Sept. 21, 1954 E. M. WICHERT 2,689,711

BALUSTRADE

Filed Aug. 14, 1952

4 Sheets-Sheet 1

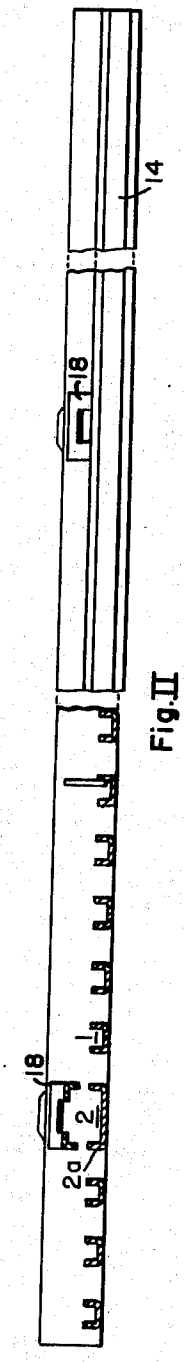


Fig. II

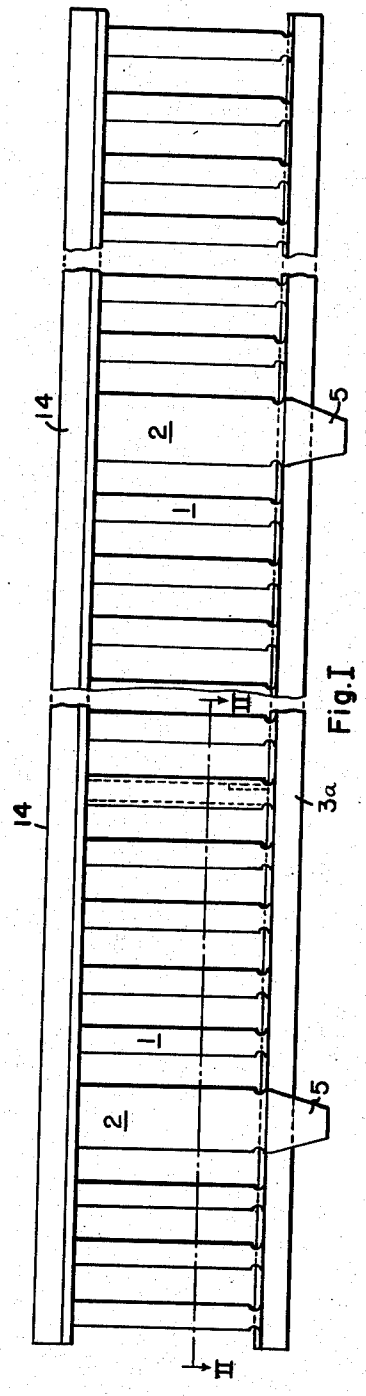


Fig. I

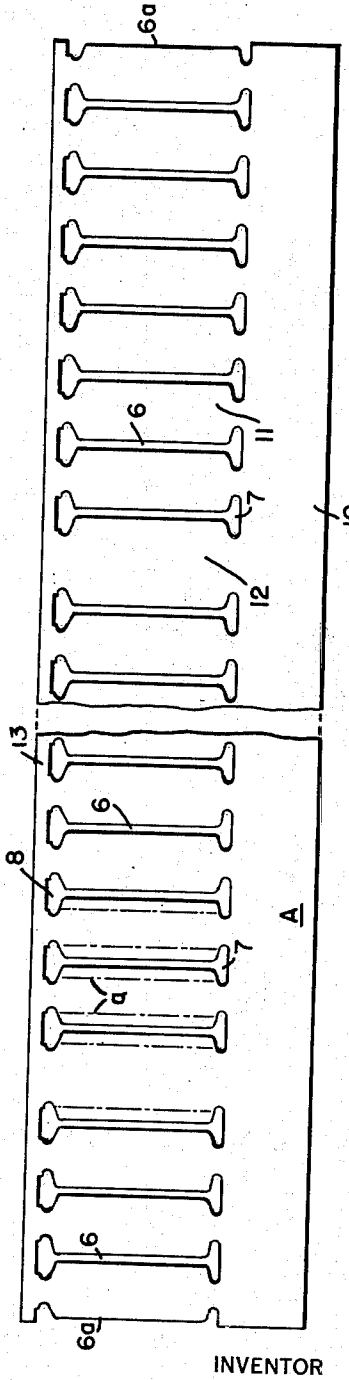


Fig. III

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BALUSTRADE

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4 Sheets-Sheet 2

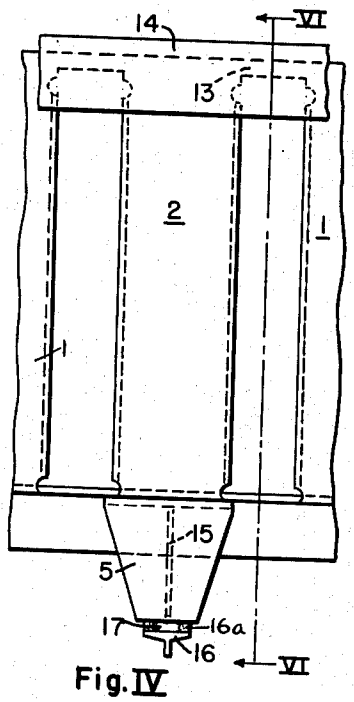


Fig. IV

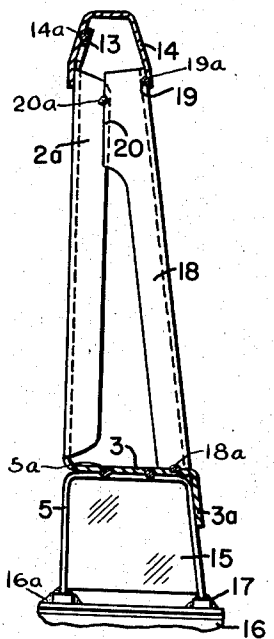


Fig. VI

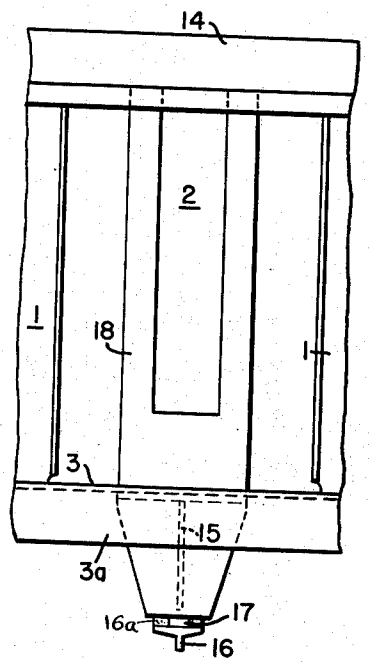


Fig. V

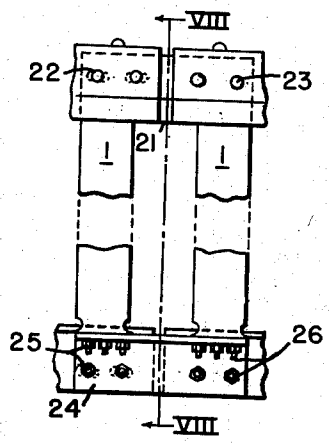


Fig. VII

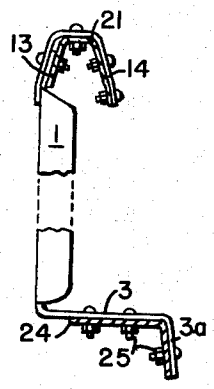


Fig. VIII

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BALUSTRADE

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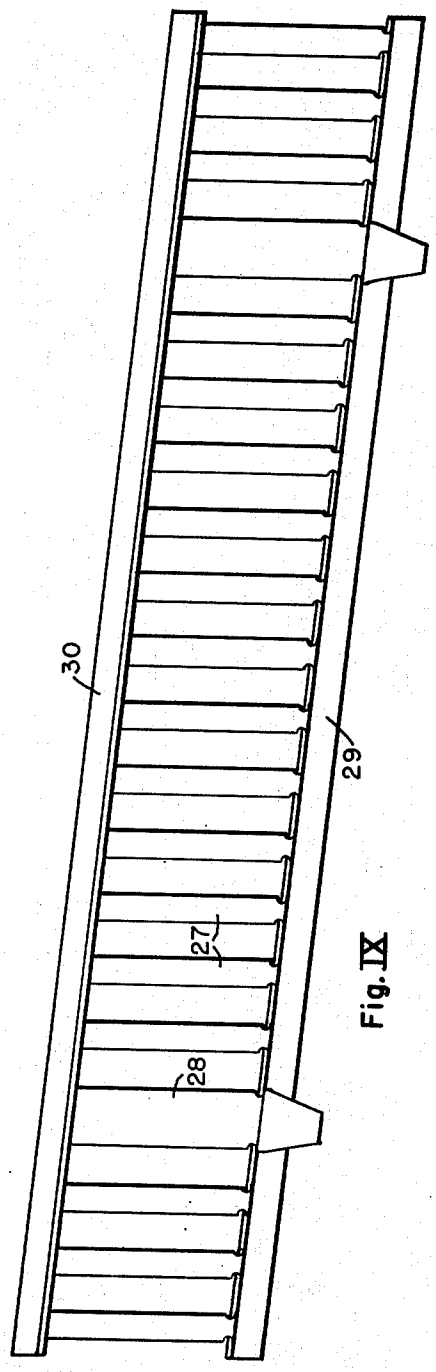


Fig. IX

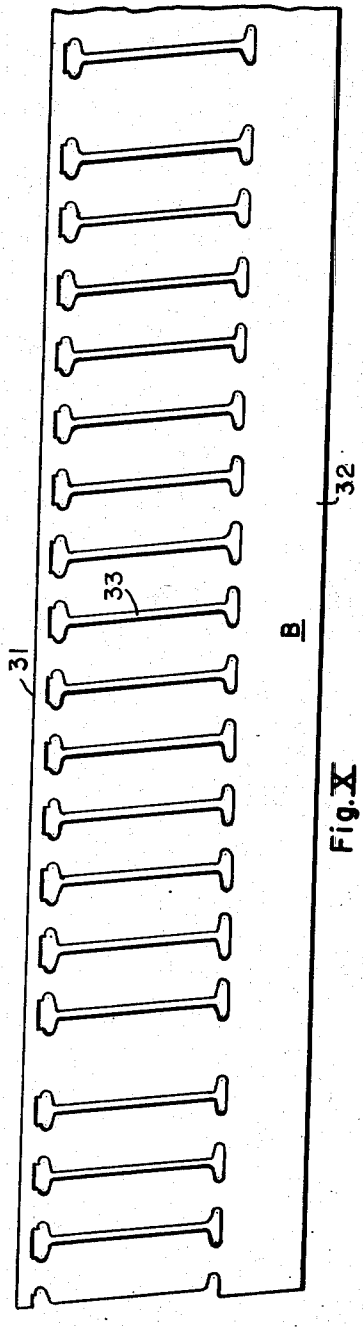


Fig. X

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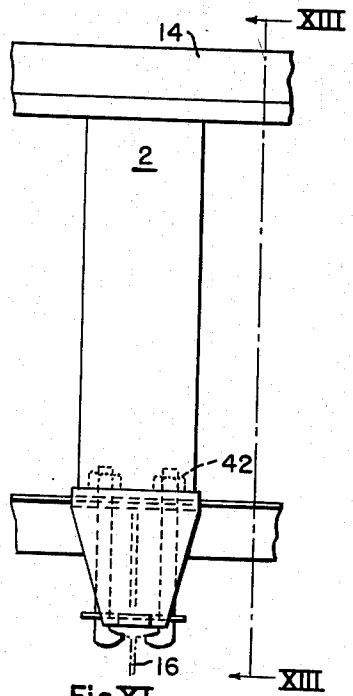


Fig. XI

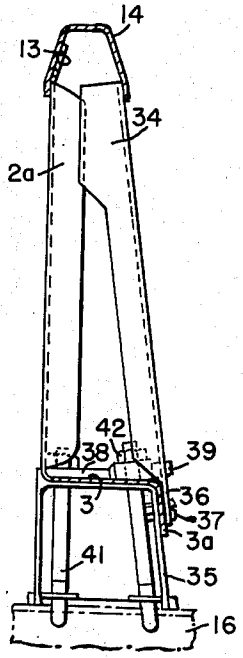


Fig. XIII

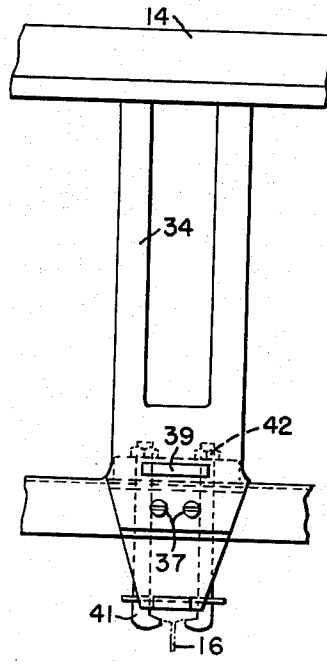


Fig. XII

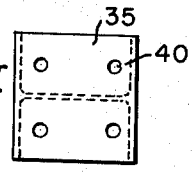


Fig. XIV

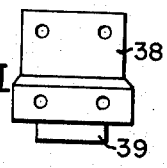


Fig. XVII

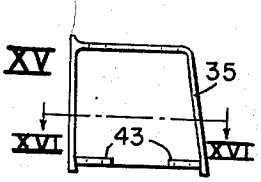


Fig. XV

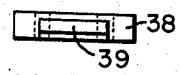


Fig. XVIII

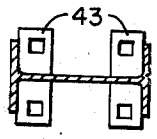


Fig. XVI

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UNITED STATES PATENT OFFICE

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BALUSTRADE

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11 Claims. (Cl. 256—21)

1

This invention relates to a formed metal guard rail, or balustrade for use in association with bridges, sidewalks, public stairways and analogous structures.

In guard rails, or balustrades, for the indicated purposes it is important to combine adequate strength and stiffness with economy in the weight of metal used and economy in manufacturing procedure. It is highly desirable that the balustrade be of pleasing appearance and particularly desirable that it present a pleasing appearance in the direction from which it is viewed closely. It is a matter of importance that the balustrade assembly should be conformable to inclined grades of the roadway which it bounds, with a minimum of complication both in installation and in manufacture. It is also a matter of importance that the balustrade assembly should be usable with simple, sturdy and effective means for mounting the assembly on standard, unspecialized structural elements such as I-beams or the like.

It is the object of my invention to provide a balustrade of the indicated sort which conforms to the above considerations.

In the accompanying drawings illustrative of the embodiment of my invention:

Fig. I is a fragmentary front elevation showing a length of the complete balustrade assembly as viewed from the inner, as for example, the bridge side of the structure.

Fig. II is a fragmentary view partly in plan and partly in horizontal section in the plane of the section line II—II, showing the assembly shown in Fig. I.

Fig. III is a fragmentary plan, or as viewed similarly to Fig. I an elevation, of the blank from which the primary element of the balustrade sections are made, showing a stage in the formation of that element.

Fig. IV is an enlarged fragmentary front elevation of the balustrade assembly viewed as in Fig. I, indicating in broken lines the formation of the upright members of the primary element and showing the position of the said primary element with its base member, or bottom rail, on a mounting structure usefully included in the ultimate assembly.

Fig. V is a fragmentary rear elevation of the balustrade, that is as viewed from a position opposite to that of Fig. IV.

Fig. VI is a vertical sectional view taken in the plane of the section line VI—VI of Fig. IV.

Fig. VII is a fragmentary front elevation showing the connection between lengths, or sections,

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of the balustrade in the region of an expansion joint therebetween.

Fig. VIII is a vertical sectional view taken in the plane of the section line VIII—VIII of Fig. VII.

Fig. IX is a front elevation of a length of the complete balustrade assembly so formed that the upright elements of the assembly stand perpendicular to a roadway made on a grade.

Fig. X shows a blank prepared for forming the primary element of a length of balustrade conformable visually to inclined mounting, this figure showing a blank which when taken as rear elevation would give when formed the arrangement of Fig. IX and which if taken as a front elevation would give the desired setting for the side of the roadway opposite that for which the balustrade section of Fig. IX is purposed.

Fig. XI is an enlarged fragmentary front elevation of a balustrade assembly which in its fundamental structure is substantially identical with a balustrade section as shown in the preceding figures of the drawings, this figure showing specialized mounting means adapted to mount the balustrade when it is composed of a metal which is not adequately susceptible to welding.

Fig. XII is a rear elevation of the structure shown in Fig. XI.

Fig. XIII is a cross-sectional view taken in the plane of the section line XIII—XIII of Fig. XI.

Fig. XIV is a plan view of the bolster which is the primary element of the mounting means for the balustrade assembly as shown in Figs. XI to XIII.

Fig. XV is a side elevation of the bolster shown in Fig. XIV.

Fig. XVI is a horizontal sectional view through the bolster taken in the plane of the section line XVI—XVI of Fig. XV.

Fig. XVII is a detail plan of the wedge used to lock the bolster of Figs. XIV to XVI to the guard rail and to supporting structure.

Fig. XVIII is an end elevation of the wedge shown in Fig. XVII.

Referring initially to Figs. I–VI inclusive of the drawings, a length of the guard rail, or balustrade, comprises a series of upright balusters which as shown are relatively narrow balusters 1 and broader balusters or posts 2, all the balusters being upright members spaced from each other longitudinally of the structure. At the lower extremities of the balusters there is a horizontal bottom rail 3 and at their upper extremities there is a horizontal top rail 14. Mounting members in the form of bolsters 5 are

secured to bottom rail 3 for mounting the balustrade on supporting structure. In accordance with my preferred practice the bolsters are shown as secured to the bottom rail by welds 5*a* in Fig. VI of the drawings.

As clearly appears in the drawings, a length of the balustrade is formed by stamping and pressing from a single sheet of metal. In Fig. III of the drawing such sheet is shown as a blank A which has been stamped out but not yet bent. As shown, the stamping, or punching, has removed from the sheet a plurality of stampings to leave a series of slots 6 having at one end lateral extensions 7 and at the other end lateral extensions 8, the latter extensions being somewhat bulbous. Above the stamped out regions of the blank there is a narrow horizontal margin 13 of uninterrupted metal and below the stamped out regions there is a wider horizontal margin 10. As the illustrated specific balustrade is made there are bodies of metal 11 between most of the slots 6, which bodies of metal are of one piece with the horizontal margins 13 and 10 of the blank. At intervals along the blank the bodies of metal 12 between slots are wider but similarly are of one piece with the horizontal margins of the blank. In Fig. III broken lines *a* indicate the bend lines along which the balusters are formed.

As appears in Fig. II of the drawings taken in conjunction with the showing of the blank A in Fig. III, the balusters 1 and 2 are of channel-shape formed by pressing rearwardly metal between the lateral extensions 7 and 8 of slots 6 parallel to the straight reaches of the slots along the bend lines *a*. This leaves the metal between bend lines as the front of each baluster, with the rearward extensions, or flanges of the baluster composed of the strips of metal bounded by the straight reaches of adjacent slots 6, the lateral extensions 7 and 8 of the slots and the bend lines *a*. The bottom rail of the length, or section, of balusters is formed by pressing the lower horizontal margin 10 of the blank rearwardly to form the horizontal bottom rail 3 of the baluster section, and pressing the rearward region of the metal downwardly to provide a terminal positioning edge flange 3*a* (Fig. VI). In many instances it is desirable that flange 3*a* forms a slightly obtuse angle with the main portion of the bottom rail base, as is shown.

At the upper end of the balustrade section the upper horizontal margin 13 of the blank stands a short distance above the upper ends of the balusters and the intervals between them. This extent of metal which is of increased depth directly above the balusters provides a flange for the attachment of a channel-shape capping 14, which is the horizontal top rail of the assembly and which desirably may be pressed from sheet metal of the same gauge as the primary structure of the balustrade section. As shown, flange 13 is bent rearwardly at an obtuse angle to conform to the specific shape of the capping. The attachment between flange 13 and capping, or top rail element, 14 can be made in any suitable manner as by welding, riveting or bolting. Particularly if the balustrade be made of steel or other metal readily susceptible to welding, welding provides the most desirable and convenient method of attachment. Welds 14*a* securing capping 14 to flange 13 are shown in Fig. VI of the drawings. The bolsters can be secured to supporting structure in any suitable manner, welding when practicable being the most desirable manner of integration.

In the assembly shown in Figs. I to VI inclusive, the balustrade section is mounted by means of bolsters 5 upon which the bottom rail 3 of the balustrade section rests with its flange 3*a* extended downwardly to the rear of the bolster and the balustrade section. Each of the bolsters 5, a plurality of which are used with each formed section, are shown in Figs. IV to VI inclusive of the drawings as of inverted U-shape and desirably are pressed or otherwise formed from sheet metal which may be of approximately the same gauge as that of the sheet from which the balusters are made. Interiorly each of the bolsters is reinforced by a web plate 15 welded or otherwise suitably secured to the outer structure of the bolster. The bolsters can be secured to supporting structure in any suitable manner, welding when practicable being the most desirable manner of integration. As shown, the bolsters are welded to the upper flange of an I-beam 16 and because of the fact that I-beams as standard structural elements vary appreciably in size and shape, a shim 17 commonly is incorporated in the weld 16*a* to insure a proper mounting level for the section. The bolsters 5 are integrated with the bottom rail 3 of the section in any suitable manner, but when the elements of the balustrade are composed of steel or other metal which readily provides a weld of good quality this integration is most desirably effected by welding, as shown in Fig. VI.

Whereas the inner or roadway side of the balusters is smooth, the outer sides of the balusters present the irregular effect caused by their channel-shape. When viewed from a distance this channel-shape of the narrow balusters is relatively unimportant. In order to improve the appearance of the broader balusters, or posts, 2 and to give additional bracing structure to which capping 14 may be secured, each of the broader balusters 2 is provided rearwardly with a cover plate 18. Such cover plates 18 are partially open channel-shape members formed from sheet metal. At their lower ends they rest upon and are welded to the upper surface of the bottom rail 3 by a weld 18*a* of the section and in their upper regions they lie within capping 14 and overlap the flanges 2*a* of the broad balusters or posts 2 in regions 19 and 20 respectively, being welded respectively to the capping and to the flanges 2*a* in those regions by welds 19*a* and 20*a*.

It will be noted that at both ends of blank A there is a half slot 6*a* stamped from the metal of the blank. This half slot 6*a* is cooperative with the next adjacent slot 6 to form the final baluster at each end of the balustrade length, or section, and to provide the proper width of interval with the adjacent baluster of the next section when the balustrade sections are brought together to provide a continuous structure of extended length.

In making an extended length of balustrade from a plurality of the balustrade lengths, or sections, most of the lengths of capping which form the rail element of the assembly and the lengths of the base member of the baluster section can be integrated into a unitary structure by welding, splice plates being desirably used as backing for the welded integration. Figs. VII and VIII of the drawings show the connection between lengths, or sections, of balustrade at points where an expansion point is desired. In making this connection a splice plate 21 shaped

in conformity with the contour of capping 14 is inserted within the capping and against the flange 13 of the one-piece baluster structure of the assembly. Splice plate 21 is then secured to the two lengths of capping which are to be joined by means of bolts 22 securing the splice plate to one capping section and bolts 23 which secure it to the other capping section. The bolt holes accommodating one or the other of these two sets of bolts are elongate to permit some relative movement between the sections under the influence of thermal expansion and contraction. Similarly an L-shaped splice plate 24 is positioned against the bottom rails 3 of two adjacent balustrade sections and is connected with these two sections respectively by means of groups of bolts 25 and 26. In this connection also the bolt holes which accommodate one set of bolts for splice plate 24 are elongate to permit limited thermal expansion and contraction of the balustrade sections.

Fig. IX shows a partial length of balustrade made with an inclination of its balusters such as to give visual compensation for an inclined mounting. It will be noted that the balusters 27 and 28 are perpendicular to the margin of the sheet of drawings and stand at an angle to the bottom rail 29 and top rail 30 of the balustrade. Fig. X indicates how this effect is obtained without change in the structure of the balustrade and without change in the relative arrangement of the members which compose the balustrade. It will be seen in this illustration of the punched blank B from which the balustrade of Fig. IX is formed that the upper margin 31 and lower margin 32 are identical in width and arrangement with the similar margins 13 and 10 shown in the blank A of Fig. III. The punched slots 33 are, however, arranged at an angle to the edges of the blank. When the balustrade is formed, the bottom rail 29 and top rail 30 can be parallel to an inclined roadway while the balusters 27 and 28 stand perpendicular to a horizontal plane. This can be done by swivelling the stamping and pressing dies of the apparatus by which the balustrade is made, without otherwise altering the process of manufacture.

Figs. XI to XVIII inclusive show a mounting for a balustrade section which is particularly appropriate for use when the balustrade is made of aluminum, aluminum alloy or a similar nonferrous metal. In the showing of Figs. XI, XII, and XIII one of the broader balusters, or posts, 2 is shown and in accordance with the best modern practice of welding it is possible satisfactorily to weld the aluminum capping which forms top rail 14 to the upper flange 13 which extends horizontally along the aluminum balustrade section. Similarly the upper region of a backing plate 34 of modified form can be welded in its upper region to capping, or top rail, 14 and to the flanges 2a of post 2. For mounting the balustrade section, however, it is desirable to avoid electrolytic action between a bolster made of aluminum or between the baluster section proper and the bolster by utilizing means of attachment other than welding to integrate the elements of the assembly.

As shown in the above noted figures of the drawings, bottom rail 3 of the balustrade section rests upon a bolster 35 which is an aluminum casting. Backing plate 34 is extended downwardly to provide a skirt 36 which lies rearwardly of flange 3a of bottom rail 3 and is secured to the skirt and to the bolster by bolts 37. A wedge 38 rests upon bottom rail 3 of the balustrade section and has a rearward projection 39 extended through a slot in backing plate 34. Bottom rail 3, wedge 38, and the upper structure of bolster 35 are provided with a plurality of bolt holes 40 through which are extended a plurality of hooked bolts 41 having at their upper ends nuts 42 by which the terminal hooks of the bolts may be caused to bear upwardly on the flanges of I-beam 16. Further to stabilize the structure, bolts 41 also pass through openings in ears 43 at the base of bolsters 35. Desirably washers are interposed between both the base 35 and I-beam 16 and also between the terminal hooks of bolts 41 and the structure of the I-beam.

This assembly as illustrated in Figs. XI to XVIII inclusive is exemplary of various means which may be used firmly to mount the balustrade on supporting structure by giving a firm bolted or clamped engagement between the balustrade and such structure.

Whereas various mounting means for the balustrade may be used and various modifications in the specific form of the balustrade itself may be made, the balustrade proper must, in accordance with my invention, consist of one or more lengths or sections of one-piece baluster structure which comprises the balusters themselves stamped and pressed in spaced relation to each other, a continuous bottom rail and a continuous upper marginal region. Each such extended length of the assembly is made by stamping and pressing a one-piece sheet of metal to give a balustrade which is of great strength with respect to the weight of metal incorporated in it and which is made by a relatively simple process. Each section of the primary balustrade section desirably is so formed that it matches with similar sections to both sides thereof to form a balustrade of uniform structure. Desirably also the balustrade sections are so provided with capping structure formed of or carried by the continuous upper marginal region of each one-piece structure as to provide a continuous top rail for the balustrade. Further, each of the one-piece lengths of the balustrade is so formed that it is readily adapted to the use of the various mounting structures which have been noted as well as to the addition of suitable rail-forming capping.

I claim as my invention:

1. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member.

2. A vertically disposed fence section as set forth in claim 1 and at least one supporting bolster, said laterally extending base member being operatively connected to said bolster.

3. A vertically disposed fence section as set forth in claim 1 and at least one supporting bolster, said laterally extending base member being operatively connected to said bolster by a weld.

4. A vertically disposed fence section as set forth in claim 1 and at least one supporting bolster, said laterally extending base member being operatively connected to said bolster by bolts.

5. The structure defined in claim 2 wherein said balusters are provided with flanges and said brace member is provided with flanges, the flanges of said brace member being connected to the flanges of a baluster by a weld, and said base member being connected to said base member by a weld.

6. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member and at least one supporting bolster, said laterally extending base member being operatively connected to said bolster, said bolster comprising an inverted U-shaped member with an interior web plate, said web plate extending in a plane at right angles to the plane of said laterally extending base member.

7. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member, said top rail being connected to said upper marginal portion by a weld and being connected to the upper portion of said brace member by a weld.

8. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member, at least one of said balusters being broader than the remaining balusters so as to form a post, said post and brace member being disposed on said laterally extending base and above said bolster.

9. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member, said balusters extending at right angles to said top rail and said base member.

10. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member, said balusters extending vertically and said top rail and base member being parallel but extending in a plane at an angle to a true horizontal plane.

11. A vertically disposed fence section comprising a balustrade having slots therein defining vertically arranged balusters, said balustrade having a continuous, longitudinally extending upper marginal portion, said balustrade having also a lower longitudinally extending marginal portion, a laterally extending base member connected to said lower marginal portion, said laterally extending base member having a downturned terminal edge portion, said balusters, said upper marginal portion, said lower marginal portion, said base member, and said terminal edge portion comprising a one-piece metal structure, at least one brace member extending from said base member to a point adjacent said upper marginal portion, and a top rail capping member embracing said upper marginal portion and the top of said brace member.

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