the above 3-4 aspects according to the circumstances, a practical movable traffic lane separation device, a variety of road conditions or a variety of length of traffic congestions is provided, and traffic congestions where a plan intersection or an interchange is a bottle neck can be alleviated or soloed.

[0034] The lifting device J1-J3 incorporated in the unit U1-U4 operates to lift the movement device K1-K4 in the block B1-B3 above the roadway surface 11, and thus each unit can be securely placed on the roadway surface 11.

[0035] In the unit U1, U2, a driving system for operating the clamping device C1, C2 does not need to be incorporated, and the clamping device operates in conjunction with the lifting device J1-J3. As such, the movement device K1, K2 can be effectively operated without needlessly complicating its structure, and can be effectively fixed clampingly on the roadway surface.

[0036] The movement device K1-K4 and the block B1-B3 can be carried to the site and easily assembled at the site.

Invention of Protective Wall Block and its Effect

[0037] According to a first invention of a protective wall block, there is provided a protective wall block B1-B3 comprising: opposed side walls 13, each of which has a support surface to a roadway surface 11; and a top wall 14 or a barrier portion 141 formed across the side walls 13; wherein the block B1, B3 has a space 12, which opens to both ends and the bottom of the block B1-B3.

[0038] According to a first invention of the protective wall block, there is provided a protective wall block B2, wherein a first end 60 of the block B2 is closed in an arcuate shape; a space 12 is formed to open to a second end of the block B2 and to a bottom end of the block B2.

[0039] - Such a simple block B1-B3 is easy to make and reduces its costs by mass production, or it can be sold alone as a single product having compatibility for the traffic lane separation or the end.

[0040] The cost for manufacturing blocks can be reduced by providing the movement device K1-K4 with a joining element 19, 27 rather than providing the block B1-B3 with it.

Invention of Protective Wall Movement Device and its Effect-

[0041] According to a first invention of a protective wall movement device, there is provided a movement device K3, wherein a lifting device J1-J3 lifting and lowering a block B1-B3 is mounted on a transverse motion capable vehicle D1, which has a running device Q reciprocally movable in a direction transverse a traffic lane, a table frame 16 is put across the lifting device J1-J3 in a longitudinal direction, and the block B1-B3 is mounted on the frame 16.

[0042] According to a second invention of the protective wall movement device, there is provided a movement device K1, K2, wherein a lifting device J1-J3 lifting and lowering a block B1-B3, and a clamping device C1, C2 fixing the block B 1-B3 on a roadway surface 11 are mounted on a transverse motion capable vehicle D 1, which has a running device Q reciprocally movable in a direction transverse a traffic lane, and the block B1-B3 is mounted on the frame 16.

[0043] According to a third invention of the protective wall movement device, there is provided a movement device K4, wherein a lifting device J1-J3 lifting and lowering a block B1-B3 is mounted on a transverse motion capable vehicle D2 movable in a direction transverse a traffic lane, a table frame 16 is put across the lifting device J1-J3 in a longitudinal direction, and the block B1-B3 is mounted on the frame 16.

[0044] Such a simple movement device K1-K4 is easy to make and reduces its costs by mass production. Further, because the table frame 16 is put across the lifting device J1-13, the block B1-B3 is easily put on the movement device at the site, and thus the assembly work can be reduced.

[0045] Invention of Fixing Device of Unit and Guiding Fixing Device of Unit and their Effect.

[0046] According to the invention of a fixing device, there is provided a fixing device, wherein a fixation base P1-P3 is placed at the movable ends of the unit U1, U3, the fixation base P 1-P3 comprising an engagement element 42a, 42b, which the clamping device C1, C2 incorporated in the unit U1, U2 engages.

[0047] According to a first invention of the guiding fixing device, there is provided a guiding fixing device, wherein a wheel 53 having a rubber wheel portion 531 and a tapered wheel portion 532 is attached to the transverse motion capable vehicle D1 of the unit U1-U3, a fixation base P3 is placed on lane lines V1 and V2, between which the unit U1-U3 reciprocally moves, the base P3 comprising a rail 54 rotatably guiding the wheel 53, and an engagement element 42a, 42b, which the clamping device C1, C2 incorporated in the unit U1, U2 engages.

[0048] According to a second invention of the guiding fixing device, there is provided a guiding fixing device, wherein a wheel 55 having a color wheel portion 551 and a tapered wheel portion 532 is attached to the transverse motion capable vehicle D1 of the unit U1-U3, a fixation

base P4 is placed on lane lines V1 and V2, between which the unit U1-U3 reciprocally moves, the base P4 comprising a rail 56 guiding the transverse motion capable vehicle D1, and an engagement element 42a, 42b, which the clamping device C1, C2 incorporated in the unit U1, U2 engages.

[0049] According to a third invention of a guiding fixing device, there is provided a guiding fixing device, wherein a driving gear 58 is attached to the transverse motion capable vehicle D1 of the unit U1-U3, a fixation base P5 is placed between lane lines V1 and V2, between which the unit U1-U3 reciprocally moves, the base P5 comprising: a rack rail 59 engaging the gear 58, in a direction transverse to the traffic lane; and an engagement element 42a, 42b, which the clamping device C1, C2 incorporated in the unit U1, U2 engages, on the lane lines V1 and V2 where the rail 59 intersects.

[0050] The unit U1, U2 having a clamping device C1, C2 is clampingly fixed on the lane line V1, V2 with the fixation base P1-P5.

[0051] Further, the positioning of the unit U1-U3 getting on the fixation base P3 is secured, and the displacement of the predetermined position of the unit U1-U3, which may be incurred by the reciprocal movement of the unit U1-U3, is prevented.

[0052] The fixation base P4, P5 secures the movement of the unit P1-P3 between the lane lines V1 and V2 on a sloping road or a road inclined in a lateral direction, and secures the clamping fixation.

Invention of Mobile Traffic Lane Separation Device and Its Effect

[0053] According to a first invention of a mobile traffic lane separation device, there is provided a mobile traffic lane separation device, wherein: a reversible lane section L1, L4 is formed with a front transition section X1, a lane shifting section Y1, and a rear transition section Z1; a plurality of a traffic lane separation units U1-U4 is joined together on one of lane lines V1 of a first direction side and V2 of a second direction side; the unit U1-U4 comprises a protective wall movement device K1-K4, and at least one protective wall blocks B1-B3 fixedly covers the movement device K1-K4; a group of the units U1-U4 incorporated in the lane shifting section Y1 is moved from one of the lane lines V1 and V2 to the other in a direction transverse to the traffic lane; a group of the units U1-U4 incorporated in the transition sections X1 and Z1 reversibly moves in alignment of a substantially polygonal line, a stepped line and a linear line.

[0054] According to a second invention of the mobile traffic lane separation device, there is provided a mobile traffic lane separation device, wherein: a reversible lane section L2-L4, L6a, L6b is formed with: a plurality of groups each consisting of: a front transition section X1, a line shifting section Y1, Y2-Yn, Ym-following-the-transition section X1; and a transition section Z1, Z2-Zn, Zm; a plurality of a traffic lane separation units U1-U4 are

joined together on one of lane lines V1 of a first direction side and "V2 of a second direction side; and the reversible lane section is configured to be shifted in multiple phases.

[0055] Therefore, by increasing the number of the lanes of one direction where traffic congestion is happening while reducing the number of the lanes where congestion is not happening, the roadway can meet the increased amount of the traffic while the limited lanes are effectively used.

[0056] The separation device can be utilized on most of the existing roads having 3-4 lanes in both directions, or having 2 lanes in both direction normally and 3 lanes at an intersection.

[0057] Specifically, this separation device allows the traffic flow coming from the road upstream section into the reversible lane section smoothly or going out from the reversible lane section to the road downstream section smoothly without any complication of the traffic between the reversible lane section and the normal section.

[0058] This separation device can deal with a variety of length of traffic congestions because the lane can be shifted in multiple phases.

[0059] The unit U4 of the front of the transition section X1 in the first and second inventions of the separation devices can be connected to one of the rear of a central division N1 separating a downstream section; the rear of a central division H1, which is immediately before an intersection A1 and is shifted towards the second direction; and an end protective wall block B2 fixed to the rear of a center line, which is immediately before the intersection and is shifted towards the second direction.

[0060] The rear unit U4 of the transition section Z1, Z2-Zn is connected to one of the front of a central division N2 separating the directions in the road upstream section; the front of the central division T2, which is immediately after an intersection A2 and is shifted towards the first direction; and an end protective wall block B2 fixed to the front end of the center line, which is immediately after the intersection and is shifted towards the first direction.

[0061] The deviation of the separation device, which may be caused by car collision to the front or rear of the separation device, is prevented, and the whole separation device serves as a half-ridged fence.

[0062] When the separation device is connected to the end of the center division H1 or the center line, which is immediately before the intersection A1 and is shifted towards the second direction, the separation device can add the extra lane to the fixed length of a right turn lane (when left hand traffic) or a left turn lane (when right hand traffic), and thus accommodate more cars in the rush hour.

[0063] As a result, congestions caused by cars going straight, cars turning right, and cars turning left are prevented, that is, traffic congestion where a plan intersections is a bottle neck is alleviated or solved.

[0064] The unit U4 of the front of a transition section X1 in the first invention and the second invention of the separation device is connected to the rear of a central

division Na separating the directions in a section between the exit from and the entrance to a interchange, and the unit U4 of the rear of the transition section Z1, Z2-Zn is connected to the front of a center division N3 separating the directions in the road upstream section.

[0065] The unit U4 of the rear of the transition section X1 is connected to the front of the center division Na separating the directions in a section between the exit from and the entrance to the interchange, and the unit U4 of the front of the transition section Z1, Z2-Zm is connected to the rear of the center division separating the directions in the road downstream section.

[0066] Thereby, traffic congestions where a tollbooth or an entrance or exit of interchanges for turnpikes or highways is a bottle neck, that is, congestions caused from an entrance and an exit of the roadway to the road upstream and the road downstream are alleviated or solved.

[0067] A lane shifting section Ha is formed at the foremost end of the transition section X1 of the first and the second inventions of the separation device, and the units U1-U4 are joined together on one of the lane lines V1 and V2 in a reversible lane section Ra consisting of the lane shifting section Ha and the transition section X1.

[0068] A lane shifting section Tb is formed at the rearmost end of the transition section Z1-Zn, the units U1-U4 are joined together on one of the lane line V1 and V2 of the reversible lane section Rb consisting of the lane shifting section Tb and the transition section Z1-Zn.

[0069] Thereby, a whole section between the intersection A1 of the downstream and the intersection A2 of the upstream are made reversible to secure smoother traffic flow.

[0070] According to a third invention of the separation device, there is provided a mobile traffic lane separation device, wherein: a reversible line section L5a is formed with a transition section Za of the rear section thereof and a lane shifting section Ta of the rearmost section thereof; traffic lane separation units U1-U are joined together on one of lane lines V1 and V2 of the reversible lane section L5a; the unit U4 of the front of the transition section Za is connected to the rear of a center division N1 separating the directions in a road downstream section.

[0071] According to a forth invention of the separation device, there is provided a mobile traffic lane separation device, wherein: a reversible line section L5b is formed with a transition section Xa of the front section thereof and a lane shifting section Ha of the foremost section thereof; traffic lane separation units U1-U are joined together on one of lane lines V1 and V2 of the reversible lane section L5b; the unit U4 of the rear of the transition section Xa is connected to the front of a center division N3 separating the directions in a road upstream section.

[0072] Thereby, a whole section between the intersections A1 and A2 are made reversible, and thus congestions near the intersections A1 and A2 are prevented by shifting a lane immediately after the intersection and a

lane immediately before the intersection.

[0073] When the fourth invention and the fifth invention of the separation device are formed between the ends of a traffic lane separation device Sp having a plurality of protective wall blocks B joined together, the separation devices serves as complementary devices to solve congestions the upstream and downstream sections of the reversible lane section Lp.

[0074] In the above case, the whole separation device can be shifted with the traffic flowing without regulate the traffic flow by operating the units U1-U3 incorporated in the separation device in a super slow speed, for example, moving the separation device by one lane in 5-10 minutes at the fastest, and in 30-60 minutes at the slowest.

[0075] The various kinds of separate devices as above can solve traffic congestions where a plan intersection or interchange is a bottle neck, reduce the potential risks of traffic accidents and traffic pollution caused by the congestions, save fuel as well as trip time, and thus, in a broad sense, save energy and prevent the global warming. As a result, the introduction and diffusion of the separate device is facilitated and the maintenance fee after the introduction is also reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0076]

Fig. 1 is an exploded perspective view showing a self-running unit, in particular, a movement device having a transverse motion capable vehicle, a lifting device, a running device and clamping devices; four blocks covering the movement device; a cover for a unit joint part.

Fig.2 is an exploded perspective view showing a self-running unit without clamping devices.

Fig. 3 is a vertically sectional front view showing a unit provided with a guard fence, in the state that the block is attached to the roadway surface, and the overall movement device is lifted a little from the roadway surface.

Fig.4 is a front view showing a state that the block is lifted from the roadway surface and a transverse motion capable vehicle is movable.

Figs. 5 and 6 are vertically sectional side views of a unit comprising the clamping device: Fig 5 shows a state that the block is placed on the roadway surface; and Fig. 6 shows a state that the block is lifted from the roadway surface.

Fig. 7 is a cross-sectional plan view of the unit.

Fig. 8 is an exploded perspective view of a linking device.

Figs. 9 and 10 are longitudinally-sectional front views showing the operation of the clamping device of the unit: Fig. 9 shows the clamping engagement of the clamping device and an engagement element; and Fig. 10 shows the non-engagement of clamping device and an engagement.

Fig. 11 is an exploded perspective view of the clamping device.

Figs. 12 and 13 are a cross-sectional plan view and a vertical sectional side view both showing the joint between adjacent units, respectively.

Figs. 14 and 15 are a perspective view and a crossing side view showing the first example of a fixation base comprising the engagement element. The fixation base is laid on a lane line of a movable end of the unit comprising the clamping device. The unit is fixed on the lane line by means of the clamping device.

Fig. 16 is a perspective view showing the second example of the fixation base. The unit having the first clamping device and/or the second clamping device is fixed on the lane line of the movement end of the unit by means of the clamping device(s).

Figs. 17 and 18 show two embodiments of a wheel of the transverse motion capable vehicle, and their fixation bases.

Fig. 19 is a perspective view showing the third example of the fixation base having a rail and a clamped element. This fixation base is placed on the lane line of the movable end of the unit having the wheel shown in Fig. 17, corrects the displacement caused by the movement of the unit, and secures the fixation by means of the clamping device.

Fig. 20 is a perspective view showing the fourth example of the fixation base having a guiding rail and a clamped element. This fixation base is placed between the lane lines in a direction transverse to the lane, and secures the movement of the unit having the wheel shown in Fig. 18 and the fixation by means of the clamping device.

Figs. 21 and 22 is a side view and a front view respectively, showing a driving gear incorporated in the transverse motion capable vehicle, and a base having a pin rack.

Fig. 23 is a perspective view showing the fifth example of the fixation base having a rack rail and a clamped element. This fixation base secures the movement of the driving gear shown in Figs. 21 and 22, and the fixation of the unit by means of the clamping device.

Figs. 24 and 25 is a perspective view showing a modified example of the vehicle frame.

Fig. 26 is a vertical sectional front view showing that the right and left ends of the vehicle frame shown in Fig. 25 are engaged with notches formed in the side walls of the block.

Fig. 27 is a perspective view showing a end block.

Figs. 28 and 29 are vertical sectional side views showing a non-self-running unit having an improved rotational ability and having a movement device and two blocks, the movement device being covered with the two blocks Fig. 28 shows a state that the block is placed on the roadway surface and the movement device is lifted in the blocks; Fig. 29 shows a state that the blocks are lifted from the roadway surface.

Figs. 30 and 31 are vertical sectional side views showing a non-self-running unit having an improved rotational ability and having a movement device and one block, the movement device being covered with the one block: Fig. 30 shows a state that the block is placed on the roadway surface and the movement device is lifted in the block; Fig. 31 shows a state that the block is lifted from the roadway surface.

Figs. 32-35 are vertical sectional side views showing other embodiments of the unit: Fig. 32 shows a self running unit lifting and lowering three blocks with three linking device; Fig. 33 shows a non self-running unit lifting and lowering two blocks with a pair of opposed linking device; and Fig. 34 shows a self-running unit lifting and lowering the two blocks with a pair of linking device arranged in a opposite direction to those of Fig. 34.

Fig. 35 shows a self-running unit lifting and lowering four blocks with two sets of a pair of opposed linking device.

Fig. 36 is a vertical sectional side view showing the schema of self-running unit lifting and lowering four blocks with four X-shaped linking devices. A clamping device is incorporated in this unit, if needed.

Fig. 37 is a vertical sectional side view showing the principle part of Fig. 36.

Figs. 38-42 are plan views showing an overall schema, in which a plurality of self-running or non-self-running units is installed in a longitudinal direction on one of the lane line of the reversible lane to solve traffic congestion whose bottle neck is a plane intersection.

Fig. 38 shows that the separation device is installed in a reversible lane section so that the length of the right-turn lane is changeable.

Fig. 39 shows that the reversible lane section where the separation device is installed is made in two or more phases so that the length of the right-turn lane is changeable.

Fig. 40 shows that a section between a central division immediately before an intersection in the downstream of the roadway (the division being offset toward a first direction by one lane for a right-turn lane) and a central division immediately after an intersection in the upstream of the roadway (the division being offset toward a second direction by one lane) is made reversibly movable in multiple phases.

Fig. 41 shows that the separation device installed between a downstream intersection and an upstream intersection is made movable by making central divisions immediately before the downstream intersection and immediately after the upper intersection, and that some part of the downstream immediately after the downstream intersection and some part of the upstream immediately after the upstream intersection are also made reversibly movable.

Fig. 42 shows that a section between the existing device and normal central divisions is made movable

to complete the existing device.

Fig. 43 shows that a section of the road upstream section and a section of the road upstream section starting from the point between the exit from and the entrance to the subject roadway is reversibly movable in multiple phases.

Figs. 44-46 are enlarged plan view showing a group of unit installed in the transition section Fig. 44 shows a configuration wherein a plurality of units (each unit has four blocks covering the unit) moves to shift a lane. Fig. 45 shows a configuration wherein a plurality of units (each unit has two blocks covering the unit) moves to shift a lane. Fig. 46 shows a configuration wherein a self-running unit having three blocks and a non-self-running unit having one block are joined alternatively, and are movable in a stepped form.

Figs. 47-49 is a vertical sectional side view showing a schema of a unit having a electrically operated jack. Fig. 47 shows a self-running unit lifting and lowering four blocks with two electrically operated jacks. Fig. 48 shows a self-running unit lifting and lowering three blocks with two electrically operated jacks. Fig. 49 shows a non-self-running unit lifting and lowering two blocks with one electrically operated jack, and having rotational ability.

Fig. 50 is a partial perspective side view showing an electrically operated jack of a lifting device.

THE BEST MODE FOR CARRYING OUT THE INVENTION

Traffic lane separation unit

[0077] A unit U1-U4 according to this invention comprises: a protective wall block B1-B3; and one of protective wall movement devices K1-K4 in four aspects, wherein at least one block is fixed to and covers one of the movement devices K1 - K4 so that the block(s) B1-B3 and the protective wall movement device K1-K4 are integrally connected.

[0078] A sequence of movable traffic separation device S1-S6a, S6b is configured by joining a plurality of units U1-U4 together along one of a lane line of a reversible lane section L1-L6a, L6b, for example a lane line V1 of the first direction. This is utilized by moving it about one lane to the lane line V2 of the second direction.

[0079] Now I will explain four aspects of a unit 400a 400d having a width of 60cm and a length of about 4 meters; a block B1-B3; a movement device K1-K4, and relevant structures and modified examples; along with the attached drawings.

[0080] In the unit U1 of the first aspect, namely, 400a, four blocks B1 fixedly covers a movement device K1-K4 as shown in Figs. 1, and 3-11.

[0081] The movement device K1 comprises a lifting device J1 lifting and lowering four blocks B1; the first clamping device C1, which activates in a side-to-side di-

rection for clamping movement; the second clamping device C2, which activates in a longitudinal direction for clamping movement; and a transverse motion capable vehicle D1 having a running device Q, which moves in a direction transverse to the traffic lane, wherein the lifting device J1 and the first clamping device C1 and the second clamping device C2 are mounted on a transverse motion capable vehicle D1.

[0082] In the unit U2 of the second aspect, namely, 400b, it does not have the second clamping device C2 shown in the bottom of Fig. 1, and, to fixedly cover the movement device K2 with four blocks B1, have the first clamping device C1 on a transverse motion capable vehicle (D1) having a lifting device K2 and a running device Q, the first clamping device C1 fixing the unit 400b on a roadway surface 11 through the movement device K2.

[0083] In the unit U3 of the third aspect, namely, 400c, it does not have the clamping device C1, C2 as shown in Fig.2, and a movement device K3 comprises a transverse motion capable vehicle D1 having the lifting device J1 and the running device Q, and four blocks B1 fixedly covers the movement device K3.

[0084] In the unit U4 of the fourth aspect, namely, 400d, a drive system of the running device Q is disposed from the movement device K3 shown in Fig. 2, a movement device K4 comprises a non-selfrunning transverse motion capable vehicle D2 having the lifting device J1, and four blocks B1 fixedly covers the movement device K4. This unit 4 moves in a direction transverse to the traffic lane or rotates depending on the self-running unit U1-U3 of the first-third aspects.

Protective Wall Block

[0085] The block B1 is a integrally-precast concrete product, wherein the central portion of the upper surface is projected upwardly, and thus the vertical sectional view of the block is gibbosity. The fore and rear ends of the block open in communication with each other, and the tunnel-shaped space 12 is formed opening the bottom of the block. More specifically, the block B1 comprises side walls 13, and a top member 14 across the tops of the side walls, projected upwardly. A stepped corner portion 15 is formed on the both shoulder of the top member 14. A groove 17 where a table frame 16 put across a lifting device J1 fits is formed in the ceiling portion of the top member 14.

[0086] The block B1 is about 60 cm in width, about 45cm in height, 1m in length and 10cm in the thickness of the wall, and 250kg/per block in weight. The shoulders of the block B1 may be inclined walls 151 having a sloping shape instead of a stepped corner portion 15.

Protective Wall Movement Device

[0087] Reference numeral 18 is a vehicle frame of a transverse motion capable vehicle D1, D2. The vehicle frame is about 40cm in width and made of a channel iron

with a length of about 4m. Connecting joints 19 fixed at both fore and rear ends of the vehicle frame each have a long hole drilled therein.

[0088] Reference numerals 20, 21 are a driving wheel and a driven wheel of the transverse motion capable vehicle D1 respectively. The driving wheel and the driven wheel are attached to the left and right surface of the bottom of the vehicle frame 18 spacing apart each other. The driving wheel 20 is supported by a bearing-frame 221 fixed toward the front and the rear portions of the vehicle frame 18, while the driven wheel 21 is born by a wheel holder 222 fixed in a central position of the vehicle frame 18.

Running Device

[0089] Reference character M1 is a motor for driving having a reduction gear G 1 rotating forward/rearward (hereinafter referred to as driving motor). This driving motor is mounted on the front and rear end positions of the vehicle frame 18. A driving chain 24 (could be a belt with teeth) is provided between a sprocket 232 fitted into an output shaft 231 of the reduction gear G1 and a sprocket 202 fitted into an axle 201 of the driving wheel 20. Reference numeral 181 is an insertion bole for the chain 24, and opens at the font and the rear positions of the vehicle frame 18.

[0090] Accordingly, when the fore and the rear motors M1 are synchronizingly driven, the transverse motion capable vehicle D1 moves substantially parallel to the traffic lane in a direction transverse to the lane. The transverse motion capable vehicle D 1 can moves with appropriate rotating by changing the number of revolutions or the revolution speed of one of the driving wheels 20 or by giving a time lag to one of the driving wheels 20.

[0091] Preferably, the reduction gear ratio of the driving motor M1 is fixed one of about 1/1,000-1/2,000, or is adjustable to a reduction gear ratio corresponding to the traffic congestion. For the first mentioned reduction gear ratio, the output shaft 231 rolls in a super slow speed with 0.5-0.6 minutes per roll.

[0092] More specifically, when the driving motor M1 drives to move the transverse motion capable vehicle D1 across a lane width of about 3-plus meters, if the wheel diameter is 10cm, the output shaft 231 and the axle 201 rotate 10 times.

[0093] By setting the reduction gear ratio for super slow rotation, for example, when the separation device operates in the early morning when there is little traffic, it takes 5-10 minutes for the transverse motion capable vehicle to move across one lane with a reduction gear ratio of about 1/1,000 1/2,000.

[0094] When the traffic is normal, for example, the period before people return home in the evening, a sports game finishes or other event finishes or people get on their back from outings when traffic congestion is expected, the transverse motion capable vehicle moves across one lane taking 15-20 minutes with a reduction gear ratio

of about 1/3,000-1/4,000.

[0095] When the traffic congestion has already began, the transverse motion capable vehicle moves across one lane taking about 30-60 minutes with a reduction gear ratio of about 1/6,000-1/12,000.

[0096] Therefore, by operating the transverse motion capable vehicle D1 of the unit U1-U3 in a super slow speed, the separation device S1-S6a, S6b configured as shown in Figs. 38-43 moves reversibly allowing the traffic to flow without any traffic restriction.

[0097] When the wheel diameter of the transverse motion capable vehicle D1 is 5 cm, this transverse motion capable vehicle D1 moves across one lane with 20 rotations. As such, with the reduction gear ratio of about 1/500-1/1,000, this transverse motion capable vehicle D1 moves across one lane in about 5-10 minutes

Lifting Device

[0098] Reference character M2 is a lifting motor having a reduction gear G2 mounted on the central position of the transverse frame 18. The lifting motor has a forward/reverse rotating shaft 25 inserted therein. Threaded portions 251 are each formed in the fore and the rear ends of the shaft 25 and also formed in proximate the middle position between the ends and the reduction gear G2. The threads in a front half of the shaft 25 and the threads in a rear half of the shaft 25 are formed opposite.

[0099] The lifting device J1 comprises: four linking devices 26 having a linking structure in an up-side-down letter y; the above lifting driving system; wherein two linking devices of the front half and two linking devices of the rear half are mounted on the center line of the vehicle frame 18 spacing apart symmetrically in a longitudinal direction.

[0100] A table frame 16 of channel iron with about 4 meter length is fixed on the linking device 26. Reference numeral 27 is a coupling joint fixed at the fore and the rear ends of the table frame 16. A long hole is drilled in the center of the coupling joint.

[0101] Now, I will explain the details of the linking device 26 as shown in the exploded perspective view of Fig. 8.

[0102] Reference numeral 28 is a main link obliquely supported- Spacers 291-293 are put in three places, namely upper, lower and bottom. Reference numeral 30 is a sub link supporting the main link 28. The upper end of the sub link is obliquely supported by a pin 311 on the outer sides of the middle of the main link 28, and its bottom end is also provided with a spacer 294.

[0103] Reference numeral 32 is a bottom metallic receiving element formed in a letter U. The bottom part of the sub-link 30 is fitted in one of the front or rear part of the bottom metallic receiving element, and pivoted with a pin 312 inserted from a side. The bottom part of the link 28 is fitted into a long hole 321 drilled in the other of the front or rear part of the metallic receiving element, and supported by a spindle 313 inserted from a side,

slidably in a back and forth direction.

[0104] Reference numeral 33 is an upper receptacle metallic part formed in an up-side-down letter U. The upper end of the main link 28 is pivoted with a pin 314. Reference numeral 34 is a cylindrical nut orthogonally fixed on the center position of the spacer 293. The nut 34 is threadedly engaged with a threaded portion 251 of the shaft 25.

[0105] A lifting device J1 is configured so that a bottom metallic receiving element 32 of the linking device 26 is fixed on the vehicle frame 18, a upper metallic receiving element 33 is fixed on the table frame 16, a rotating shaft 25 is threadedly fitted with nuts 34 of front two linking devices 26 and rear two linking devices 26.

[0106] The upper end of the main link 28 can be directly attached to the table frame 16. In this case, the upper metallic receiving element 33 is not necessary as shown in Fig. 2.

[0107] Therefore, when a lifting motor M2 runs and the rotating shaft 25 forward/reverse rotates, the bottom end of the main link 28 moves in a back or forth direction to push the table frame 16 vertically upward or brings it downward keeping it horizontal. Thereby, the gap between the table frame 16 and the vehicle frame 18 gets relatively wide or narrow.

[0108] Therefore, this separation device becomes movable by lifting the table frame 16 to lift the block B1 approximately several cm to 10 cm above a roadway surface 11 and grounding wheels 20, 21 of the transverse motion capable vehicle D1, D2 as shown in Figs. 4 and 6.

[0109] On the contrary, when the table frame 16 is lowered, the block B 1 is lowered to be placed on the roadway surface 11 and further the vehicle frame 18 is lifted as shown in Figs. 3 and 6, and thereby the gap between the table frame 16 and the vehicle frame 18 becomes relatively small. As a result, the overall movement device K1-K4 is lifted in the block B 1 placed on the roadway surface 11, and thus the wheels 20, 21 of the transverse motion capable vehicle D1, D2 slightly floats above the roadway surface 11.

[0110] Thereby, the unit U1-U4 is stably placed on the roadway surface 11 by adding the overall weight of the movement device K1-K4 to the overall weight of the block B1.

First clamping device

[0111] Now, the first clamping device C1 shown in the exploded perspective view of Fig. 11 is explained below.

[0112] The first clamping device C1 comprising: a pair of inverted-L-shaped clamp arms 35a swingably pivoted; and connecting levers 36a such as links or rods. The first clamping device C1 is fixed to the vehicle frame 18 and the table frame 16 of the movement device K1, K2.

[0113] Reference character 37a is a bearing fixed on the vehicle frame 18. This bearing pivots the bottom of the clamp arm 35a with a pin 371.

[0114] Reference numeral 38a is a bearing fixed on

the table frame 16. This bearing pivots the top of the clamp arm 36a with a pin 381.

[0115] The bottom of the connecting lever 36a is pivoted to a corner 351 of the clamping arm 35a with a pin 382.

[0116] Reference numeral 352 is a hook formed at one end of the clamp arm 35a.

[0117] Reference numeral 182 is an insertion hole formed in the vehicle frame 18 for the clamp arms 35a.

First base

[0118] An engagement fixing base P 1 (hereinafter referred to as the first base) that is engaged with the first clamping device C1 is explained below according to Figs. 14 and 15.

[0119] The first base P1 is buried in or laid on the roadway surface 11 along the lane lines V1 and V2 of the movement ends of the unit U2, and fixed with anchor bolts 39 at the four corners thereof.

[0120] The top of the first base P1 is formed in a truncated pyramid 401 raised from the roadway surface 11. The truncated pyramid 401 has ramps 402 in the circumference.

[0121] Reference numeral 41a is a groove for guiding one end of the clamp arm 35a. The groove is formed in the center of the base P 1 within the truncated pyramid 401 in a side-to-side direction.

[0122] Reference numeral 42a is an engagement element, such as a rod, wire and strip, fixed across the groove 41a in the upper center position. The engagement element 42a is engaged with the hook 352 of the clamping arm 35a.

[0123] Reference numeral 43 is a reflection plate fitted in the top 401 or ramps 402 of the truncated pyramid.

[0124] Therefore, the first base P1 functions for a line marker without obstructing the traffic flow by placing it on the lane lines V1, V2.

[0125] When the lifting motor M2 runs and the table frame 16 lowers in a vertical direction, the corner of the clamping arms 35a in a spread position as shown in Fig 10 is pushed down by the connecting lever 36a.

[0126] Then the clamp arm 35a swings to a closed position at the pin 37, which is a supporting point, and the end of the arm is guided in the groove 41a of the first base P1, finally the hook 352 of the end of arm clamps the engagement element 42a as shown in Fig.9.

[0127] For details, the block B1, which lowers integrally with the table frame 16, is placed on the roadway surface just before the clamping engagement, and the overall movement device K1, K2 is lifted in the block B1, finally the hook 352 engages the engagement piece 42a where the wheel 20, 21 of the transverse motion capable vehicle D1 is lifted slightly above the roadway surface 11.

[0128] Thereby, the unit U2 is fixed on the lane line V1, V2 of the movable end of the units U2.

[0129] On the other band, the table frame 16 is lifted by running the lifting motor M2, the corner 351 of the

clamp arm 35a in a closed position as shown in Fig. 9 is lifted by the connecting lever 36a. Then, the clamp arm 35a swings to a spread position at the pin 37a, which is a supporting point, and the hook 352 of the arm end releases the engagement with the engagement piece 42a.

[0130] As shown in Fig. 10, the unit becomes movable in a direction transverse to the traffic lane by grounding the wheel 20, 21 of the transverse motion capable vehicle D 1 and lifting the block B1 above the roadway surface 11.

[0131] Therefore, the self-running unit U2 is attached to the head and tail of the group of the units U1-U4 placed in the lane shifting section Y1, Y2-Yn of the separation device S1-S6a, S6b as shown in Figs. 38-43; or in the case that the roadway shape is curving, the unit U2 is placed in the middle of the group accordingly.

[0132] For example, in the case that the length of the lane shifting section Y1, Y2-Yn is more than 100m, the unit 2 is placed about every 50-100m. The separation device S1-S6a, S6b is formed by incorporating the unit U3 shown in Fig. 2, or incorporating the unit U3 and the unit U4, in the almost all of the other part thereof.

[0133] Thereby, in case that a vehicle collides into the separation device S1-S6a, S6b, the whole separation device functions as a half-rigid guard fence, and prevents the colliding vehicle from diving into the opposite lane or running off the track and gets the colliding vehicle back to the normal track.

[0134] In addition, for example, when it takes about 20-30 minutes for the separation device S1-S6a, S6b to shift the lane and shift the lane back, the overall separation device is steadily fixedly kept on the lane line V1, V2 on the roadway surface 11 in the other 23 hours and a half.

Second Clamping Device

[0135] The second clamping devices C2 shown in the bottom of Fig. 1 spacing apart in a longitudinal direction are placed adjacent to the center of the vehicle frame 18 and the center of the table frame 16, inward the first clamping device C1, and operate as a clamp in a longitudinal direction as shown in Figs. 5-7 in phantom lines.

[0136] This second clamping device C2 has the same structure as the first clamping device C1 except for being placed by turning around 90 degrees.

[0137] As such, the detailed explanation of the structure is omitted. The second clamp device C2 comprises a clamping arm 35b, a connecting lever 36b, and a bearing 37b, 38b.

[0138] In the case that the first clamping device C1 and the second clamping device C2 are incorporated in the movement device K1, a fixation base P2 (hereinafter referred to as the second base) shown in Fig. 16 for being clamped is fixed on the lane lines V1 and V2 of the movement end of the unit U2 accordingly.

Second base

[0139] A first half of the second base P2 is formed in the same engagement portion as that of the first base P1, and a second half of the second base P2 is formed in a truncated cone 403 raised from the roadway surface 11 as in the same manner as the first half.

[0140] Reference character 41b is a groove to guide the end of clamp arm 35b. This groove 41b is formed in the center of the base P2 in a longitudinal direction. Reference character 42b is an engagement element, such as a rod or wire, to be engaged with the hook of the clamping arm 35b. The engagement element 42b is fixed across the groove 41b in a lateral direction in the center upper position.

[0141] When the table frame 16 is lowered vertically by running the lifting motor M2, each clamp arm 35a, 35b swings to the closed position at the bearing 37a, 37b, which is a support point, and the hook 352 of the end of the arm 35a clamps the engagement element 42a of the second base P2 while the hook 352 of the end of the arm 35b clamps the engagement element 42b.

[0142] The block B1, which is lowered with the table frame 16 integrally, is placed on the roadway surface 11, and the overall movement device K1 is lifted in the block B1, finally, each hook 352 clamps the engagement element 42a, 42b to lock the separation device where the transverse motion capable vehicle D1 is lifted slightly above the roadway surface 11.

[0143] On the other hand, when the table frame 16 is lifted by running the lifting motor M2, the hook 352 of the end of the arm 35a releases the engagement with the engagement element 42a while the hook 352 of the end of the arm 35a releases the engagement with the engagement element 42b, finally the arm ends swing to a spread position with the groove 41a, 41b of the second base P2 guiding the arm ends.

[0144] Thereby, the wheel 20, 21 of the transverse motion capable vehicle D 1 grounds, the block B1, which is lifted with the table frame integrally, is lifted above the roadway surface 11, and the separation device thus becomes movable in a direction transverse to the traffic lane.

[0145] Thereby, the movement device K1 is lifted to add its overall weight to the overall weight of the block B1, the clamping device C1, C2 closes and clamps the fixing base, and thus the unit 1 shown in Fig. 1 is fixedly supported by the roadway surface 11.

[0146] The unit U1 is mainly placed on the front end of the lane shifting section Ha of the foremost part of the separation device S4, S5a, S5b or the rear of the lane shifting section Ta, Tb of the rearmost part of the separation device S4, S5a, S5b and thus the unit is movable and is clampingly fixed on the lane line V1, V2 of a movable end thereof.

[0147] In addition, the separation device S4, S5a, S5b is configured such that the unit 2 (400b) is placed at the fore or rear end of the lane shifting section Y1, Y2-Yn of

the main section of the reversible lane section L4, L5a, L5b; and the unit U3 (400c) shown in Fig. 2, or the unit U3 and the unit 4 (400d) is placed in the middle part of the reversible lane section.

[0148] Thereby, the separation device S4, S5a, S5b shown in Figs. 41 and 42 functions for the half rigid guard fence against a colliding vehicle, prevents the colliding vehicle from diving into the opposite lane, gets the colliding vehicle back to the normal track, and alleviate impact caused by a head-on collision against the unit U1 (400a) of the foremost part or rearmost part and excels in preventing the collided car from running in an unexpected direction.

[0149] This arrangement also excels in steadily, fixingly holds the overall separation device on the lane lines V1, V2 except for the operating time of the device S4, S5a, S5b.

Other structure of the traffic lane separation unit

[0150] In Figs. 1 and 2, reference numerals 441-444 are through holes drilled in the block B1; 161 is a through hole drilled in the table frame 16. A approximately four-meter-long flexible guard fence made of a steel pipe, namely a pole 451 of a guard fence 45 is fixedly fitted in the through hole 441 provided in the center of the top member 14.

[0151] A traffic barrier mainly comprising a rigid protective wall is formed by fixing the fence 45 across four blocks B1.

[0152] The grooves 17 of the blocks B1 fits on the table frame 16, and then the blocks B1 and the table frame are fixed together using bolts and nuts 461 through through holes 442 formed in the top member 14 and through holes 161 formed in the table frame 16.

[0153] Through holes 443 are formed in side walls 13 of adjacent blocks, and a connecting member such as a long collecting rod 47 or a piano wire or wire is inserted through each through holes 443. Reference numeral 48 is a sheet-like packing interposed between adjacent blocks B 1.

[0154] Therefore four blocks B 1 are integrally connected such that a connecting rod 47 is inserted though four blocks B 1 disposed on the table frame 16 and the packings 48 interposed between them, and that each end of the connecting rod 47 is tightened with a nut 471.

[0155] Reference numeral 131 is a indentation formed at front and rear ends of outer surfaces of side walls 13. a joining element 49 is fitted into the indentations 131 of adjacent blocks B1, and a bolt (not shown) is screwed in a through hole 444 formed in each indentation 131, or the joining element 49 is fitted through embedded bolts projected from the indentations 131 and tightened with nuts (not shown).

[0156] In addition, the integral connection of a plurality of blocks B 1 can also be achieved with only one of the connection rod 47 and the joining element 49.

[0157] Reference numeral 50 is an elastic pad made

from hard rubber. This elastic pad is fixed on the bottom face of the side walls 13, has moderate cushioning and enhances installability to the roadway surface 11 or drainage when raining.

[0158] Reference numeral 51 is a joining element cover formed in a bellow shape. This joining element cover has the vertical profile of convex, which is the same as that of the block B 1, and comprises: side cover portions 511 on both sides of the joining element; a top cover portion 512 that extends between the side cover portions 511; and a stepped cover portion 513 located at the both shoulders of the top cover portion. The outer edge is fixed at one end of the block B 1 with screws.

[0159] Thereby, the joint of adjacent units U1-U4 are flexibly and bendably covered, and the connection of the units U1-U4 is made attractive while it prevents debris from getting into the joint.

[0160] Reference numeral 52 is a rotatable warning light attached on top of the guard fence 45. The warning light informs drivers that the separation device S1-S6a, S6b formed as shown in Figs. 38-43 starts moving or is working, or the separation device S1-S6a, S6b is reversible.

[0161] In Figs. 12 and 13, reference number 462 is a bolt and nut for connecting the unit U1-U4. The joining element 19 extended from the vehicle frame 18 is connected with an adjacent joining element 19 with the bolt and nut 462, or a joining element 27 extended from the table frame 16 and the joining element 19 are connected with an adjacent joining element 27 and an adjacent joining element 19 respectively with a connecting bolt 463.

Other embodiments of the wheel and the fixation base

[0162] A wheel 53 of the transverse motion capable vehicle D1 shown in Fig. 17 has a hard-rubber wheel portion 531 in the center of the wheel, and a tapered wheel portion 532 in a truncated-cone shape in the side.

[0163] This wheel 53 is used instead of the wheel 20, 21 of the transverse motion capable vehicle D1 of the unit U1-U3, and a fixation base P3 (hereinafter referred to as the third base) having a rectangular shape is placed along the lane line V1, V2

[0164] In Fig. 19, reference numeral 54 is a rail for guiding the wheel 53. The rail 54 is formed in the front, rear and center position of the third base P3 in a side-to-side direction, one end of the rail 54 has a wide-mouthed portion opened in the shape of a horn aperture, and the other end is closed.

[0165] In the front and rear portion of the third base P3, engagement portion 57 having an engagement rod 42a, 42b and a groove 41a, 41b in the top portion 403 raised as is the same case with the second base P2. The groove of the rail S4 and the roadway surface 11 are formed substantially flush by making the base P3 raised from the roadway surface 11 to some extend.

[0166] Therefore, as the transverse motion capable vehicle D1 having the wheel 53 shown in Fig. 17 moves

transversely between lane lines V1 and V2, the rubber wheel portion 531 faces a wide-mouthed portion 541 of the third base P3, and a tapered wheel portion 532 rolls the guiding edge 542 of the rail 54 through the wide-mouthed portion 541.

[0167] Thereby, the positioning of the unit U1-U3 when getting on the third base P3 is secured, and the displacement of the location of the unit U1-U3 caused by its reciprocal movement is prevented or corrected. In particular, the unit U1, U2 secures clamping engagement in place.

[0168] In addition, a wheel 55 shown in Fig. 18 has a discal-collar wheel portion 551 formed in the center of the wheel, and a tapered wheel portion 552 formed in the sides of the wheel.

[0169] This wheel 55 is used instead of the driving wheel 20 of the transverse motion capable vehicle D1 of the unit U1-U3, a fixation base P4 (hereinafter referred to as the fourth base) of the unit U1-U3 is extended across the width between the lane lines V1 and V2 as shown in Fig. 20.

[0170] In Fig. 20, reference numeral 56 is a guide rail formed in a direction transverse to the traffic lane. The color wheel portion 551 of the wheel 55 is fitted into the guide rail 56. The unit 1-3 moves transversely between the lane lines V1 and V2 by rolling the tapered wheel portion 552 along the guiding edges 561 of the guiding rail 56.

[0171] In Fig. 21, a gear 58 is shown as a driving wheel 20 of the transverse motion capable vehicle D1. The gear 58 comprising a gear portion 581 in the center of the gear, and a tapered wheel portion 582 formed in the sides of the gear.

[0172] Accordingly, a fixation base P5 (hereinafter referred to as the fifth base) of the unit U1-U3 is extended across the width between the lane lines V1 and V2.

[0173] In this fifth base P5, a rack rail 59 having a pin rack 591 is formed in a direction transverse to the traffic lane, and an engagement portion 57 similar to the aforementioned engagement portion is formed in the both ends of the fifth base P5.

[0174] The driving gear 58 may be mounted on the axle 201, which is the same shaft the driving wheel 20 is mounted on.

[0175] Therefore, the driving gear 58 of the transverse motion capable vehicle D1 is engaged with and rolled on the pin rack 591 placed on the roadway surface 11, and the unit U1-U3 thus moves transversely between the lane lines V1 and V2.

[0176] The guiding rail 56 of the fourth base P4 and the rack rail 59 of the fifth base P5 are designed for installing the unit U1-U3 on a road lining inclination in a traffic lane direction or in a lateral direction to the lane, and thus secure that the unit U1-U3 reciprocally moves between lanes on a predetermined track without sliding downward.

[0177] Of course, for roads other than sloping roads, the guiding rail 56 of the fourth base P4 and the rack rail

59 of the fifth base P5 enable the unit U1-U3 installed in the separation device S1-S6a, S6b to reciprocally move on a predetermined track.

[0178] The unit U1, U2 can also securely clamp the engagement portion 57 formed in both ends of the base P4, P5.

[0179] However, there is a discussion that such a crossing groove is subject to clogging with dust or debris. This problem is easily solved by cleaning the groove of the first base P1 - the fifth base P5 with compressed air or a vacuum pump when maintenance is regularly made for this traffic lane separation device.

Protective wall block for ends

[0180] The block B2 shown in Fig 27 closes one of the front and rear ends to form an end wall portion 60, the front part of which is arcuate, and an arcuate barrier portion 141 is integrally formed over the front part of the top member portion 14.

[0181] This block B2 is attached to the foremost portion of the separation device S4, S6a, S6b, or the front or rear of the rearmost portion of the unit U1 as shown in Figs. 41 and 42. In addition, the single product may be placed as a lane line block of the front of a central division H1, H2 or the rear of a central division T1, T2 as shown in Figs. 38-40.

Other modified examples

[0182] In the above case, there was explained me linking device 26 lifting and lowering the table frame 16 as a driving mechanism, wherein a rotating shaft 25 with a thread where the front half and the rear half are opposite is threaded to a nut 34 orthogonally placed on the bottom of the main link 28, and is forward/reverse rotated.

[0183] Instead, a Lifting motor M2 and a linear head (equivalent to reference character G2) of a pinion mechanism are combined, a linear guide (equivalent to reference character 25) in place of the rotating shaft 25 passes through the linear head, the linear guide is moved linearly in a back and forth direction, and thus the table frame 16 supported by the linking device 26 can be lifted and lowered.

[0184] In this case, a beating (equivalent to reference character 34) of the linear guide in place of the nut 34 is projected from the spacer 293, the linear guide is connected to the bearing, and thereby the linking device 26 is operated.

[0185] In the above case, the main link 28 and the sub link 30 are each configured with a pair of side frames spaced apart with the spacers 291-294; however they can be pressed-molded-products, in which the side frames are integrally cast in a U-shape of the vertical section.

[0186] In the above case, the length of the vehicle frame 18 and the table frame 16 is about 4m so that the module of the movement device K1-K4 can be transport-

ed by ordinary trucks. However, it may be about 5-8m or about 10m if a large truck having a long body can be used for carrying them.

[0187] In the above case, the block B1 is 1 m in length; however it may be a channel steel of about 2m or 60cm in length.

Deformation example of the vehicle frame

[0188] Although the vehicle frame 18 is formed as a channel steel of 40cm in width in the above case, it may be a vehicle frame 61, 62 as shown in Fig. 24 or 25.

[0189] In the frame 61 shown in Fig. 24, holder frames 612; 613 for the wheels 20, 21 respectively are projected orthogonally to the main frame 611 at the front; rear and center position. The ends of the holder frames 612, 613 each bear the wheel 20, 21.

[0190] The vehicle frame 62 shown in Fig. 25 comprises folder frames 612, 613 are projected to intersect to the main frame 621 of an H-steel or an I-steel.

[0191] In Figs. 1, 2 and 26, reference numeral 132 is a notch formed in the side wall 13 of the block B1. The notch 132 faces one end of the holder frame 612, 613 as shown in Fig. 26, so that the wheel-base of the wheel 20, 21 is made longer, the stability when running is enhanced.

[0192] When the width of the block B1 shown in Figs. 1 or 2 is about 30-40 cm, the notch 132 of the block B1 allows the ends of the holder frame 612, 613 of the vehicle frame 61, 62 to lift and lower, thereby the width of the median strip can be narrowed, and the wheel base between the left wheel 20, 21 and the right wheel 20, 21 of the traverse motion capable vehicle D1, D2 is made longer, and the stability when running is secured.

[0193] In Fig. 3, reference numeral 63 is a crawler belt 63 put across the driving wheels 20. By providing the crawler belt 63 in the transverse motion capable vehicle D1 of the unit U1-U3, its grounding property to the roadway surface 11 improves when running, and it provides advantage to deal with the irregularity of the roadway surface 11.

[0194] In addition, in a block B3 shown in Fig. 3 by a phantom line, a top member portion of the Block B1 is integrated with a barrier portion 142 raised in a projection.

[0195] Thereby, the block B3 is an integrally molded product of about 60cm in width, about 80cm in height and about 450-500kg in weight so that its stability and the barrier function are enhanced when the block B3 is placed on the roadway surface 11.

[0196] Of course, a unit may be made by combining the block B having relatively low height and the block 3 having tall walls, or by combining the block 331, B2 and a guard fence 45.

[0197] In addition, instead of attaching the guard fence 45 on the block B1, a guard rail, guard pipe, guard cable, anti-glare fence or the like can be attached on the block B1.

Other embodiments of the traffic lane separation unit

[0198] The separation device S1-S6a, L6b is configured by installing the unit U1-U4 in appropriate positions. However, a unit 300a, 200a-200c, 100 maybe installed in a lane shifting section Y1, Y2-Yn or a transition section X1, Z1, Z2-Zn of the separation device S1-S6a, S6b as shown in Figs. 38-43, depending on the length of a reversible lane section L1-L6a, L6b or the transition section, the width of the traffic lane, or the degree of curving of the lane shifting section.

[0199] Now, embodiments of those units are explained below according to accompanying drawings.

[0200] In the self-running unit 300a (U3) shown in Fig. 32, three linking devices 26 are mounted on the 3meter-long transverse motion capable vehicle D1 having a running device Q, approximately three blocks B1 are fixed to and covers the 3 meter-long table frame 16, and the linking device 26 enables the block B1 to move up and down.

[0201] The detailed explanation of the other configuration is omitted because it is the same as that of the unit 3.

[0202] In the self-running unit 200a (U3) shown in Fig. 34, two linking devices 26 supports two blocks B1, and moves them up and down. In this case, the two linking devices 26 are mounted in an opposite direction to the above case.

[0203] In the non-self-running unit 200b (U4) shown in Figs. 28 and 29, two linking devices 26 are mounted on the 2-meter-long transverse motion capable vehicle D2 in a longitudinal direction, the linking devices 26 facing each other, two blocks B1 is fixed on and covers the table frame 16, one or two casters 64 are attached to the back side of the vehicle frame 18 at the center, or at the front and rear portion, trailing wheels 21 are attached to the back side of the vehicle frame 18 at the sides so that the non-self-running unit 200b is rotatable about the trailing wheels 21.

[0204] This unit is incorporated in a place where it follows and trails the unit U1-U3, mainly in a transition section where drivers smoothly change lines. This is useful to adjust the line shape and the intervals of units because it allows the traffic lane separation unit to be rotatable in a relatively short span.

[0205] In a non-self-running unit 200c (U4) in Fig. 33, two blocks B1 are supported by two linking device 26 so that it is movable up and down. In this case, a left-and-right pair of the trailing wheels 21 is attached to the back side of the transverse motion capable vehicle 18 in a longitudinal direction.

[0206] In anon-self running unit 100 (U4) shown in Figs. 30 and 31, a pair of linking devices 26 placed on the one-meter-long transverse motion capable vehicle D2 in a longitudinal direction liftably and lowerably support the block B1, the trailing wheel 21 are born at the left and right positions of the center of the back side of the transverse frame 18.

[0207] This is also incorporated in the transition section or lane shifting section, which follow and trail the unit U1-U3, and useful to adjust a line shape. In a self-running unit 400e (U3) shown in Fig. 35, two of four blocks B1 fixed on the table frame 16 are supported by a pair of opposed linking devices 26 placed on the front part of the vehicle frame 18, and the other two of four blocks B1 are supported by a pair of opposed linking devices 26 placed on the rear part of the vehicle frame 18. Further, the self-running unit 400e is operated by either of a lifting motor M2 having a reduction gear G2 or a lifting motor M2 having a linear box of pinion mechanism, both of which are placed between a pair of opposed linking devices 26.

[0208] Of course, when the unit 400e is incorporated at the front, end or intermediate position, or the foremost or the rearmost position of the lane shifting section Y1, Y2-Yn, Ym of the separation device S1-S6a, S6b, clamping devices C1, C2 are incorporated in the front and rear part of the protective wall movement device K1, K2, and the unit 400e is stably placed on the lane line V1, V2 except when the separation device S1-S6a, S6b operates. This is envisaged for a unit U1-U3 having a long size of more than several meters, or for a block B1-B3 having the weight of more than several hundreds of kilograms.

Other embodiments of the lifting device

[0209] In a self-running unit 400f(U3) shown in Fig. 34, a lifting device J2 shown in Fig. 37, namely a X-shaped linking device 65 supports four blocks B1 fixed on and covering the table frame 16.

[0210] In the linking device 65, a main link 66 and a sub link 67 are connected in a shape of the letter X, the top end of the sub link 67 supports a roller 68 with a pin 681, and the roller 68 rolls in the groove of the table frame 16.

[0211] Of course, in this unit 400f, the clamping device C1, C2 is installed in the movement device K1, K2, depending on the position where the unit 400f is installed.

[0212] In the above case, the lifting device J1, J2 comprises the linking device 26, 65 in an up-side down form of a letter y or in a form of a letter X, and its drive system; however, a lifting device J3 in place of the lifting device J1, J2 can be made as an electric jack 71.

[0213] Referring to Fig. 50, reference numeral 72 is a casing. A lifting motor M3 is fixed on one of the side wall of the casing 72. Reference numeral 73 is an outer cylinder forming internal thread. This outer cylinder is liftably fitted into the casing 72. Reference numeral 74 is a screw shaft forming an external thread. This screw shaft 74 is threaded in the outer cylinder 73. The driven bevel gear 75 is rotatably attached at a shank 751 of the bottom of the shaft 74. a bearing 76 is fitted into the driven bevel gear 75. Reference numeral 77 is a driving bevel gear fixed to an output shaft 771 of the lifting motor M3. This driving gear 75 is engaged with the driven bevel gear 75.

Reference numeral 78 is a roof fixed to the upper end of the outer cylinder 73. A base 721 of the casing 72 is fixed to the vehicle frame 18 of the transverse motion capable vehicle D1, D2, and the roof 78 is fixedly fitted on the table frame 16.

[0214] The electric jack 71 of this embodiment can be incorporated in the unit U1-U4 instead of the linking device 26, 65.

[0215] In a self-running unit 400g (U3) shown in Fig. 47, two electrically operated jacks 71 are placed on the 4-meter length transverse motion capable vehicle D1 including a running device Q, at intervals in a longitudinal direction, the table frame 16 is put across the jacks 71, and four blocks B1, B3 are fixed to and cover the table frame 16 of the movement device K3.

[0216] In a self-running unit 300b (U3) shown in Fig. 48, three blocks B1, B3 are configured to be moved up and down by fore and rear two electrically operated jacks 71.

[0217] In a non-self-running unit 200d (U4) shown in Fig. 49, two blocks B1, B3 are configured to be moved up and down by one electrically operated jack 71.

[0218] In these units 400g, 300b, the clamping device C1, C2 is also installed in the movement device K1, K2, depending on the position where the unit is installed.

Mobile traffic lane separation device

[0219] First of all, the outline of movable traffic lane separation device S1-S5a, S5b (hereinafter referred to as, first separation device fifth separation device) that is suitable for alleviate or solving traffic congestions where a grade intersection is a bottle neck, is explained below in each device as shown in Figs. 38-41, which adopt a left-hand traffic.

[0220] The movable traffic lane separation device basically requires at least three lanes in both directions: however, in the case of a roadway having only two lanes in both directions, a section from an intersection toward the roadway upstream and/or the roadway downstream needs to be defined in three lanes or widened to three lanes.

[0221] In Figs. 38 and 39, the roadway upstream section in the right of the drawings forms four lanes and the roadway downstream section in the left of the drawings forms five lanes by adding another lane.

[0222] In the following explanations, it is explained mainly the case that vehicles flow from the upstream toward downstream keeping to the left hand side.

First separation device

[0223] In Fig. 3 8, reference character A1 is a subject grade intersection of the roadway downstream. In many cases, such a grade intersection is controlled by traffic signals. Reference character H1 is the front portion of a central division where opposed lanes are separated immediately before the intersection A1 (hereinafter referred

to as the front division). The front division is fixed by shifting the width of approximately half a lane one lane from the road center to the other way.

[0224] In the first direction (the lower half of the roadway in Fig. 38) defined by the front division, there are provided a right-turn lane F1, a straight-through lane F2, and a straight-through and left-turn lane F3. The light-turn lane F1 preferably has a fixed length that is able to meet the normal amount of traffic except a period of congestion, for example, 10-20m at the shortest and 40-50m at the longest.

[0225] Reference character N2 is a central division which separates the directions in the roadway upstream section (hereinafter referred to as the upstream division). A reversible lane section L1 is formed between the front division H1 and the upstream division N2. Traffic lane lines V1, V2 are formed in substantially parallel with substantially one lane spaced apart.

[0226] A first end of the lane line V1 is merged to a first end of the lane line V2 by obliquely extending the first end of the lane line V1 to one end of the front division H1. The lane line V1 and the lane line V2 are merged together by obliquely extending the ends of the both lines V1 and V2 to one end of the upstream division N2. The first ends and the second ends of the lane lines V1 and V2 are referred to as a first merging point Va and a second merging point Vb respectively, and a section between the lane lines V1 and V2 is a reversible lane Fa.

[0227] A reversible lane section L1 consists of three sections: a first transition section X1, a lane shifting section Y1 and a second transition section Z1. A plurality of the units U2-U4 is adequately installed on the lane line V1, V2 and joined together end-to-end.

[0228] Specifically, in Fig. 44, a transition device X1S, which is a traffic lane separation device bendable in a polygonal line, is assembled in a transition section X1 on the lane line V1. The transition device X1S consists of: a front unit 400d (U4) as a front portion thereof; at least one intermediate unit 400c (U3) following the front portion; and a tail unit 400c (U3).

[0229] The front unit 400d (U4) is connected to the front division H1, or to one of the blocks B1 and B3 fixed to the rear end of the front division H1.

[0230] In Fig. 45, a transition device is assembled by bendably connecting: one of a unit 200b (U4) shown in Figs. 28 and 29 and a unit 200c (U4) shown in Fig. 33; and a plurality of units 200a (U3) shown in Fig. 34.

[0231] In Fig. 46, a transition device is assembled by bendably connecting a unit 100 (U4) shown in Figs. 30 and 31 and a unit 300a (U3) shown in Fig. 32 alternately to be a stepped formation in a top plane view.

[0232] A lane shifting device. YLS is assembled on the lane line V1 of the lane shifting section by joining a front unit 400b (U2), a plurality of intermediate units 400c (U3) and a rear unit U2 together end to end along the roadway.

[0233] One end of the front unit 400b (U2) is bendably connected to one end of the rear unit 400c (U3) of the transition device X1S.

[0234] It is preferable to place the unit 400b (U2) having a clamping device C1 at the both ends of the lane shifting section Y1 S to secure the movement transverse to the traffic lane. In this case, one of the first base P 1 and the third base P3 is placed on the lane lines V1 and V2, between which the unit U2 moves, or one of the fourth base P4 and the fifth base P5 is placed between the lane lines V1 and V2.

[0235] Although the lane shifting device Y1S is a line as shown in drawings, in many cases a roadway consists of linear sections and curved sections. As such, in the intermediate section of the lane shifting section, there is provided: the unit U3; the unit 400b (U2), which is excellent in clamping fixation; and 400d (U4), which is capable to rotate for adjusting the line shape.

[0236] On the lane line V1 of the transition section Z1, there is assembled a rear transition device Z1S by bendably joining: the front unit U3, at least one intermediate unit U3, and the rear unit U4 in an order opposite to the order shown in Figs. 44 and 45.

[0237] One end of the front unit U3 of the transition device Z1S is bendably joined to one end of the rear unit U2 of the lane shifting device Y1S, and the other end of the rear unit U4 of the transition section Z1S is fixed to the front end of the upstream division N2 or fixed to a block fixed to one of the blocks B1 and B3 fixed to the front of the upstream division N2.

[0238] Thereby, the first separation device S1 is movably formed with the front transition device X1S, the lane shifting device Y1S and the rear transition device Z1S.

[0239] To move the first separation device S 1 from one of the lane lines V1 and V2 to the other, the following steps are taken:

[0240] Firstly, the lifting motor M2 of each of the units U2-U4 which are placed on the lane line V1 is driven to rotate the rotation shaft 25 to lift the block B1 of each unit U2-U4 above the roadway surface 11.

[0241] Subsequently, the driving motors M1 each incorporated in each unit U2-U3 placed in the lane shifting section Y1S are driven in synchronism to move each transverse motion capable vehicle D1 in parallel to the traffic lane.

[0242] In the case that the unit U4 is incorporated between the unit 2 and the unit 3, the unit 2 and the unit 3 moves the unit U4 with adequate rotation.

[0243] Correspondingly, the driving motors M1 of each unit U3 incorporated in the transition device X1S, Z1S are subsequently driven. In the case as shown in Figs. 44 and 45, the driving motors M1 of the unit U3 is controlled by changing the number of revolutions or speed of revolutions of the driving motors M1 one another, or adding some time lag in the rotation of the drive wheel 20.

[0244] Thereby, as the each transverse motion capable vehicle D1 moves from one of the lane lines V1 and V2 toward the other, the unit 4 moves in a direction transverse to the traffic lane with adequate rotation.

[0245] In Fig. 46, as the units 300a (U3) of each step transversely moves in substantially parallel to the road-

way, the unit 100 (U4) is rotated and is moved transversely by the driving force of the unit U3.

[0246] The lane shifting device Y1 in the first separation device S1 moves in parallel from the lane line V1 in the first direction to the lane line V2 in the second direction, and consequently, as shown in Figs. 38, 44-46, the transition device X1S formed in polygonal line or in steps moves to the lane line V2 in the second direction to be substantially linear, and the rear transition device Z1S is polygonally merged to the central division N2.

[0247] At this stage, when the driving motor M1 is stopped driving, and the rotation shaft 25 is reversely rotated by driving the lift motor M2 of the unit U2-U4 of the first separation device S1, the block B1, B3 of the unit U2-U4 is lowered to the roadway surface 11 on the lane line V2, and the movement device K2-K4 is lifted and stored in the block B1, B3.

[0248] The unit U2 placed at the fore and rear ends and the intermediate of the lane shifting device Y1S if necessary clamps the engagement piece 42a of the base P1, P3 installed at the movable end of the unit.

[0249] In the case that the forth base P4 or fifth base P5 is installed, the unit U2 is moved securely in place and fixed at the movable end thereof.

[0250] On the other hand, before the time slot when the amount of traffic is inverted in two directions, the lifting motor M2 of each unit U2-U4 is driven to release the clamping engagement between the clamping arm 35a of unit U2 and the engagement piece 42a of the base P1-P5 to lift the block B1, B3 of each unit U2-U4 above the roadway surface 11.

[0251] Then, the driving motor M1 of each unit U2-U3 incorporated in the lane shifting device Y1S is driven to reverse the rotation of the output shaft 231 to move the transverse motion capable vehicle in a direction transverse to the traffic lane in substantially parallel toward the lane line V1 in the first direction. Correspondently, each transverse motion capable vehicle D1 moves in the direction transverse to the traffic lane with appropriate rotation by sequentially interconnectingly controlling the driving motors M1 of units U3 incorporated in the transition device X1S, Z1S.

[0252] Thereby, as shown in Figs 44-46 in solid lines, the front transition device X1S is merged with the front division in a polygonal or stepped formation and the rear transition device Z1 S is merged with the rear central division in a polygonal formation on the lane line V1 as shown in Fig. 38 in a solid line.

[0253] At this stage, the running motor M1 is stopped, and the lifting motor M2 of each unit U2-U4 is driven to reverse the rotation of the rotation shaft 25 to lower the block B1, B3 of the unit U2-U4 on the lane line V2.

[0254] The unit U2 incorporated in the lane shifting device Y1S clamps the engagement piece 42a of the base P1-P5 placed at the movable end of the unit U2, and the movement device K2-K4 of each unit U2-U4 is lifted and stored in the block B1, B3.

[0255] In Fig. 38, reference character T1 is a rear cen-

tral division of the downstream section, which separates the directions immediately after the intersection. It is fixed by approximately one lane off the center of the roadway toward the first direction. In the downstream of the rear central division, a similar device to the first separation device S 1 is configured symmetrically.

[0256] Thereby, not only the upstream section where the subject intersection A1 is a bottle neck, but also the downstream section can alleviate or solve the traffic congestions drastically.

[0257] In particular, when the direction of the traffic congestion is inverted and the amount of the traffic of the second direction increases, congestions around the intersection A1 is alleviated and solved.

Second separation device

[0258] In the second separation device S2 shown in Fig. 39, the lane shifting section 12 between the front division H1 and the upper division N2 is formed to be able to shift in two or more phases so that the length of the right-turn lane at the intersection A1 can be changed.

[0259] In this drawing, reference character R1 is a first-phase reversible line section, comprising the front transition section X1, the first lane shifting section Y1 and the intermediate transition section Z1, from the front of the first-stage reversible line section toward the rear (upstream) of the first-stage reversible line section.

[0260] Reference character R2 is a second-phase reversible lane section, comprising the transition section Z1, the second-phase lane shifting section Y2, and the rear transition section Z2. The reversible lane section Rn is formed by repeating the above configurations to make the third and more phases reversible lane sections.

[0261] Therefore, in the second separation device S2, the reversible lane section L2 forms a group of: the front transition section X1; the line shifting section Y1, Y2-Yn; and the transition section Z1, Z2-Zn. The units U2-U4 are joined together on one of the lane lines V1 and V2 of the reversible lane section L2. The units U2-U4 are configured with the movement device K1-K4, and at least one block B1-B3 fixed to and covering the protective wall movement device K1-K4.

[0262] A group of the units U2-U4 incorporated in the first-phase reversible lane section R1 (namely, the first-phase lane separation device R1S), a group of the units U2-U4 incorporated in the second-phase reversible lane section R2 (namely, the second-phase lane separation device R2S), and a group of the units U2-U4 incorporated in the third and further reversible lane sections Rn (namely, the n-phase lane separation device RnS) are sequentially movable from the line lane V1 to the line lane V2 in multiple phases to deal with a various length of traffic congestions.

[0263] In this case, preferably the first separation device S1 or the second separation device S2 is also configured symmetrically in the downstream of the subject intersection as shown in Fig. 39.

Third separation device

[0264] In Fig. 40, reference character T2 is a rear central division (hereinafter referred to as rear division) separating the directions immediately after the intersection A2.

[0265] In the third separation device S3, the reversible lane section L3 between the front division H1 and the rear division T2 forms in 2 phases or more as is the case with the second separation device S2, the length of the right-turn lane of the intersection A1 can be extended to the rear division T2, or shortened to deal with a variety of grade of traffic congestion.

[0266] Reference character H2 is a front portion of a central division immediately before the intersection A2 (hereinafter it is also called the front division).

[0267] In this case, it is also preferable to install one of the first separation device S1 - the third separation device S3 in the downstream of the rear division T1 and the upstream of the front division H2.

[0268] Although in the first separation device S1 - the third separation device S3, the roadway is fixedly separated by the front division H1, H2 and the rear division T1, T2, it can be separated by a centerline (not shown). In this case, the end block B2 is fixed to the rear of a front centerline, and the front of a rear centerline, and is connected to the end of the first separation device S1 or the second separation device S2. In the third separation device S3, the front end and the rear end of the third separation device S3 each connect to the block B2. Thereby, the ends of the first separation device S1 - the third separation device S3 is made attractive.

Fourth separation device

[0269] In Fig. 41, the front division H1 or the rear division T2 shown in Figs. 38-40 is made movable, and a reversible lane line section L4 is formed all the way between, the intersection A1 of the downstream section and the intersection A2 of the upstream section.

[0270] In the same drawing, reference character-Ra is a reversible lane section of the foremost part, comprising a lane shifting section Ha immediately before a downstream intersection A1 and a transition section X1. A lane shifting device Has of the front most part is configured on the lane V2 of the lane shifting section Ha so that the front unit U1, the intermediate unit U3, the rear unit U2 are joined from the foremost part of the downstream. The rear end of the rear unit U2 is bendably joined to the front unit U4 (can be U3) of the transition device X1S shown in Figs. 44-46.

[0271] One of the first base P1 - the fifth base P5 is placed on the lane lines V1 and V2, or placed between the lane lines V1 and V2, which are movable ends of the front unit U1 or the rear unit U2.

[0272] Reference character Rb is a rearmost reversible lane, comprising a transition section Z1; and a lane shifting section Tb immediately after the intersection A2

of the upstream. A rearmost lane shifting device TbS is configured with a front unit U2, an intermediate unit U3, a rear unit U1 from the downstream. The front end of the front unit U2 is bendably connected to the rear end of the rear unit U3, U4 of the transition section Z1S.

[0273] As is the case with the above, one of the first base P1-the fifth base P5 is placed on the movable ends of the front unit U2 and the rear unit U1 of the lane shifting device TbS, or placed between the lane lines V1 and V2.

[0274] As such, in the fourth separation device S4, a traffic lane separation device RaS of the reversible lane section Ra of the foremost part and the lane separation device RbS of the reversible lane section Rb of the rearmost part are transversely moved from one of the lane lines V1 and V2 to the other, and thus secures the smoother traffic flow.

[0275] Although a one-phase reversible lane section R1 is configured between the foremost lane shifting section Ha and the rearmost lane shifting section Tb in Fig. 41 as is the case with the third separation device S3 shown in Fig. 40, a multiple-phase reversible lane section R1, R2-Rn can be configured between them so that the length of the right-turn lane can be changeable to deal with the various level of traffic congestions.

[0276] Although both of the foremost lane shifting section Ha and the rearmost lane shifting section Tb are configured to be movable in the fourth separation device S4, it is possible to make one of them movable and make the other to be the front division H1 or the rear division T2 shown in Figure 40.

Fifth separation device

[0277] In Fig. 41, reference character N1 is a central division separating the roadway downstream section (hereinafter referred to as downstream division) in two directions, and reference character L5a is a reversible lane section immediately after an intersection A1 of the downstream section and comprises a transition section Za and a rear lane shifting section Ta.

[0278] A downstream transition device ZaS is assembled in a transition section Za by joining a front unit U4, an intermediate unit U3 and a rear unit U3 from the downstream division N1 toward a lane line V1 as shown in Fig. 44 and 45. A downstream lane shifting device TaS is assembled on the lane line V1 of a lane shifting section Ta by joining a front unit U2, an intermediate unit U3 and a rear unit U1.

[0279] One of the first base P4-the fifth base P5 is placed at the movable end of the front unit U2 and the rear unit U1 of the lane shifting device Tas, or placed between the lane lines V1 and V2.

[0280] Thereby the fifth separation device S5a is configured immediately after the downstream intersection A1.

[0281] Reference character N3 is a central division separating the directions in a roadway upstream section (hereinafter called as upstream division). Reference

character L5b is a reversible lane section immediately before an upstream intersection, comprising a front lane shifting section Ha and a transition section Xa.

[0282] An upstream lane shifting device HaS is assembled on a lane line V2 of the lane shifting section Ha by joining a front unit U1, an intermediate unit U3 and a rear unit U2. An upstream transition device XaS is assembled in a transition section Xa by joining a front unit U1, an intermediate unit U3 and a rear unit U4 from the lane line V2 toward the upstream division N3.

[0283] One of the first base P1 the fifth base P5 is placed at the movable end of the front unit U1 and the rear unit U2 of the lane shifting device HaS, or placed between the lane lines V1 and V2.

[0284] When the traffic lane separation device RaS of the foremost reversible traffic lane section Ra of the forth separation device S4 and the traffic lane separation device RbS of the rearmost reversible traffic lane device Rb transversely move from one of the lane lines V1 and V2 to the other, the fifth separation device S5a, S5b installed in the downstream section of the intersection A1 and the upstream section of the intersection

A2 moves correspondingly.

[0285] Thereby, a whole section between the downstream division N1 and the upstream division N3, which includes the intersections A1 and A2 shown in Fig. 41 is reversibly movable to secure the smoother traffic flow.

[0286] An existing device shown in the center in Fig. 42, the traffic lane separation device configured in a reversible traffic lane section Lp reversibly moves from a lane line V1 to a lane line V2 across the section.

[0287] As a result, gaps of half a lane - one lane are formed between the ends of the reversible traffic lane section Lp and normal traffic lane sections.

[0288] As such, the fifth separation device S5a, S5b is configured in the downstream section and the upstream section of the existing device Sp as shown in Fig. 42, and is moved correspondingly as the existing device Sp is moved by a transfer vehicle 10.

[0289] Thereby, a whole section between the downstream division N1 and the upstream division N3 is reversibly movable to secure the smooth traffic flow.

[0290] Therefore, the fifth separation device S5a, S5b is utilized as a complement device to solve the complication of the traffic between the ends of the existing device and the normal traffic lanes.

[0291] Reference numeral 69 is a connecting member such as a wire, a chain and a guard pipe. The connecting member connects each block B of the ends of the existing device Sp to the rear unit U1 of the lane shifting device TaS and the front unit U1 of the lane shifting device HaS. Thereby it prevents the existing device Sp from moving in an unexpected direction when the front part or rear part of the existing device Sp is hit by a car.

Sixth separation device

[0292] Now, a movable traffic lane separation device (hereinafter referred to as the sixth separation device S6a, S6b), which is suitable for alleviating or solving traffic congestions where an interchange is a bottle neck, is explained below based on schematic plan views shown in Fig. 43.

[0293] In the enter of Fig. 43, reference characters E1, W1 are an exit and an entrance of the first direction near an interchange respectively, and E2, W2 are an exit and entrance of the second direction respectively. An intermediate central division Na separating the directions of the roadway is provided between the exits E1, E2 and the entrance W1, W2.

[0294] A reversible traffic lane section L6b of the road upstream shown in from the right of the top to the bottom of the middle of Fig. 43 is formed between the central division separating the road upstream section (hereinafter referred to as upstream division) and the intermediate division Na, while a reversible traffic lane section L6b of the road downstream shown in the left of the middle to the top of Fig. 43 is formed between the intermediate division Na and a central division separating the directions of the road downstream section (hereinafter referred to as downstream division).

[0295] The upstream sixth separation device S6b is configured on one of a lane line V1 and V2 in the reversible traffic lane section L6b of the upstream of the intermediate division Na, in two or multiple phases, as is the case with the third separation device S3 shown in Fig. 39 or the fourth separation device S4 shown in Fig. 40.

[0296] The downstream sixth separation device S6a is configured on one of the lane lines V1 and V2 in the reversible traffic lane section L6 of the downstream of the intermediate division Na, symmetrically to the sixth separation device S6b, in two or multiple phases.

[0297] Thereby, congestions between cars running the driveway and cars entering or exiting the roadway does not occur and thus traffic congestions where an interchange is a bottle neck is alleviated and solved.

[0298] In the above case, the rear part of the downstream division N1 and the front part of the upstream division N3 is made in a wedge shape to allow cars to change lanes smoothly.

Claims

1. A traffic lane separation unit U1 - U4, wherein:

one or more protective wall blocks B1 - B3 fixedly cover on a protective wall movable device K1-K4;

in said movable device K3, a lifting device J1 - J3 lifting and lowering said block B1 - B3 is incorporated in a transverse vehicle D1 having a running device Q, which is reciprocatingly

moves in a traffic lane transverse direction;
and, by activating said lifting device J1 - J3, said
block B1 - B3 is floated from a road surface 11
or is placed on said road surface 11, and said
movable device K3 is lifted or lowered in the in-
side of said block B1 - B3.

2. A traffic lane separation unit U1-U4, wherein:

one or more protective wall blocks B1-B3 fixedly
covers on a protective wall movable device K1-
K3;
in said movable device K1, K2, a lifting device
J1-J3 lifting and lowering said block B1-B3 and
a clamping device C1, C2 fixing said block B1-
B3 on a road surface 11 are incorporated in a
traverse vehicle D1 having a running device Q,
which reciprocatingly moves in a traffic lane
traverse direction;
and, by activating said lifting device J1 - J3, said
block B1 - B3 is floated from a road surface 11
or is placed on said road surface 11, and said
movable device K3 is lifted or lowered in the in-
side of said block B1 - B3.

3. A traffic lane separation unit U1-U4, wherein: a
protective wall block B1-B3 fixedly covers a protec-
tive wall movable device K1-K4;
in said movable device K4, a lifting device J1-J3 lift-
ing and lowering said block B1-B3 is incorporated in
a transverse vehicle D2 moving in a traffic lane trans-
verse direction;
and, by activating said lifting device J1 - J3, said
block B1 - B3 is floated from a road surface 11 or is
placed on said road surface 11, and turningly moves
or transversely moves depending on a traverse move-
ment of either or both of a traffic lane separation unit
U3 of claim 1 and a traffic lane separation unit U1,
U2 of claim 2.

4. A traffic lane separation unit, wherein a table frame
16 is placed across said lifting device J1-J3 of claim
1, 2 or 3, and a protective wall block B1-B3 fixedly
covers said frame 16.

5. A traffic lane separation unit, wherein:

said protective wall block B1-B3 of claim 1, 2, 3
or 4, is an integrated molded product made of
concrete and comprising: opposed side walls
13, each of which has an installation surface to
a road surface 11; and one of a top wall 14 and
a barrier portion 141 both formed across the top
of said side walls 13;
said block B1, B3 has a space 12, which opens
to opposed ends and the bottom of said block
B1, B3, and
said space 12 houses a protective wall movable

device K1-K4, which lifts and lowers and travers-
es said block B1-B3.

6. A traffic lane separation unit, wherein said lifting
device J1, J2 of claim 4 is a foldable linkage 26, 65
incorporated between a table frame 16 and a trans-
verse vehicle D1, D2.

7. A traffic lane separation unit, wherein said lifting
device J3 of claim 4 is an electric jack 71 incorporated
between a table frame 16 and a transverse vehicle
D1, D2.

8. A traffic lane separation unit, wherein:

said linkage 26, 65 of claim 6 is configured with
a main link 28, 66 and sub link 30, 67
in one of a up-side-down form of the letter y, or
a form of the letter X; and the bottom end of said
linkage 26, 65 is pushed and pulled in a longi-
tudinal direction so that a protective wall block
B1-B3 is lifted and lowered through a table frame
16.

9. A traffic lane separation unit, wherein:

the bottom end of said main link 28 and sub link
30 of claim 8 is pivoted on a
longitudinal position of bottom receptacle metal-
lic part 32 fixed on said transverse
vehicle D1, D2 of claims 1-3; and
the bottom end of one of said linkages 28 and
30 is slid in a longitudinal direction so that a table
frame 16 is pivoted on the top of said main link 28
is lifted and lowered.

10. A traffic lane separation unit, wherein:

the bottom end of said main link 66 and sub link
67 of claim 8 is pivoted on the longitudinal posi-
tion of said bottom receptacle metal part 32 fixed
to said transverse vehicle D1, D2 of claims 1-3;
and
the bottom end of said sub link 67 slidingly guid-
ed in a longitudinal direction so that a protective
wall block B1-B3 is lifted or lowered through a
table frame 16, and
the top of said sub link 67 is rollingly guided or
slidingly guided in a longitudinal direction of said
table frame 16.

11. A traffic lane separation unit, wherein said clamp-
ing device C1, C2 of claim 2 is engageable with and
disengageable from an engageable piece 42a, 42b
placed on a road surface by actuating a lifting device
J1-J3.

A traffic lane separation unit, wherein:

said clamping device C1, C2 of claim 2 or 11 has a link structure comprising a clamp arm 35a, 35b pivoted on a transverse vehicle D1 and a connecting lever 36a, 36b pivoted on a table frame 16 of claims 4 and 6-10;
said clamp arm 35a, 35b is openable and closable through said connecting lever 36a, 36b by actuating a lifting device J1-J3.

13. A traffic lane separation unit driving said transverse vehicle D 1 of claim 1 or 2 in a super slow speed.

14. A traffic lane separation unit, wherein the speed reduction ratio of a drive motor M1 incorporated in said transverse vehicle D 1 of claim-13 is about 1/500 - 1/12,000.

15. A traffic lane separation unit, wherein:

a through hole 443 is formed in said side walls 13 of claim 5;
two or more protective wall blocks B1-B3 in a face-to-face relation are integrally connected with a connecting member 47 inserted through said through hole 443.

16. A traffic lane separation unit, wherein:

a dent 131 is formed in front and rear end of the outer surface of said side walls 13 of claim 5;
a joint board 49 is fitted in said dent 131 and fixingly join protective wall blocks B1-B3, which are adjacent each other in the longitudinal direction.

17. A traffic lane separation unit, wherein an elastic pad 50 is fixed on the bottom surface of said side walls 13 of claim 5.

18. A traffic lane separation unit, wherein:

a vehicle frame 18 of said transverse vehicle D1, D2 of claim 1, 2 or 3 is configured with a main frame 61, 62 and holder frames 612 and 613 extended from both sides of said main frame 61, 62;
both ends of said holder frames 612 and 613 each face to a notch 132, which is formed in side walls 13 of a protective wall block B1-B3.

19. A traffic lane separation unit, wherein:

a joint is formed in the fore and rear end of said traffic lane separation unit U1-U4 of claim 1, 2, 3 or 4;
said joint is a connecting joint 19, 27, which is formed on either or both of a vehicle frame 18

of a transverse vehicle D 1, D2 and a table frame 16 of a lifting device J1-J3.

20. A traffic lane separation unit, wherein said joint of claim 19 is covered with a joint cover 51 comprising at least: side cover portions 511 placed at both sides of said joint; and a top cover portion 512 covering between said side cover portions 511; the front and rear outer edge of said cover 51 is fixed on the edge of a protective wall block B1, B3.

21. A protective wall block B1-B3 comprising:

opposed side walls 13, each of which has an installation surface to a road surface 11; and a top wall 14 or a barrier portion 141 formed across said side walls 13;
wherein:

said block B1, B3 has a space 12, which opens to both ends and the bottom of said block B1-B3 ; and
said space 12 houses a protective wall movable device K1-K4, which lifts and lowers and traverses said block B1-B3.

22. A protective wall block B1-B3 comprising:

opposed side walls 13, each of which has an installation surface to a road surface 11; and one of a top wall 14 and a barrier portion 141 formed across said side walls 13; wherein:

said block B2 has one of the longitudinal ends closed and has a space 12, which opens to the other longitudinal end and the bottom of said block B1-B3; and
said space 12 houses a protective wall movable device K1-K4, which lifts and lowers and traverses said block B1-B3.

23. A protective wall block, wherein a table frame 16 put across a lifting device J1-J3 is fitted in the ceiling portion of said top wall 14 or barrier portion 141 of claim 21 or 22.

24. A protective wall block, wherein both shoulders of said top wall 14 or a skirt portion of said barrier portion 141 of claim 21 or 22 are formed either in a stepped corner part 15 or in a inclined wall 151 having a sloping shape.

25. A protective wall movable device, wherein:

a lifting device J1-J3 for lifting and lowering a protective wall block B1-B3 is incorporated in a transverse vehicle D1 having running device Q, which reciprocatingly moves in a traffic lane

transverse direction;
 a table frame 16 is put across said lifting device J1-J3 in a longitudinal direction;
 said block B1-B3 is put across said frame 16, which supports said block B1-B3.

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26. A protective wall movable device, wherein:

a lifting device J1-J3 lifting and lowering a protective wall block B1-B3, and a clamping device C1, C2 fixing said block B1-B3 on a road surface 11 are incorporated in a transverse vehicle D having running device Q, which reciprocatingly moves in a traffic lane transverse direction;
 a table frame 16 is put across said lifting device J1-J3 in a longitudinal direction;
 said block B1-B3 is put across said frame 16, which supports said block B1-B3.

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27. A protective wall movable device, wherein:

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a lifting device J1-J3 for lifting and lowering a protective wall block B1-B3 is incorporated in a transverse vehicle D2 moving in a traffic lane transverse direction;
 a table frame 16 is put across said lifting device J1-J3 in a longitudinal direction;
 said block B1-B3 is put across said frame 16, which supports said block B1-B3.

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28. A protective wall movable device, a lifting device J1-J3 of claim 25, 26 or 27 is either: a foldable linkage 26, 65 incorporated between a table frame 16 and a transverse vehicle D1, D2; or an electric jack 71.

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29. A protective wall movable device, wherein said clamping device C1, C2 of claim 26 comprising: a clamp arm 35a, 35b pivoted on a transverse vehicle D1; and a connecting lever 36a, 36b pivoted on a table frame 16;
 said clamp arm 35a, 35b is openable and closable through said connecting lever 36a, 36b by actuating a lifting device J1-J3.

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30. A locking device of a traffic lane separation unit, wherein a fixing base P1-P3 having an engageable piece 42a, 42b is placed on a relocation end of said traffic lane separation unit U1-U3 of claim 1 or 2.

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31. A locking device of a traffic lane separation unit, wherein said fixing base P1-P3 of claim 30 is provided on a lane line V1, V2 of the movement end of reciprocation end of a traffic lane separation Unit U1-U3.

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32. A guide locking device of a traffic lane separation unit, wherein;

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a wheel 53 comprising a rubber wheel portion 531 and a tapered wheel portion 532 is attached to said transverse vehicle D 1 of claim 1 or 2;
 a fixing base P3 is laid on lane lines V1 and V2 where said traffic lane separation unit U1-U3 of claim 1 or 2 reciprocately moves; and
 said base P3 comprises: a rail portion 54 rollingly guiding said wheel 53; and an engageable piece 42a, 42b engaged with a clamping device C1, C2 incorporated in said unit U1 U2.

33. A guide fixing device of a traffic lane separation unit, wherein:

a wheel 55 comprising a collar wheel portion 551 and a tapered wheel portion 552 is attached to said transverse vehicle D1 of claim 1 or 2;
 a fixing base P4 is laid between lane lines V1 and 2 where a traffic lane separation unit U1-U3 of claim 1 or 2 reciprocately moves;
 a guiding rail 56 rollingly guiding said transverse vehicle D1 in a traffic lane transverse direction is formed in said base P4;
 a engageable piece 42a, 42b engaged with a clamping device C1, C2 incorporated in said unit U1, U2 is structured on lane lines V1 and V2 intersecting said guiding rail 56.

34. A guiding fixing device of a traffic lane separation unit, wherein:

a driving gear 58 is attached to said transverse vehicle D 1 of claim 1 or 2;
 a fixing base P5 is laid between lane lines V1 and V2 where a traffic lane separation unit U1-U3 of claim. 1 or 2 reciprocately moves,
 a rack rail 59 engaging said gear 58 is formed in said base P5 in a traffic lane transverse direction; and
 an engageable piece 42a, 42b for engagement with a clamping device C1, C2 incorporated in said unit U1, U2 is structured on said lane lines V1 and V2 intersecting said rail 59.

35. a guiding fixing device of a traffic lane separation unit, wherein said engageable piece 42a, 42b of claim 32, 33 or 34 is a rod, which is respectively fixed across a groove portion 41 a, 41b formed in a fixing base P1-P5.

36. A mobile traffic lane separation device, wherein:

a reversible lane section L1, L4 is formed with a converging section X1 as a front portion thereof, a lane following section Y1, and a converging section Z1 as a rear portion thereof;
 a plurality of a traffic lane separation unit U1-U4 is installed on lane lines V1 and V2 on one of

the sides of said reversible lane section L1, L4 and the other side of said reversible lane L1, L4; said unit U1-U4 comprises a protective wall movable device K1-K4, and one or more protective wall blocks B1-B3 fixedly covers said movable device K1-K4; a group of said unit U1-U4 incorporated in said lane following section Y1 is traversed from one of said lane lines V1 and V2 to the other; a group of said unit U1-U4 incorporated in said converging sections X1 and Z1 reversibly moves in alignment of a substantially kinked line, a stepped line and a linear line.

37. A mobile traffic lane separation device, wherein:

a reversible lane section L2-L4, L6a, L6b is formed with: a group of sections consisting of: a converging section X1 of a front portion thereof; a line following section Y1, Y2-Yn, Ym; and converging section Z1, Z2-Zn, Zm; a plurality of a traffic lane separation unit U1-U4 is connectedly installed on the lane line V1, V2 of one of the sides of or the other side of said reversible lane section L2-L4, L6a, L6b; said unit U1-U4 comprises: a protective wall movable device K1-K4; and one or more protective wall block B1-B3 fixedly covering said movable device K1-K4; said reversible line section L2-L4, L6a, L6b is reversibly movable in multi-steps.

38. A mobile traffic lane separation device, wherein:

said unit U4 of the front portion of said converging section X1 of claim 36 or 37 is connected to one of: a rear end of a central divider N1; a rear end of a central divider H1, in which the vicinity of vehicle flowing part for grade intersections A1 of a lower road section is moved to the other side; and a protective wall block B2 which is fixed on a rear end of a road central line wherein the vicinity of a vehicle flowing part for grade intersections A1 of a lower road section is moved to the other side.

39. A mobile traffic lane separation device, wherein:

a unit U4 of the tail portion of said tapered slope portion Z1, Z2-Zn of claim 36 or 37 is connected to one of: a fore end of a central divider N2 separating the lanes of a road upper section; a fore end of a central divider T2, wherein the vicinity of a vehicle flowing part for grade intersections A2 of a upper road section is moved to the other side; and a protective wall block B2, which is fixed on a fore end of a road central line

wherein the vicinity of the vehicle glowing part for the grade intersections A2.

40. A mobile traffic lane separation device, wherein:

said unit U4 of the front part of said converging section X1 of claim 36 or 37 is connected to a rear end of a central divider Na dualing an exit and an entrance from the main lines of an interchanges; a unit 4 of the tail part of converging section Z1; Z2-Zn, is connected to the fore end of a central divider N3 dualing main lines of a road upper section.

41. A mobile traffic lane separation device, wherein
said unit U4 of the tail part is connected to the front part of central divider Na dualing an exit and an entrance from main lines of interchanges;

a unit U4 of the front part of a converging section Z1, Z2-Zm is connected to a rear end of a central divider N1 dualing main lines in road lower section.

42. A mobile traffic lane separation device, wherein:

a road following section Ha is formed at the front part of said converging section X1 of claim 36 or 37; a traffic lane separation unit U1-U4 is connectedly installed on lane lines V1 and V2 of a reversible line section Ra comprising said road following section Ha and said converging section X1.

43. A mobile traffic lane separation device, wherein:

a road following section Tb is formed at a tail portion of said converging section Z1-Zn of claim 36 or 37; a traffic lane separation unit U1-U4 is connectedly installed on lane lines V1 and V2 of a reversible line section Rb comprising said road following section Tb and said converging section Z1-Zn.

44. A mobile traffic lane separation device, wherein:

a reversible line section L5a is formed with a converging section Za of a tail section thereof and a lane following section Ta of the tail section thereof; a traffic lane separation unit U1-U4 is connectedly installed on lane lines V1 and V2 of said reversible lane section L5a; said units U1-U4 comprising: a protective wall movable device K1-K4; one or more protective wall block B1-B3 fixedly covering said movable device K1-K4;

said unit U4 of a front part of said converging section Za is connected to a rear end of a central divider N1 dualing a road lower section;
 a group of said unit U1-U4 installed in said road following section Ta traversed from one of said lane lines V1 and V2 to the other;
 a group of said unit U1-U4 installed in said converging sections Za so that it reversibly moves in alignment of a substantially kinked line, a stepped line and a linear line.

45. A mobile traffic lane separation device, wherein:

a reversible line section L5b is formed with a road following section Ha of the most front part thereof and a converging section Xa of a front part thereof;
 a traffic lane separation unit U1-U4 is connectedly installed on lane lines V1 and V2 in said reversible line section L5b;
 said unit U1-U4 comprises: a protective wall movable device K1-K4; and one or more protective wall block B1-B3 fixedly covering said movable device K1-K4;
 said unit U4 of a tail end of said converging section Xa is connected to a front end of a central divider N3 dualing a road upper section;
 a group of said unit U1-U4 installed in said road following section Ha traversed from one of said lane lines V1 and V2 to the other;
 a group of said unit U1-U4 installed in said converging sections Xa so that it reversibly moves in alignment of a substantially kinked line, a stepped line and a linear line.

46. A mobile traffic lane separation unit, wherein:

said reversible line section L5a is formed proximity to the directly front of a vehicle flowing part to a road lower part from a grade intersection A1;
 a plurality of a protective wall block B is installed proximity to the line of the lower section of connected traffic lane separation device Sp;
 said reversible line section L5b of claim 45 is formed proximity to the directly front of vehicle flowing part from road upper section to a grade intersection A2;
 a plurality of a protective wall block B is installed proximity to the line of the upper section of connected traffic lane separation device Sp.

47. A mobile traffic lane separation device, wherein:

a traffic lane separation unit U1, U2 having said clamping device C1, C2 is installed at a front part and a tail part of said road following section Y1, Y2-Yn, Ym, Ha, Ta, Tb of claim 36, 37, 42, 43, 44 or 45;

a fixing base P1, P2 is laid on lane lines V1 and V2 where said unit U1, U2 reciprocatingly moves;
 an engageable piece 42a, 42b engaged with said clamping device C1, C2 is formed in said base P1, P2.

48. A mobile traffic lane separation device wherein:

a traffic lane separation unit U1-U3 having said transverse vehicle D of claim 1 or 2 is installed at a front part and a tail part of said road following section Y1, Y2-Yn, Ym, Ha, Ta, Tb of claim 36, 37, 42, 43, 44 or 45;
 a fixing base P3 is laid on lane lines V1 and V2 where said unit U1-U3 reciprocatingly moves;
 said base P3 comprises: a rail portion 54, which guides said transverse vehicle D1; and an engageable piece 42a, 42b, which is engaged with said clamping device C1, C2 incorporated in said unit U1, U2.

49. A mobile traffic lane separation device, wherein:

a traffic lane separation unit U1-U3 having said transverse vehicle D1 of claim 1 or 2 is installed at a front part and a tail part of said road following section Y1, Y2-Yn, Ym, Ha, Ta, Tb of claim 36, 37, 42, 43, 44 or 45;
 a wheel 53 comprising a rubber wheel portion 531 and tapered wheel portion 532 in said transverse vehicle D1;
 a fixing base P3 is laid on lane lines V1 and V2 where said unit U1-U3 reciprocatingly moves;
 said base P3 comprising: a rail portion 54, which rollingly guides said wheel 53; and an engageable piece 42a, 42b, which is engaged with a clamping device C1, C2 incorporated in said unit U1, U2.

50. A mobile traffic lane separation device, wherein:

a traffic lane separation unit U1-U3 having said transverse vehicle D 1 of claim 1 or 2 is installed at a front part and a tail part of said road following section Y1, Y2-Yn, Ym, Ha, Ta, Tb of claim 36, 37, 42, 43, 44 or 45;
 a wheel 55 comprising collar wheel portion 551 and a tapered wheel portion 552;
 a fixing base P4 is laid between lane lines V1 and V2 where said unit U1-U3 traverses;
 a guiding rail 56 rolling a said transverse vehicle D1 in a traffic lane transverse direction is formed in said base P4;
 an engageable piece 42a, 42b, which is engaged with a clamping device C1, C2 incorporated in said unit U1, U2 is formed on lane lines V1 and V2 intersecting with said rail 56.

51. A mobile traffic lane separation device, wherein:

a traffic lane separation unit U1-U3 having said transverse vehicle D1 of claim 1 or 2 is installed at a front part and a tail part of said road following section Y1, Y2-Yn, Ym, Ha, Ta, Tb of claim 36, 37, 42, 43, 44 or 45; 5

a driving gear 57 is mounted in said transverse vehicle D1;

a fixing base P5 is laid between lane lines V1 and V2 where said unit U1-U3 transverses; 10

a rack rail 58 engaging said gear 57 is formed in said base P5 in a traffic lane transverse direction; and

an engageable piece 42a, 42b, which is engaged with a clamping device C1, C2 incorporated in said unit U1, U2 is formed on lane lines V1, V2 intersecting with said rail 58. 15

said side walls 13;

said block B1, B3 has a space 12, which opens to both fore and rear ends and the bottom of said block B1, B3.

52. A mobile traffic lane separation device, wherein: 20

in a protective wall movable device K3 of claim 36, 37, 42, 43, 44 or 45, a lifting device J1-J3 lifting and lowering said block B1-B3 is incorporated in a transverse vehicle D1 having a running device Q reciprocatingly moving in a traffic lane transverse direction; 25

and said protective wall movable device K3 drives said transverse vehicle D1 in a super slow speed.

53. A mobile traffic lane separation device, wherein:

in a protective wall movable device K1, K2 of claim 36, 37, 42, 43, 44 or 45, a transverse vehicle D1 having a running device Q reciprocatingly moving in a traffic lane transverse direction comprises: a lifting device J1-J3 lifting and lowering said block B1-B3; and a clamping device C1, C2 fixing said block B1-E3 on a road surface 11; and 30

said protective wall movable device-K3 drives said transverse vehicle D1 in a super slow speed. 35 40

54. A mobile traffic lane separation device, wherein:

in a protective wall movable device K4 of claim 36, 37, 42, 43, 44 or 45, a lifting device J1-J3 lifting and lowering said block B1-B3 is incorporated in a transverse vehicle D2 moving in a traffic lane transverse direction. 45

55. A mobile traffic lane separation device, wherein:

said protective wall block B1-B3 of said claim 36, 37, 42, 43, 44 or 45 is an integrated molded product made of concrete and comprising: opposed side walls 13, which have an installation surface to a road surface 11; and one of a top wall 14 and a barrier portion 141 formed across 50 55

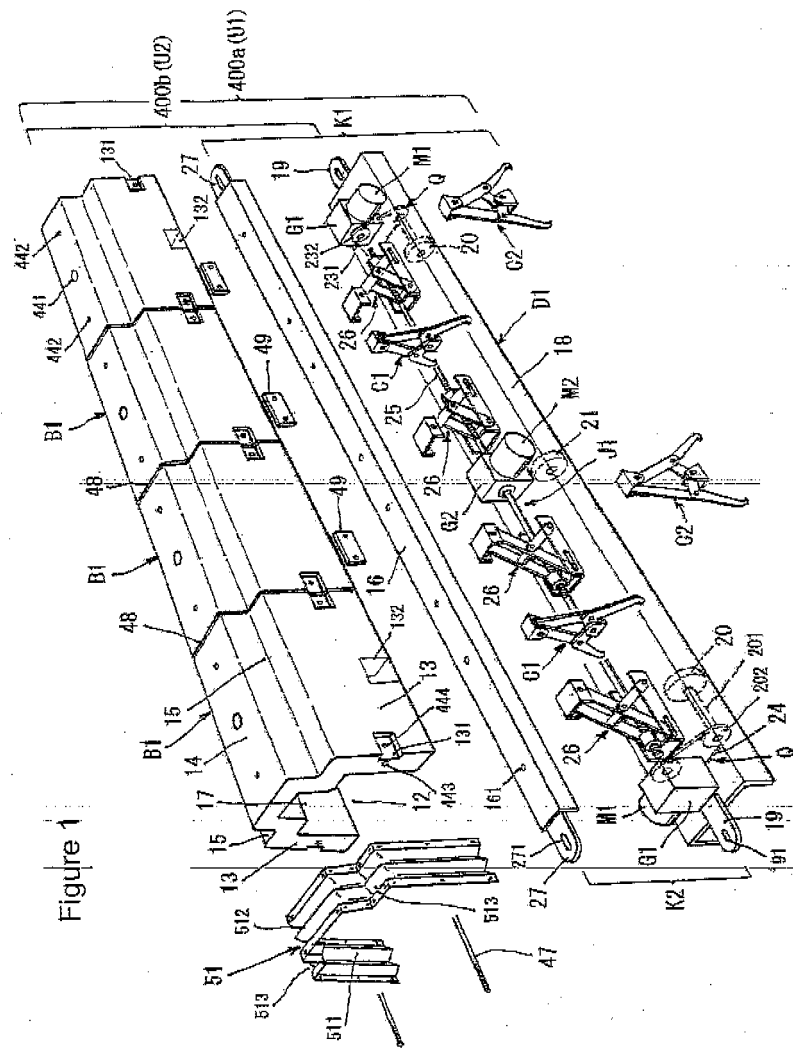


Figure 1

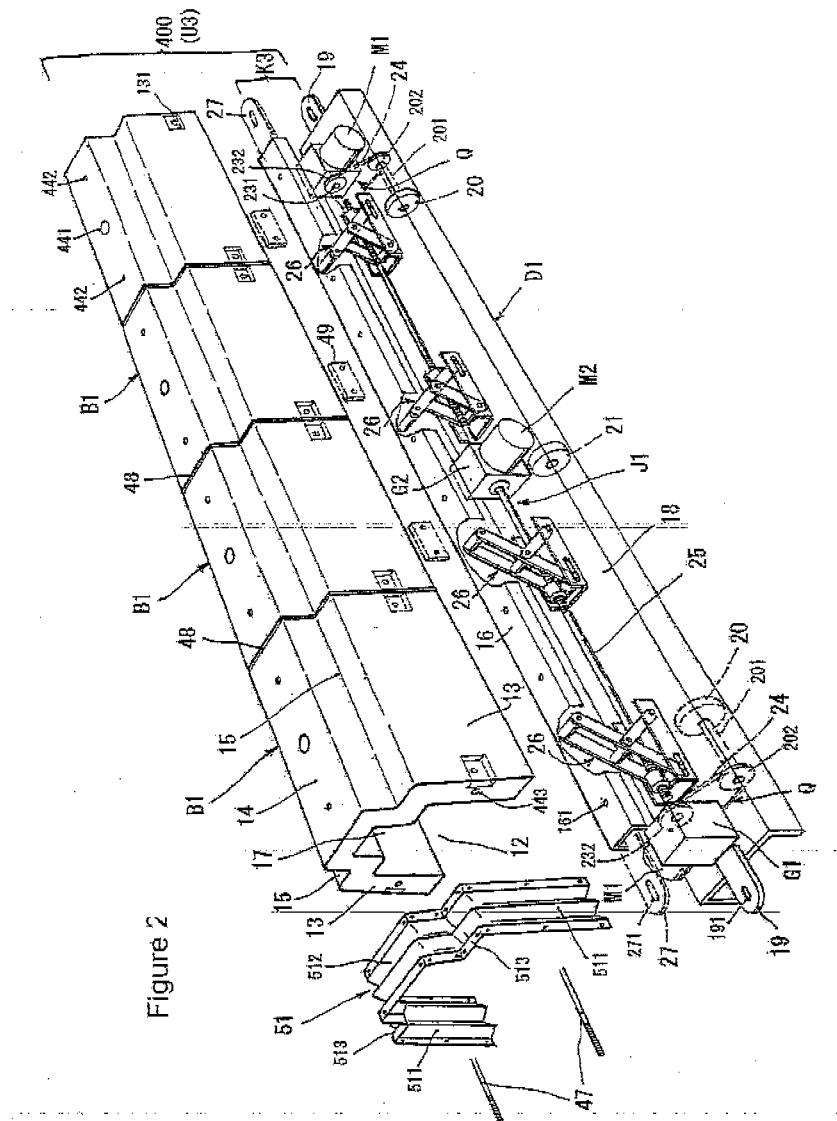
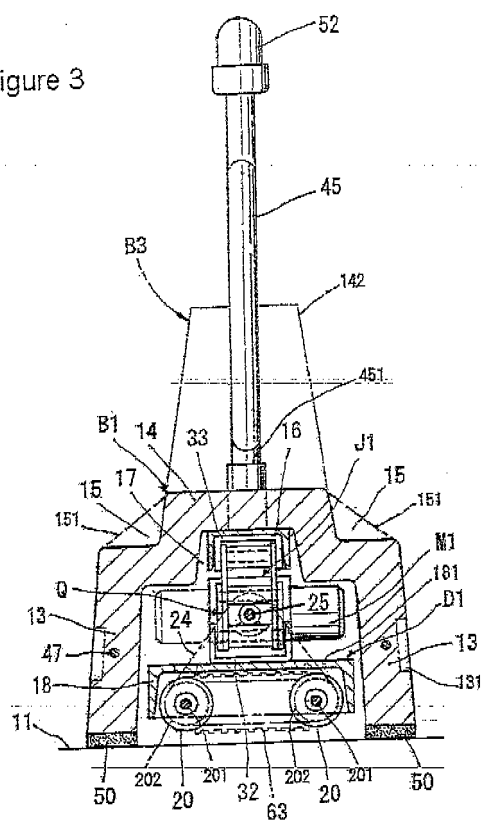
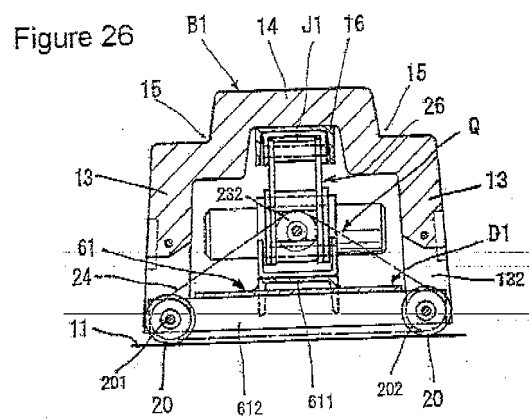
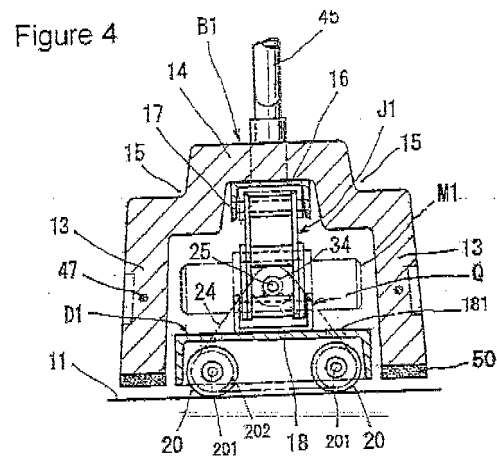


Figure 3





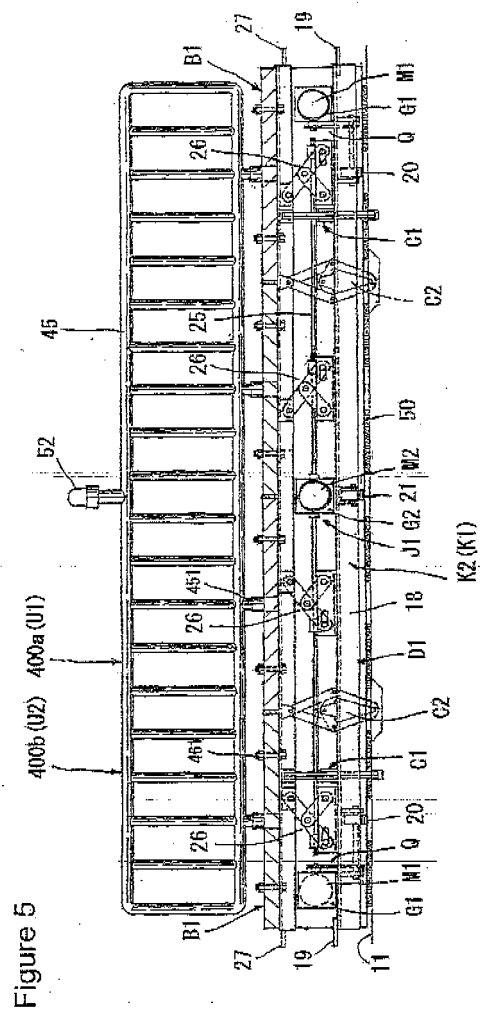


Figure 6

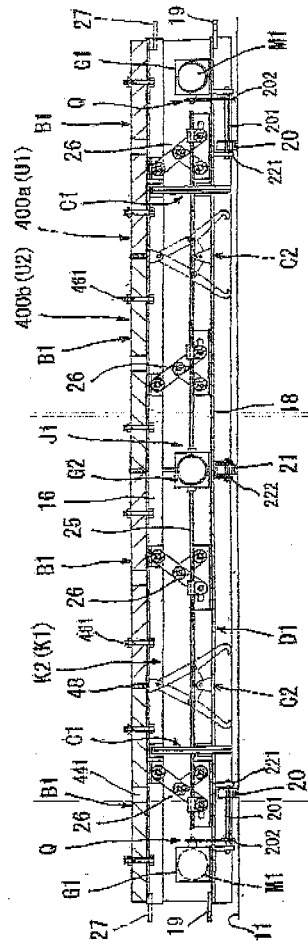


Figure 7

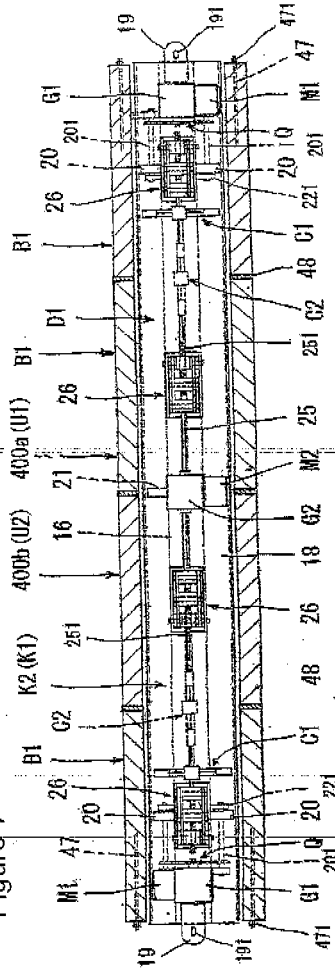


Figure 8

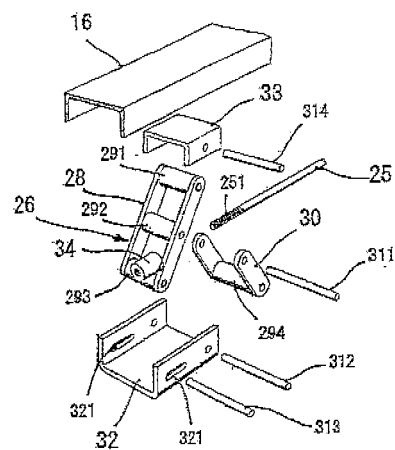


Figure 11

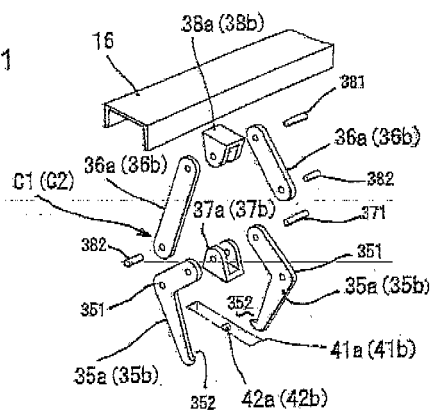


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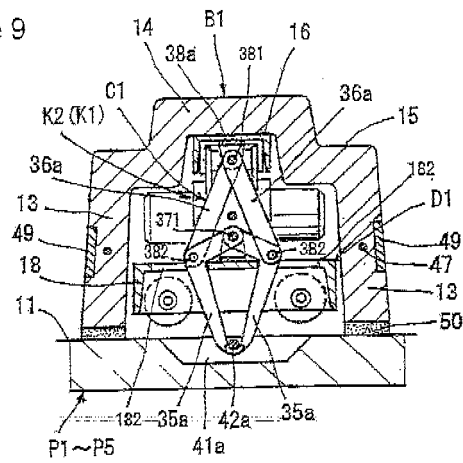
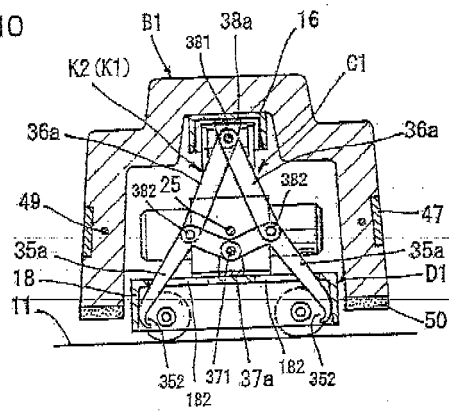


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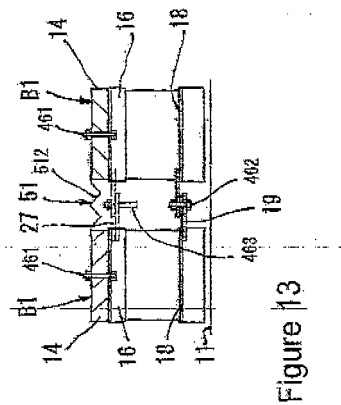
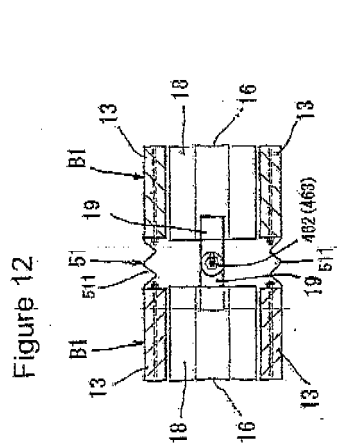
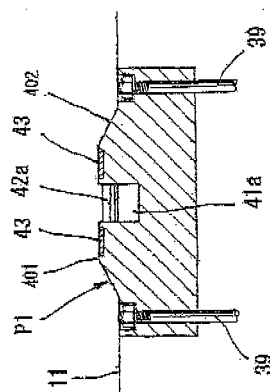
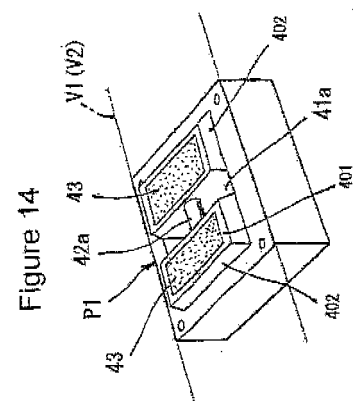


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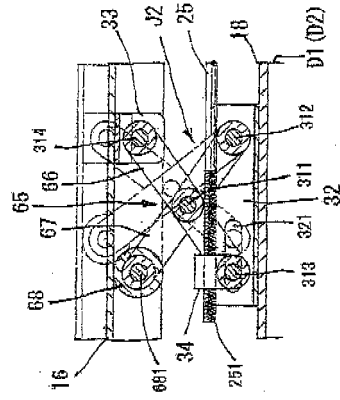


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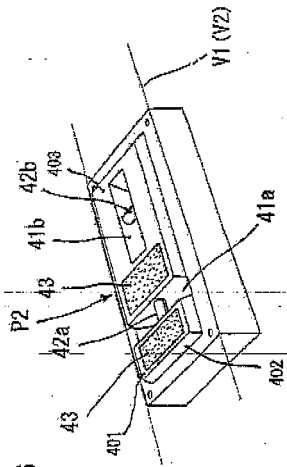


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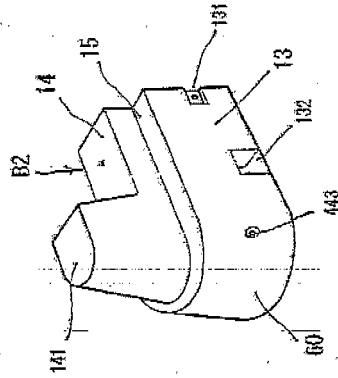


Figure 50

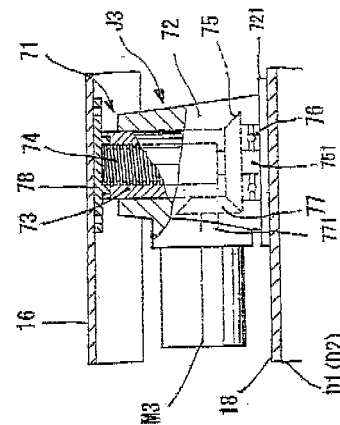


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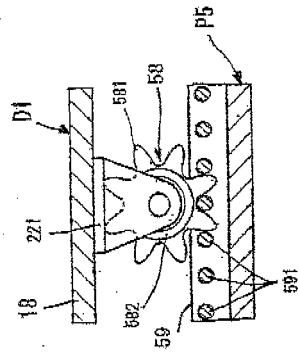


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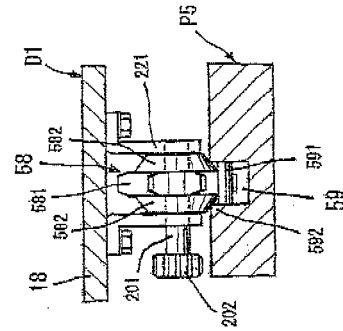


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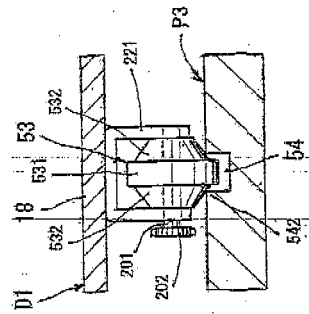


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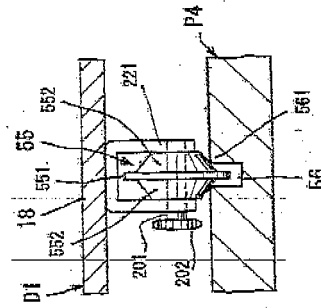


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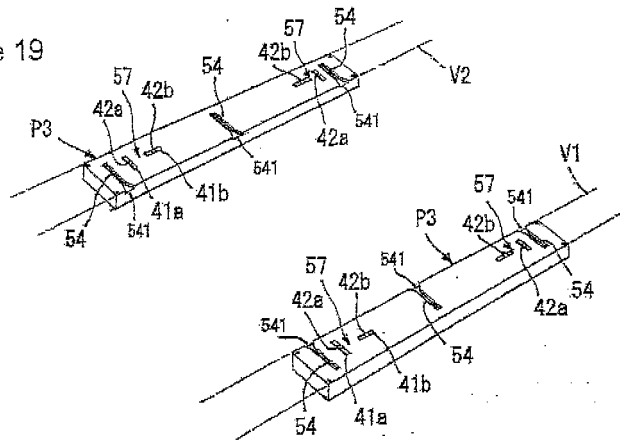


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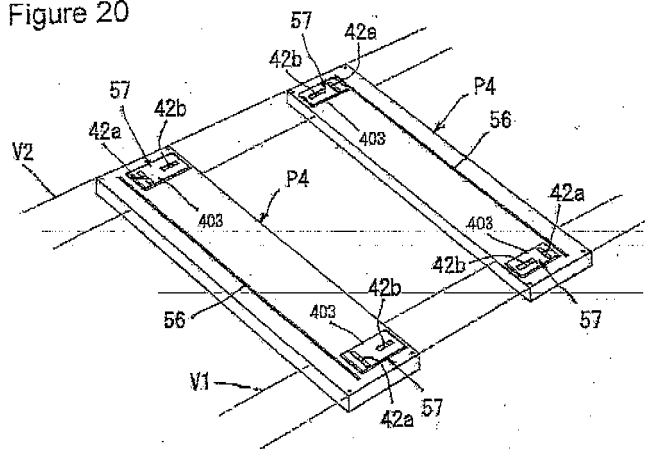


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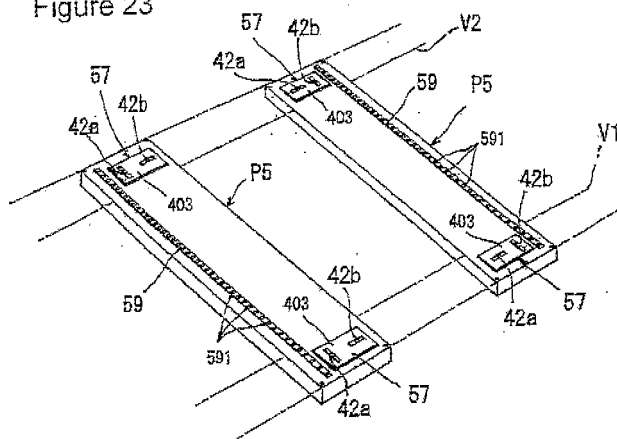


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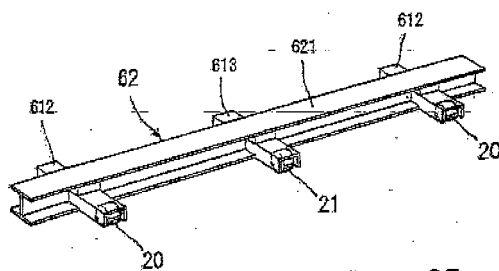
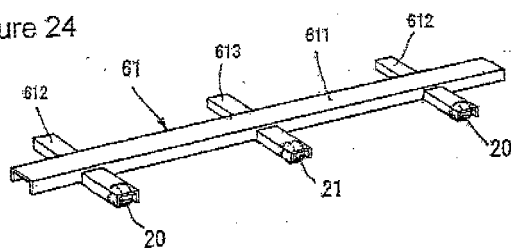
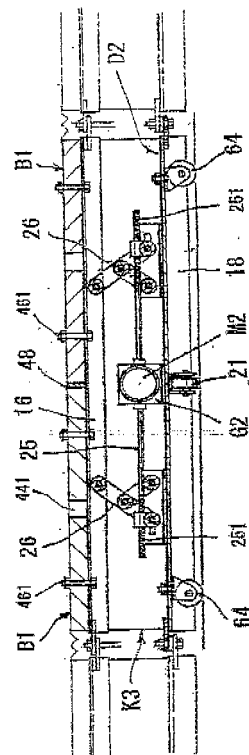
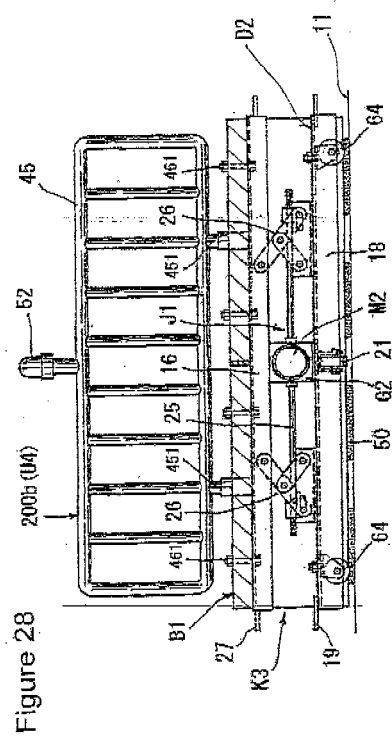


Figure 25



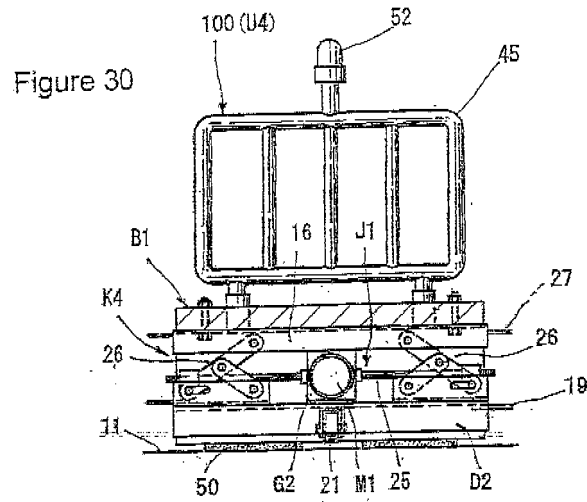


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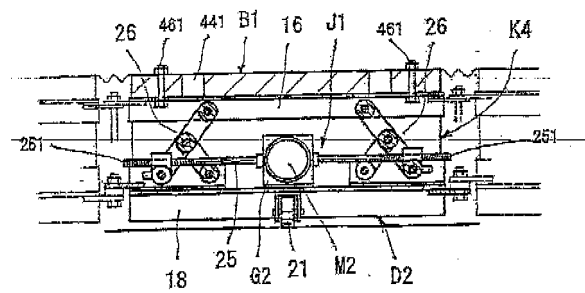


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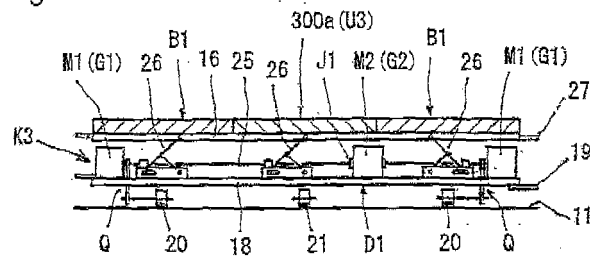
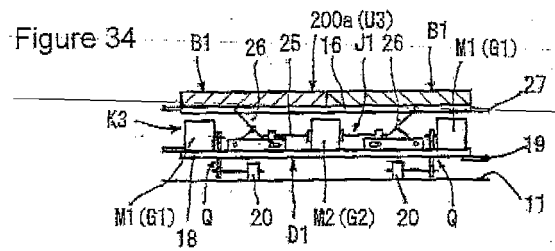
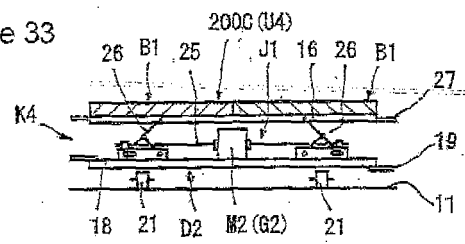
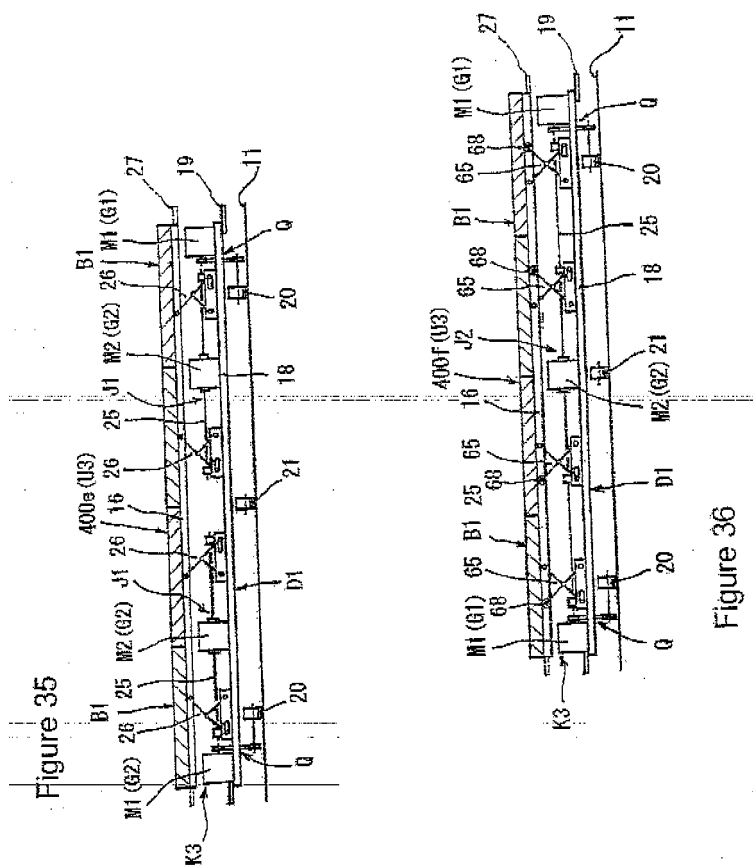
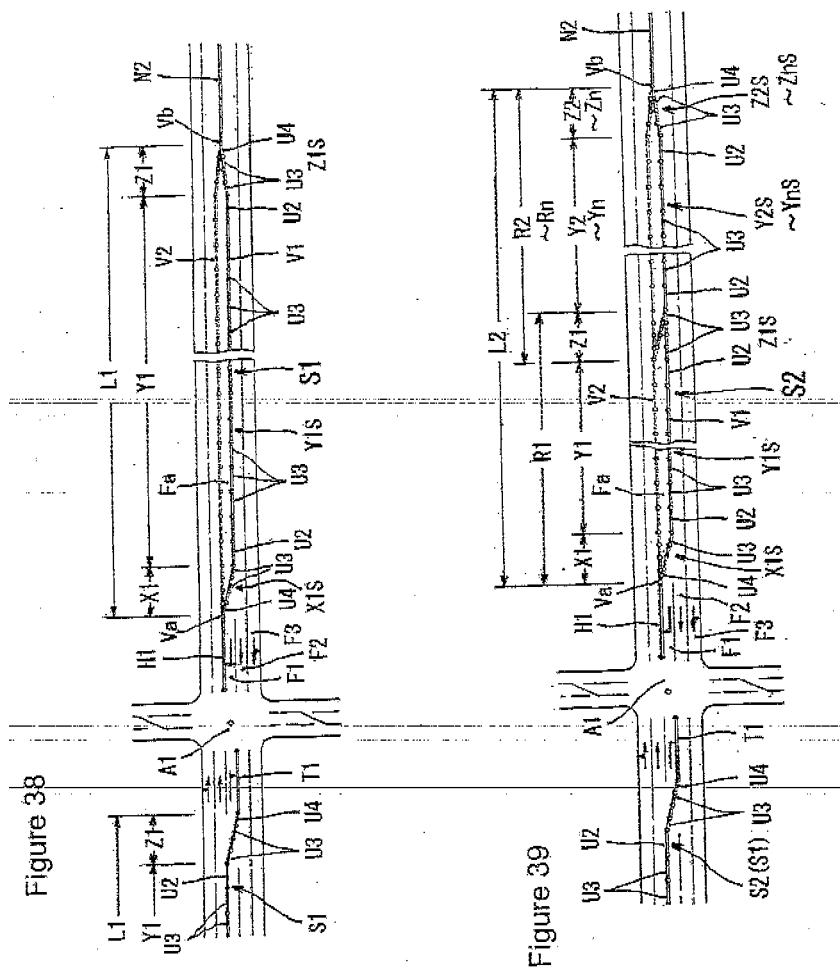


Figure 33







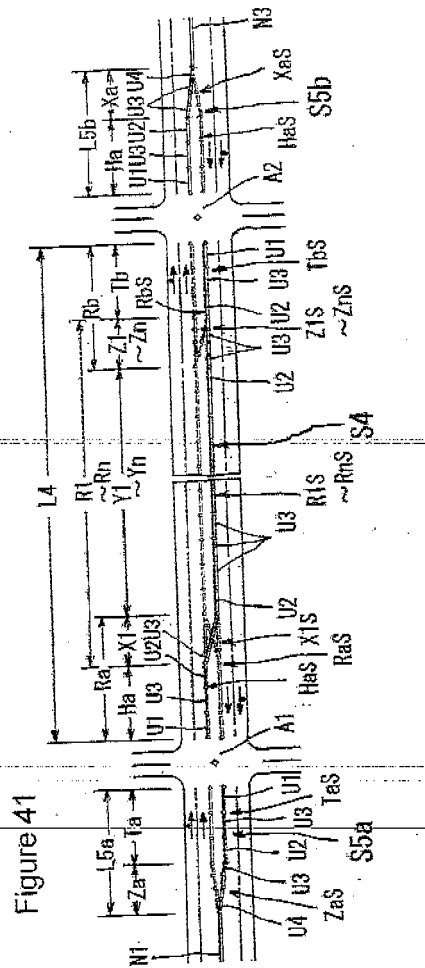
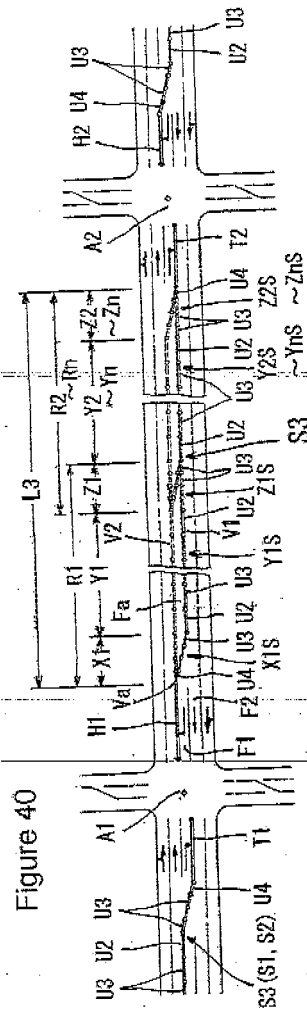
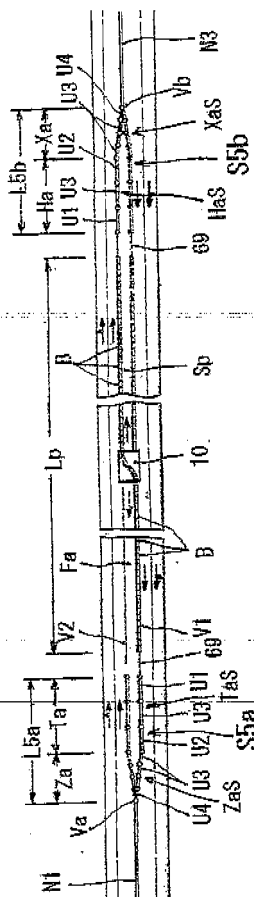
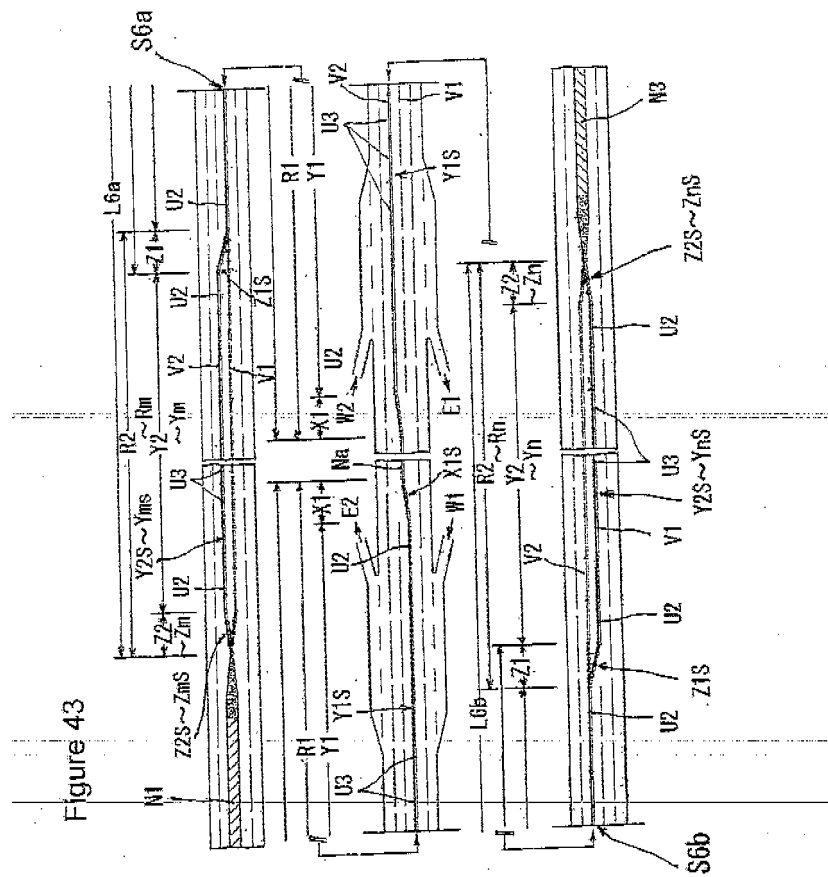


Figure 42





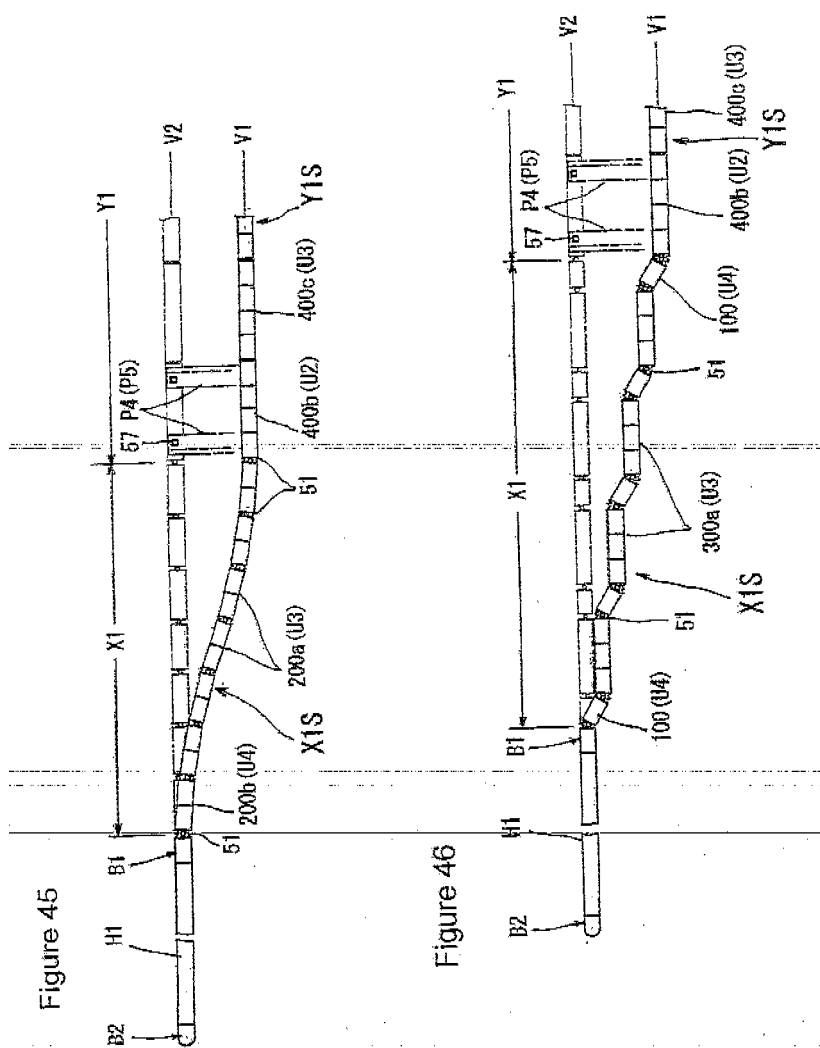


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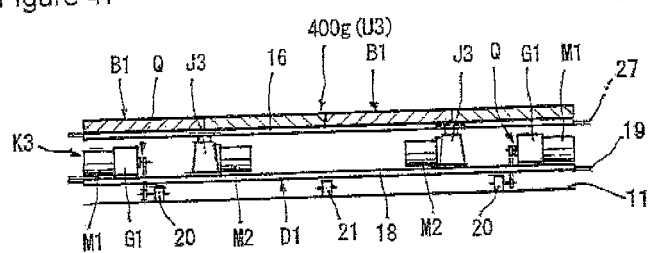


Figure 48

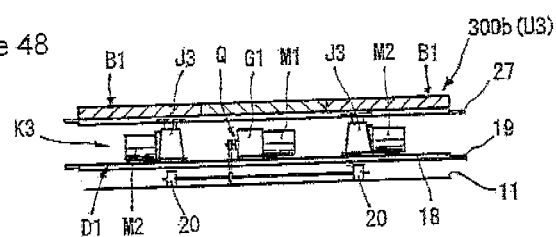
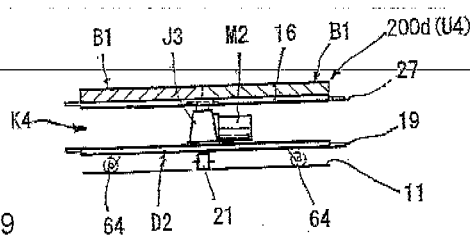


Figure 49



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/004815

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ E01F15/12		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ E01F15/00, 8/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2004 Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 8-20921 A (Nippon Raina Kabushiki Kaisha), 23 January, 1996 (23.01.96), Full text; all drawings (Family: none)	1-55
A	JP 4-228711 A (Energy Absorption Systems, Inc.), 18 August, 1992 (18.08.92), Full text; all drawings & US 5192157 A & EP 517377 A	1-55
A	JP 6-257113 A (Energy Absorption Systems, Inc.), 13 September, 1994 (13.09.94), Full text; all drawings & EP 605976 A	1-55
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 06 July, 2004 (06.07.04)		Date of mailing of the international search report 27 July, 2004 (27.07.04)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

REFERENCES CITED IN THE DESCRIPTION

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- JP H07886 A [0009]

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- Application of mobile protective fence made from concrete. **KENJI TSUIKI**. Highways and cars. Highway search committee, 01 April 2000, 25-28 [0009]
- *Moveable Medians Congestion relief on the move*, 19 July 2002, <http://www.barriersystemsinc.com/#> [0009]