

July 12, 1938.

L. S. CAIN
HIGHWAY GUARDRAIL
Filed June 8, 1936

2,123,167

2 Sheets-Sheet 1

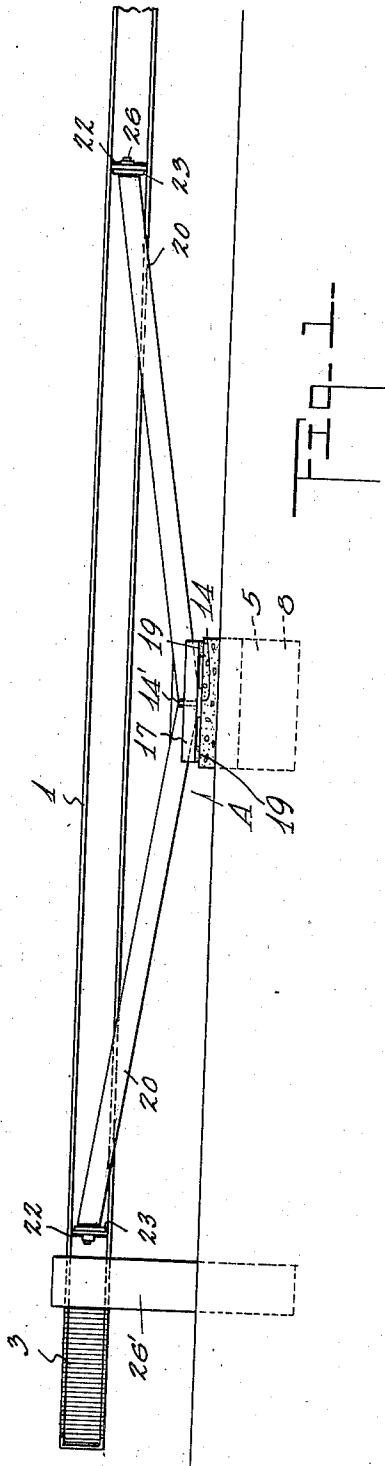
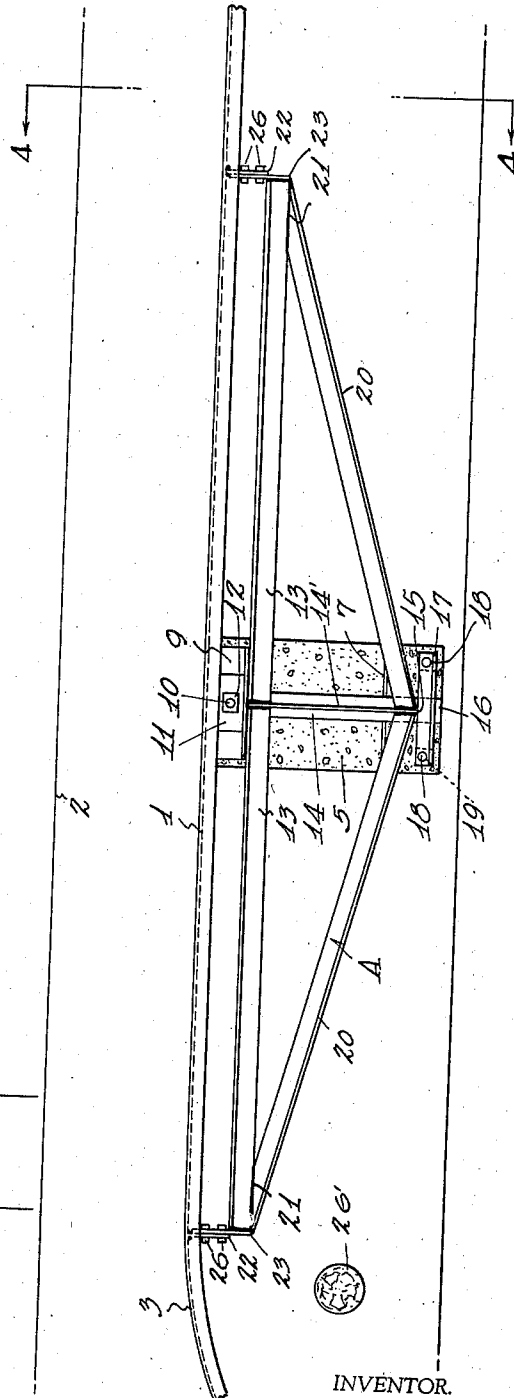


Fig. 1-



INVENTOR.

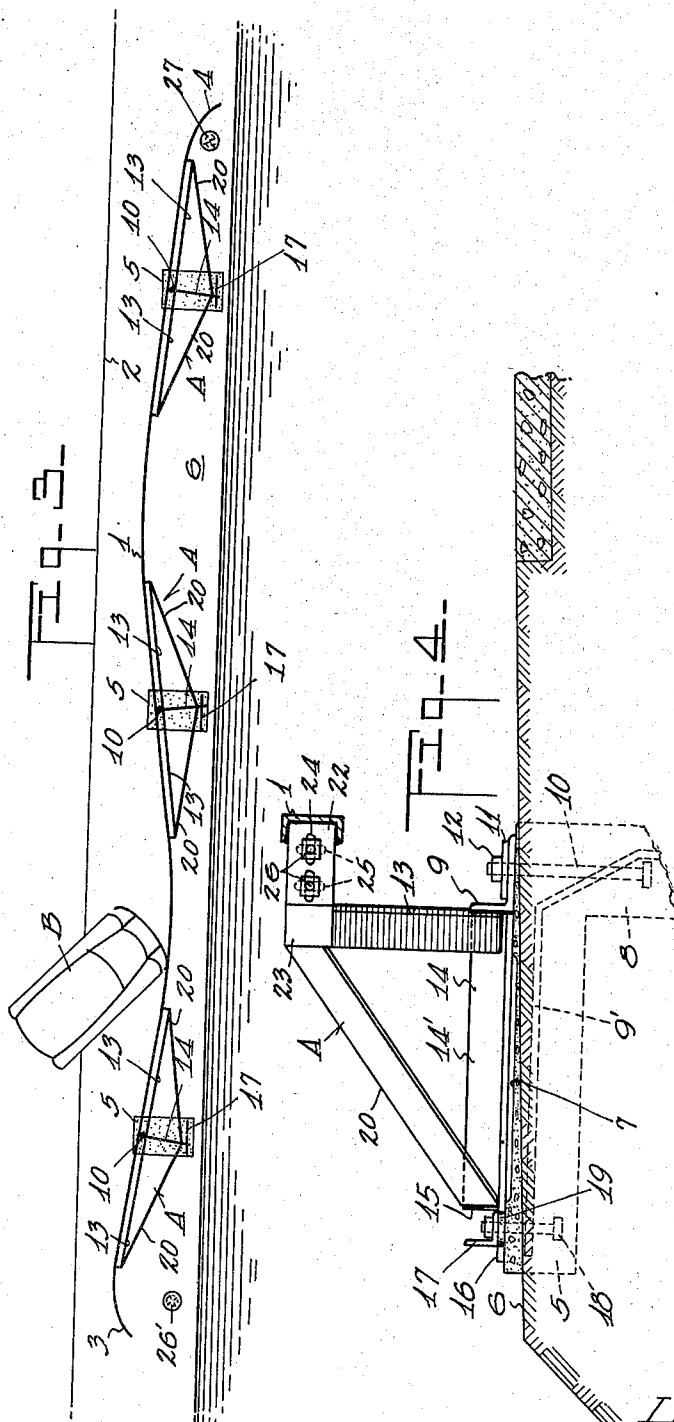
BY *LOUIS S. CAIN*
Munn, Anderson & Kiddy
ATTORNEYS.

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UNITED STATES PATENT OFFICE

2,123,167

HIGHWAY GUARDRAIL

Louis S. Cain, Honolulu, Territory of Hawaii

Application June 8, 1936, Serial No. 84,099

9 Claims. (Cl. 256—13.1)

My invention relates to improvements in highway guardrails, and it consists of the combinations, constructions and arrangements hereinafter described and claimed.

5 An object of my invention is to provide an elongated comparatively flat member, such as a channel beam, so supported that the member can flex at all points of possible impact by an impinging vehicle. The flexure exerts an approximately even force which tends to return the vehicle to the highway with a greater degree of safety than when supported by rigid or relatively rigid post supports. There is thus produced a continuously yielding barrier tending to allow a gradual rather than an abrupt stop, and to return the vehicle gradually, rather than abruptly, toward the highway.

10 The member when flexed has a tendency to return to normal position, and this will cause the member to exert a force upon the vehicle for returning it to the highway. I provide novel means for supporting the channel-shaped member at different points along its length, and this means is designed to rotate in a horizontal plane when the member is struck, and in this way the flexibility of the member is maintained, even though the member is anchored to and supported by the ground at all times. I provide a novel strut support in each of the member-supporting means, and this strut support prevents vertical movement of the member when struck by a vehicle while still permitting the member to be flexed in a horizontal plane.

15 I have found that by providing a flexible highway guardrail, a greater safety results over a rigid guard rail using the same amount of material. If the safety provided by the usual rigid or semi-rigid guardrail is sufficient, then the flexible guardrail can be made with a less amount of material while still providing the same safety, and thus reduce the cost of manufacture. In construction of my highway guardrail there are no rigid or semi-rigid supports to cause a dangerous impact when a vehicle strikes the device, or to cause a dangerous deflection of the vehicle after striking the rail. Instead, there is a continuous and nearly even yield of the guard channel carried by the device which will tend to deflect the vehicle back onto the highway. The device is simple in construction and efficient for the purposes intended.

20 Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming a part of this application, in which

Figure 1 is a rear elevation of a part of the guardrail;

Figure 2 is a top plan view of Figure 1;

Figure 3 is a schematic view illustrating the guardrail in use; and

Figure 4 is a section along the line 4—4 of Figure 2.

10 In carrying out my invention I provide a channel-shaped member 1, and this member may be of any length desired. In the schematic showing of Figure 3 the member 1 is supported by three separate supporting members indicated at A. It is obvious that the guardrail 1 may be supported by two or more of the members A if desired. In Figure 1 the member 1 is shown with the flanges of the channel facing away from the highway 2. It is possible to face the channel 1 in the opposite direction if desired, or a plain spring steel plate may be used in place of the channel 1. Figure 3 illustrates how the ends of the channel 1 are curved as at 3 and 4.

25 Since each of the supporting members A for the channel 1 is the same I will describe one of these members. Member A is shown in detail in Figures 1, 2 and 4. A concrete block 5 is imbedded in the shoulder 6 of the highway and the top of this block is provided with a recess 7, see Figure 4. Figure 4 also illustrates the front of the block as being provided with a downwardly depending portion 8. The block may be reinforced by reinforcing irons 9' if desired.

30 The support proper for the channel 1 consists of an angle iron 9 rotatably mounted on the top of the block 5 by means of a bolt 10. The bolt 10 is imbedded in the block as shown in Figure 4. A washer 11 is placed on top of the angle iron 9 and a nut 12 is threaded down onto the bolt 10 for pivotally securing the angle iron to the block 5.

35 Figure 2 shows two T irons or struts 13 welded or otherwise secured to the rear flange of the angle iron 9. These struts 13 extend upwardly at an angle from the center of the rear face of the member 9. A second T iron 14 projects rearwardly from the angle iron 9 and extends at right angles thereto. The T iron 14 is welded to the T irons 13 and also to the angle iron 9. Figure 4 shows the T iron 14 as movable over the upper surface of the block 5. The purpose of the recess 7 in the top of the block 5 is to reduce the friction between the moving T iron 14 and the block. The upwardly extending web 14' of the T iron 55

14 is cut away at 15 and the base portion 16 of the T iron extends beyond the edge 15 for a slight distance. Figure 2 shows a tail anchor 17 connected to the rear of the block 5 by bolts 18. The tail anchor 17 is an angle iron and is spaced above the top of the block by washers 19. The bolts 18 pass through the angle iron 17 and through the washers 19. The bolts are imbedded in the block 5 and therefore will hold the tail anchor in position. The washers 19 space the tail anchor above the top surface of the block 5 a sufficient distance to slidably receive the extension 16 of the T iron 14. It will be seen from this construction that the T iron 14 can swing with the angle iron 9 about the bolt 10 as a pivot, and this swinging movement is limited by the washers 19.

In addition to the struts 13 I provide T iron struts 20. These struts are welded to the T iron 14 adjacent to the edge 15 and are inclined upwardly and forwardly so that their free ends contact with the free ends of the T irons 13. The struts 13 and 20 are welded together at 21.

The channel 1 is secured to the free ends of the struts 13 and 20 by means of plates 22 and 23. Figure 2 shows the plates 22 welded to the channel iron 1 and the plates 23 welded to the ends of the struts 13. Figure 4 shows the plates 22 provided with horizontal slots 24 and the plates 23 provided with vertical slots 25. Bolts 26 are passed through these slots and connect the channel iron 1 with the member A. The horizontal and vertical slots permit adjustment between the channel iron 1 and the member A.

In Figure 3 I show a post 26' disposed adjacent to the end 3 of the channel iron 1 and the post 27 disposed adjacent to the end 4. The members A may be disposed any distance apart desired. I have found that the distance of twenty-six feet between centers of adjacent members will provide sufficient supporting means for the channel iron 1.

From the foregoing description of the various parts of the device the operation thereof may be readily understood.

In Figure 3 I show the position of the guardrail 1 in relation to the highway 2 and the shoulder 6. An automobile or vehicle indicated at B is shown striking the guardrail between two of the members A. It will be noted that these two members are swung about their pivot bolts 10 due to the flexing of the guardrail 1. The portion of the guard rail disposed between the next two adjacent members A will be flexed in the opposite direction. This will cause the member A positioned at the right-hand end of Figure 3 to swing in the manner shown about its pivot bolt 10. The posts 26' and 27 limit the extreme flexing of the guard rail 1 in the event impact occurs at these overhanging extremities.

The guardrail 1 will have a tendency to return to its normal position, and this will exert a force on the vehicle B for returning the vehicle back to the highway. The device, as shown in the drawings, is designed to withstand the impact of a vehicle weighing 3500 pounds and traveling at the rate of thirty-five miles per hour, while striking the guardrail at an angle of 30°. The members A, while permitting the guardrail to flex in a horizontal plane, will prevent longitudinal and vertical movement of the rail.

The amplitude of the horizontal movement of the rail 1 may be eighteen inches. This yield of the guardrail greatly reduces the force of

the impact, and therefore produces greater safety for the same materials as when used in a rigid construction.

The two sets of V-shaped struts 13 and 20 in the supporting member A permit the flexing of the guardrail in a horizontal plane, while preventing the longitudinal and vertical movement of the rail. One set of struts 13 are disposed in a vertical plane, and carry the stresses of tension to the ground, thus preventing a vertical movement of the guardrail. The second set of struts 20 extend back to the rear of the concrete block 5 and are connected to the anchor bolt 10 by the T iron 14. This T iron is of sufficient length to afford a proper bracing effect for the struts 20, and these struts prevent the first mentioned struts 13 from being bent backwardly when the guardrail 1 is struck by a vehicle. At the same time, however, the member A can pivot as a unit about the bolt 10. It will be noted from Figure 4 that the pivoting of the member A is substantially directly beneath the guardrail 1.

The T iron 14 has its rear end slidably held in place by the tail anchor 17. This permits the member A to turn in the direction of the greatest impact force, and thus to withstand severe shocks. The device is designed so that the bolt 10 will yield or shear before the struts 13 and 20 will buckle. It is advisable to make the anchor bolts 10 of the two end members A heavier in construction than the bolt used for the middle member. For example, the end bolts 10 may be 2¼ inches in diameter, while the same bolt for the middle member may be 1¼ inches in diameter.

The pivot action of the triangular supports for the member 1 is exaggerated in the diagram shown in Figure 3 for the purpose of illustration. This pivot action is only of use when the member 1 is struck at or near the points of the support 26. There will be enough yield in the elasticity of the member and in the supporting plates 22 and 23 to permit deflection of the guardrail member 1. This flexure will rapidly decrease away from the point of impact.

While I have shown only the preferred forms of my invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A pivotal support for a highway guardrail comprising a base, a frame pivoted thereto, said frame including two inclined struts arranged in a vertical plane and forming a V, a second pair of inclined struts forming a V, the free ends of the second pair being secured to the free ends of the first pair while the apex of the second pair is spaced from the first pair, a horizontal member connecting the two apexes together, means pivotally connecting one end of the horizontal member with the base, means for limiting the swinging of the opposite end of the horizontal member, a guardrail, and means for connecting the guardrail to the free ends of the struts.

2. A pivotal support for a highway guardrail comprising a base, a frame pivoted thereto, said frame including two inclined struts arranged in a vertical plane and forming a V, a second pair of inclined struts forming a V, the free ends of the second pair being secured to the free ends of the first pair while the apex of the second pair is spaced from the first pair, a horizontal mem-

ber connecting the two apexes together, means pivotally connecting one end of the horizontal member with the base, means for limiting the swinging of the opposite end of the horizontal member, a guardrail, and means for connecting the guardrail to the free ends of the struts, said guardrail connecting means spacing the guardrail from the struts for permitting a flexing of the guardrail portion that extends between the connecting means.

3. A guardrail support comprising a base, a member having one end pivotally secured to the base, a V-shaped strut connected to the member near the pivot point, a second V-shaped strut connected to the member near its opposite end and having its free ends connected to the free ends of the first strut, means for holding the swinging end of the member against vertical movement and for limiting its movement, and means connecting the free ends of the struts to a guardrail.

4. In combination, a plurality of triangularly-shaped frames, means pivotally mounting the frames so that they will swing about the mid-points of their bases as centers, and a guardrail carried by all of the frames, said guardrail being connected to each frame at each end of the base of the frame, whereby the guardrail can flex between adjacent frames and also flex between the ends of each frame, means for limiting the flexing of the guardrail, and auxiliary means for limiting the pivoting of the frames.

5. In combination, a plurality of triangularly-shaped frames, means pivotally mounting the frames so that they will swing about the mid-points of their bases as centers, and a guardrail carried by all of the frames, said guardrail being connected to each frame at each end of the base of the frame, whereby the guardrail can flex between adjacent frames and also flex between the ends of each frame.

6. A pivotal support for a highway guardrail comprising a base, a frame pivoted thereto, said frame including two inclined struts arranged in a vertical plane and forming a V, a second pair of inclined struts forming a V, the free ends of the second pair being secured to the free ends of the first pair while the apex of the second pair

is spaced from the first pair, a horizontal member connecting the two apexes together, means pivotally connecting one end of the horizontal member with the base, a guardrail, and means for connecting the guardrail to the free ends of the struts.

7. A pivotal support for a highway guardrail comprising a base, a frame pivoted thereto, said frame including two inclined struts arranged in a vertical plane and forming a V, a second pair of inclined struts forming a V, the free ends of the second pair being secured to the free ends of the first pair while the apex of the second pair is spaced from the first pair, a horizontal member connecting the two apexes together, means pivotally connecting one end of the horizontal member with the base, a guardrail, and means for connecting the guardrail to the free ends of the struts, said guardrail connecting means spacing the guardrail from the struts for permitting a flexing of the guardrail portion that extends between the connecting means.

8. A universally flexible highway guardrail comprising an elongated metal strip, supporting frames connected to the strip at spaced distances, each frame being connected to the strip at two widely separated points, means for pivotally supporting each frame to permit the frame to swing in a horizontal position to accommodate the flexing of the strip when struck by a vehicle at a point between two adjacent frames, said strip also being designed to flex when struck by a vehicle at a point between the two connections of a single frame.

9. A universally flexible highway guardrail comprising an elongated channel-shaped metal member, frames for supporting the channel, each frame supporting the channel at two spaced points, means for pivotally supporting the frames for permitting them to freely swing in a horizontal plane when the channel is struck by a vehicle, thereby permitting the channel to flex under the impact of the vehicle, said channel being semi-rigid for flexing slightly when struck by a vehicle and then aiding in returning the vehicle to the highway by its inherent tendency to assume its normal position.

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