This invention relates to improvements in a highway barrier of the type to restrain a vehicle which may impact the barrier.

Heretofore a construction of highway barrier has been provided in which a guard rail was attached to the upper ends of relatively stiff posts. When a vehicle impacted such a barrier either the guard rail would break free of one or more of posts leaving the latter substantially upright to snag the offending vehicle, or the posts would bend at ground level and in doing so lower the guard rail so that many times the vehicle would pass over the barrier. It is accordingly the primary object of the present invention to overcome the deficiencies of such prior art highway barriers.

More specifically, an important object of the present invention is to provide a highway barrier which includes a guard rail which may be deflected laterally when impacted by a vehicle but which maintains substantially the same height while being so deflected and thereby prevents the vehicle from passing over the guard rail.

Another specific object is to provide such a highway barrier which is supported in an elevated position on relatively flexible posts individually readily bendable at ground level and freeable from connection with the guard rail when the rail is impacted by a vehicle so that the posts do not snag the vehicle.

A further object is to provide such a highway barrier in which the guard rail provides increased lateral bending strength to reduce vehicle pocketing.

Another aim is to provide such a highway barrier in which the guard rail provides increased tensile strength resulting in a more positive barrier for larger impact forces.

Another object is to provide such a highway barrier in which the guard rail presents a flat surface to contact the vehicle and thereby reduce vehicle damage.

Another object is to provide such a highway barrier which is cheaper to repair for most impact conditions.

A further aim is to provide such a highway barrier having an overall width which renders the barrier particularly advantageous for narrow median application.

Another object is to provide such a highway barrier having a configuration which renders it suitable for use without change for either median or road-side installation.

Other objects and advantages of the present invention will be apparent from the following detailed description of preferred embodiments shown in the accompanying drawings in which:

FIG. 1 is a side elevational view of an end portion of one form of highway barrier constructed in accordance with the principles of the present invention.

FIG. 2 is an enlarged fragmentary vertical transverse sectional view thereof taken on line 2—2 of FIG. 1.

FIG. 3 is a fragmentary longitudinal sectional view thereof taken on line 3—3 of FIG. 2.

FIG. 4 is a horizontal sectional view thereof taken generally on line 4—4 of FIG. 2.

FIG. 5 is a top plan view of a complete inventive highway barrier of the type shown in FIGS. 1—4, except for intermediate portions being broken out so as to illustrate the anchor means at opposite ends of the guard rail, and illustrating the condition of the barrier before impact.

FIG. 6 is a view similar to FIG. 5 but showing the barrier during impact.

FIG. 7 is another view similar to FIG. 5 and showing the barrier after impact.

FIG. 8 is a vertical transverse sectional view similar to FIG. 2 but on a reduced scale and showing the condition of the barrier immediately before impact.

FIG. 9 is a view similar to FIG. 8 but depicting the condition of the barrier during an initial phase of impact.

FIG. 10 is another view similar to FIG. 8 but depicting the condition of the barrier during an intermediate phase of impact.

FIG. 11 is another view similar to FIG. 8 but depicting the condition of the barrier after impact.

FIG. 12 is a fragmentary side elevational view of another form of highway barrier constructed according to the principles of the present invention.

FIG. 13 is a vertical transverse sectional view thereof taken on line 14—14 of FIG. 12.

FIG. 14 is a fragmentary enlarged horizontal sectional view thereof taken on line 15—15 of FIG. 13.

FIG. 15 is a fragmentary enlarged vertical sectional view thereof taken on line 15—15 of FIG. 13.

FIG. 16 is a fragmentary vertical longitudinal sectional view through a portion of a guard rail and the upper end portion of a post, constituting a third form of the present invention.

FIG. 17 is a fragmentary vertical transverse sectional view thereof taken on line 17—17 of FIG. 16.

FIG. 18 is a top plan view of a portion of a guard rail forming an element of the inventive highway barrier and showing one manner of splicing or joining two lengths of tubular guard rail.

FIG. 19 is a vertical transverse sectional view thereof taken on line 19—19 of FIG. 18.

FIG. 20 is a fragmentary enlarged sectional view of the central portion of the structure illustrated in FIG. 19.

FIG. 21 is a top plan view similar to FIG. 18 and illustrates the means for joining two lengths of tubular guard rail so as to provide an expansion joint.

FIG. 22 is a vertical transverse sectional view thereof, taken on line 22—22 of FIG. 21.

In accordance with the present invention, a highway barrier is provided which comprises a guard rail, anchor means at opposite ends thereof, and a plurality of posts arranged at intervals along the guard rail and supporting the same in an elevated position, there being no attachment between the posts and the guard rail.

FIGS. 1—11.

In the form of the invention shown in FIGS. 1—11, the highway barrier comprises an elongated continuous guard rail indicated generally at 30, anchor means at one end of the rail 30 and represented generally by the numeral 31, other anchor means arranged at the opposite end of the rail 30 and represented generally by the numeral 32 (FIGS. 5—7), and a plurality of relatively flexible upright posts arranged at intervals longitudinally along the rail 30 and supporting the same in an elevated position, each of the posts being represented by the numeral 33.

The guard rail 30 is shown as being made up of a plurality of lengths of paired channels such as 30a arranged so that their upper flanges 30b oppose each other and their lower flanges 30c similarly oppose each other and are joined together respectively, as by weldments 34 provided at intervals longitudinally of the rail. Thus the rail forms a tubular and box-like beam having its major dimension in cross section arranged vertically, as shown in FIG. 2. This arrangement provides substantially vertical and flat outer surfaces on the guard rail for contact by a vehicle.

The two anchor means 31 and 32 are similar in construction and hence only a detailed description of one, namely means 31, need be given. While both such means
may be variously constructed, the same is shown as including a tie rod 35 one end of which is suitably anchored to one end of guard rail 30 as indicated at 36 and the opposite end portion of which is shown as embedded in a deadman or block of concrete 38 buried in the ground. The level of the ground is indicated at G which may be representative of the highway surface adjacent to which the inventive barrier is disposed and running longitudinally thereof. The anchor means 31 also includes a turn-buckle 39 operatively interposed between the ends of tie rod 35 for adjusting its effective overall length.

Referring again to the construction of the guard rail 30 per se, it is given the desired length by joining a series of paired channels in any suitable manner. The mode of joining disclosed in FIG. 1 comprises welding a plate 40 on each of the four flat outer sides of the guard rail with such plates severely straddling the joint provided by the abutting rail sections. Each of the posts 33 is shown as comprising a length of I-beam of light structure as compared to the guard rail 30 so that the post can be bent relatively easily for a purpose explained infra. The lower end portion of each post 33 is shown embedded in a concrete foundation 41 located in the ground. Any other suitable mode of mounting the post may be used. Connected to the upper end of each post 33 is a saddle member 42. As best shown in FIG. 2, such saddle member 42 is an upright U-shaped member which receives the bottom portion of the guard rail 30.

The horizontal intermediate portion of the saddle member 42 is shown as having welded thereon a pair of attaching flanges 43, 44 severally having depending elements 45 which together embrace the upper end portion of the corresponding post 33. As shown in FIG. 4, a pair of bolts 45, 46 extend through aligned holes provided in the flange elements 44 and corresponding flanges of the I-beam post 33. Each of these bolts is held in operative position by a nut 46.

From the foregoing, it will be seen that the guard rail 30 is supported by the posts 33 in an elevated position without attachment therebetween and that the anchor means 31 and 32 at the opposite ends of the guard rail 30 prevent displacement of the opposite ends of such rail 30 toward each other. The spacing between the posts 33 need only be that which will prevent undue sag of the guard rail between adjacent posts. Referring now to FIGS. 5–11, it will be seen that when a vehicle (not shown) strikes or impacts the guard rail 30 intermediate its anchored ends, the rail will yield or deflect laterally, as specifically depicted in FIG. 6. In doing so, the guard rail 30 will maintain substantially its original height, as shown in FIGS. 8–11. This is achieved by the lock of attachment between the upper ends of the posts 33 and the guard rail 30, coupled with the fact that the posts 33 themselves are relatively flexible and will bend at ground level.

In the depiction of what can happen to the barrier during impact, FIG. 9 shows the attaching bolts 45 for the saddle member 42 on the upper end of a post being sheared off not only to separate the saddle member from the post but also to allow separation of the guard rail 30 and the saddle member, as depicted subsequently in FIGS. 10 and 11. In FIGS. 8–10, the arrow F represents the lateral load which operates to deflect the beam laterally and substantially horizontally.

Since the posts 33 readily bend and there is no attachment between the upper ends of these posts and the guard rail 30, the guard rail is permitted to retain its same elevated and substantially horizontal position. This maintenance of elevated position for the guard rail provides an ever-present barrier for the impacting vehicle to restrain such vehicle without pocketing the same on the barrier. In this connection, since the deflection of the guard rail 30 is gradual, as shown in FIG. 6, the impacting vehicle may be cammed along a portion of a length of the guard rail producing such deflection in this rail as the impacting forces determine. Inasmuch as the posts 30 are relatively easily bent, they will not snag the impacting vehicle but will rather bend down and allow the vehicle to pass thereover. Also, the vehicle slides along a relatively flat surface thereby minimizing damage to the vehicle and barrier.

Following impact, if the guard rail 30 has not been permanently distorted as a result of its lateral deflection, it will return substantially to its original position as shown in FIGS. 7 and 11. The barrier can be readily and economically repaired by replacing the posts 33 and saddle members 42.

FIGS. 12–15

In FIGS. 12–15 there is shown a modified construction of posts and mode of mounting the guard rail on the same. The post 53 is shown as tubular and box-like in cross section. To the lower end portion of this post 53 is suitably attached as by welding a plate 54 which runs longitudinally of the tubular or post-like guard rail 55. The upper end portion of the post 53 has suitably attached thereto as by welding a support plate 56. This plate 56 extends transversely of the guard rail 55 and projects upwardly through a transversely elongated hole or slot 58 provided in the lower wall portion of guard rail 55. The upper edge of support plate 56 is shown as being horizontal and engaging the lower or inner horizontal surface of the top wall portion of guard rail 55. The support plate 56 is shown as being somewhat wider than post 53.

It will be understood that guard rail 55 will be provided with a plurality of such openings 58 arranged at spaced intervals longitudinally thereof and that a post 53 with its support plate 56 will be provided at each of such openings. By arranging the upper end of the posts in the guard rail the vertical flat outer sides of the rail are continuous and uninterrupted by support elements.

The form of post and guard rail shown in FIGS. 12–15 operates generally in the same manner when impacted by a vehicle as previously explained in connection with the description of the form of the invention shown in FIGS. 11–17 except that the plates 56 will either be broken off from the posts 53 or will withdraw from the rail openings 58 when the rail is impacted and the posts bend.

FIGS. 16–17

Another form of post and guard rail is shown in FIGS. 16 and 17. There the post 63 is also a hollow rectangle in cross section but its upper end portion is flattened resulting in some broadening, as depicted in FIG. 17, to provide an integral support plate 64. This support plate projects upwardly through a transversely elongated opening or slot 65 provided in the bottom wall portion of a guard rail 66. The upper edge of the support plate 64 is shown as being flat and horizontal and engaging the lower and inner horizontal surface of the upper wall portion of guard rail 66 thereby to support the same.

Here again, it will also be understood that a series of openings 65 will be provided at longitudinally spaced intervals along guard rail 66 and that a post 63 with its flattened upper end portion 64 will be provided for each such opening. Also, a barrier having this rail and post construction will operate in much the same manner as described for the form shown in FIGS. 12–15 except the integral support plates 64 will likely not break off but rather withdraw from the rail openings 65 as the posts 63 are bent down.

FIGS. 18–20

A mode different from that shown in FIG. 1 for splicing together sectional lengths of guard rail is illustrated in FIGS. 18 and 19. As there shown, one guard rail section 71 is joined to another guard rail section 71, both of tubular or box-like construction in cross section as illustrated in FIG. 19, by a third tubular or box-like bridge member.
or connector 72. Member 72 has one end portion thereof arranged internally within the rail section 70 and its other end portion arranged within the other rail section 71. A pair of nut and bolt assemblies 73, 73 severally pass through aligned holes provided in the upper and lower walls of the inner member 72 and the corresponding outer rail sections 70 or 71, as shown in FIG. 20.

FIGS. 21—22

Instead of having a rigid connection between two adjacent rail sections as has just been described in connection with FIGS. 18—20, a connection between two adjacent rail sections can be provided which allows for expansion. Such an arrangement is illustrated in FIGS. 21 and 22. As there shown, a first rail section 80 is joined to a second rail section 81 by an internal bridging member 82. One end of this member 82 is fixedly connected to rail section 80 by a vertical nut and bolt assembly 83. A similar nut and bolt assembly 84 slidably connects the other rail section 81 to the member 82 but here the shank of the bolt passes through a pair of longitudinally elongated slots 85 severally provided in the upper and lower walls of the tubular or box-like bridge member 82.

In this manner the two rail sections 80 and 81 can have limited relative longitudinal movement. Such an arrangement provides a simple expansion joint.

From the foregoing, it will be seen that the present invention accomplishes the stated objects. Since modifications in the construction of the highway barrier may occur to those skilled in the art without departing from the spirit of the invention, the embodiments shown are illustrative and not limiting of the invention the scope of which is to be measured by the appended claims.

What is claimed is:

1. A highway barrier, comprising an elongated continuous tubular guard rail having side wall portions spaced closer together than upper and lower wall portions and substantially vertical and flat outer surfaces to provide a laterally deflectable box-like beam, a plurality of readily bendable upright posts of lighter structure than said guard rail arranged at intervals along said rail and supporting the same in an elevated position such that a clearance between ground level and the lower wall portion of said rail is greater than the vertical extent of said rail itself, means freely supporting said rail on said posts free of attachment therebetween, and means at opposite ends of said rail to prevent longitudinal displacement thereof, said rail when impacted by a vehicle being laterally deflectable without substantial change in height above ground level and said posts being individually readily bendable at ground level and freeable from connection with said rail to at not to snag the vehicle.

2. A highway barrier according to claim 1 wherein said means freely supporting said rail includes a saddle member on the upper end of each of said posts and receiving said rail and means securing each such member to its post.

3. A highway barrier according to claim 1 wherein said lower wall portion of said rail has a plurality of openings spaced at intervals longitudinally along said rail, said posts being arranged severally at said openings, and said means freely supporting said rail includes an upright plate on one side of each of said posts and projecting upwardly through the corresponding one of said openings and engaging the upper wall portion of said rail and means securing each such plate to its post.

4. A highway barrier according to claim 1 wherein said lower wall portion of said rail has a plurality of openings spaced at intervals longitudinally along said rail, said posts being tubular and arranged severally at said openings, and said means freely supporting said rail includes a flattened upper end portion of each post to provide a plate portion which projects upwardly through the corresponding one of said openings and engages the upper wall portion of said rail.

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