Aug. 21, 1934. J. F. ROBB 1,970,979

UNIT SYSTEM GRADE SEPARATION STRUCTURE

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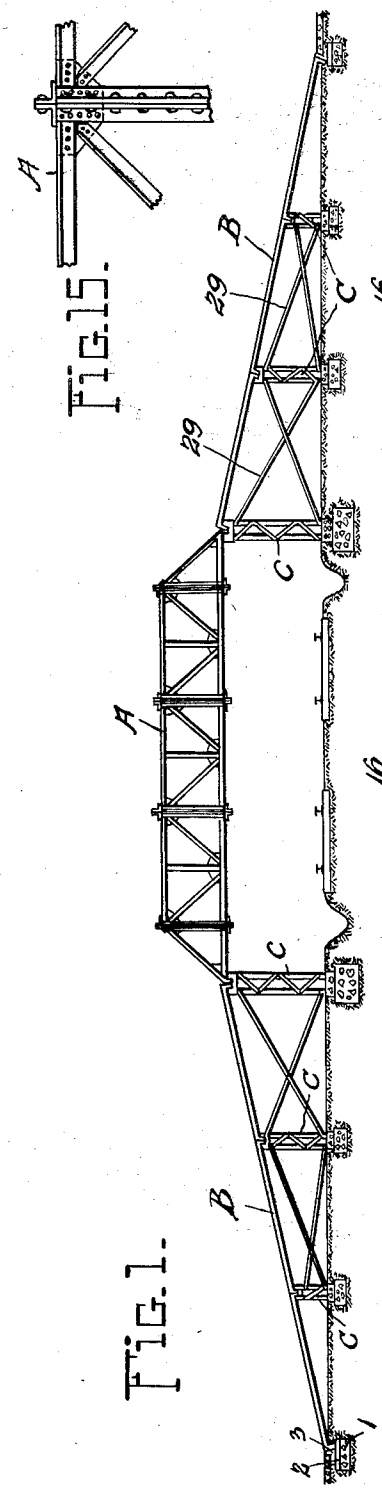


Fig. 1.

Fig. 1a.

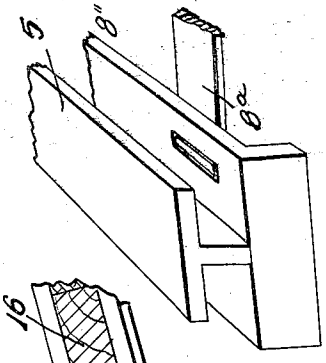


Fig. 4.

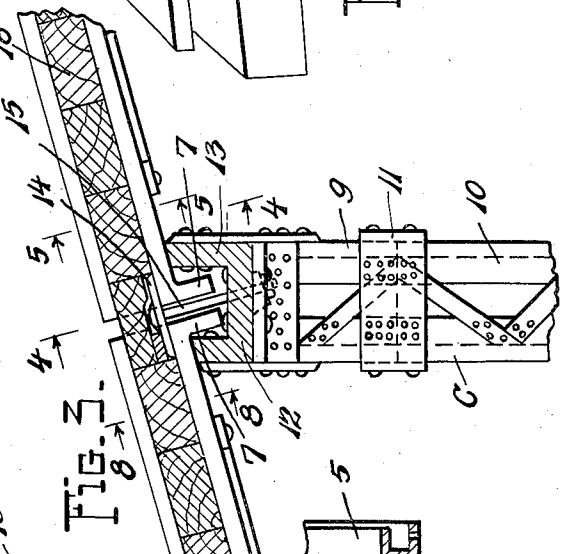


Fig. 3.

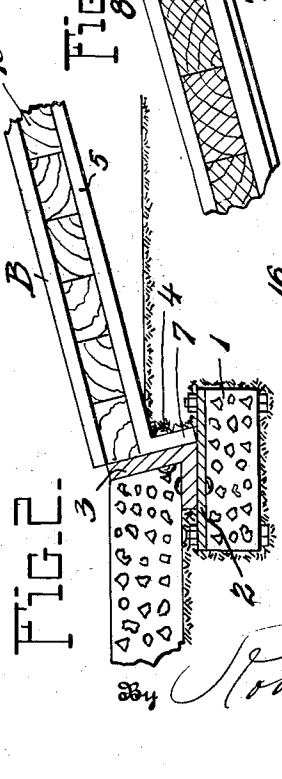


Fig. 2.

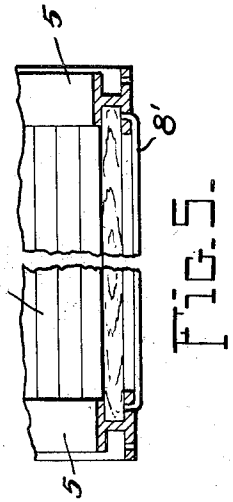


Fig. 5.

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Fig. 6.

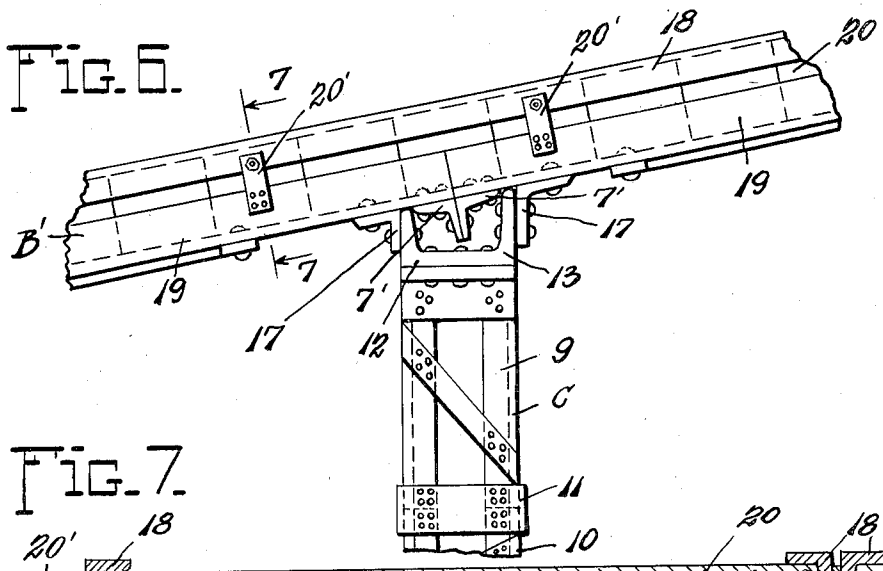


Fig. 7.

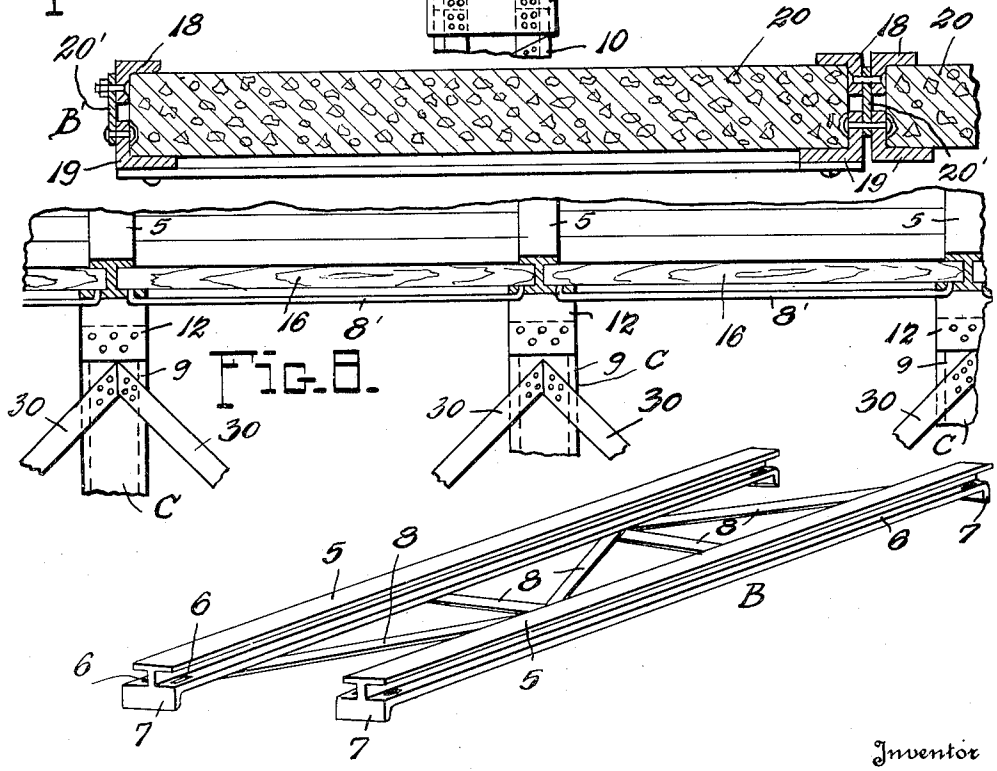


Fig. 8.

Fig. 9.

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UNIT SYSTEM GRADE SEPARATION STRUCTURE

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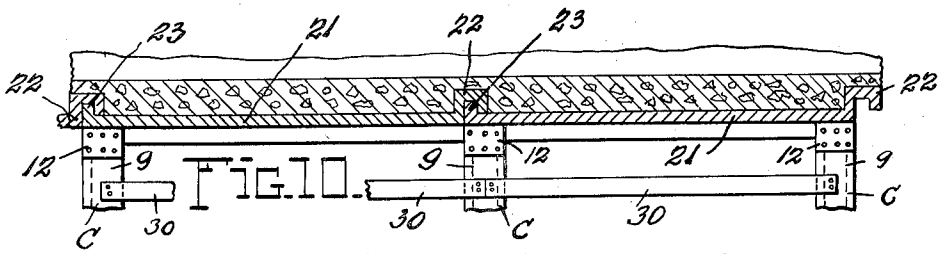


Fig. 10.

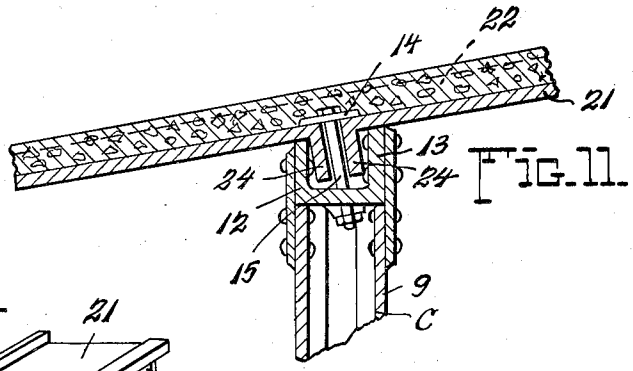


Fig. 11.

Fig. 12.

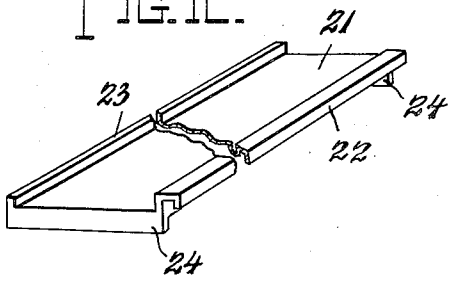


Fig. 13.

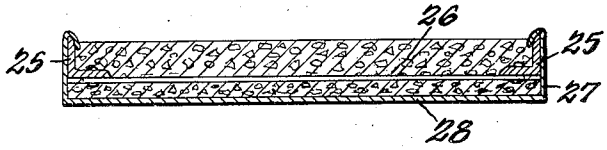
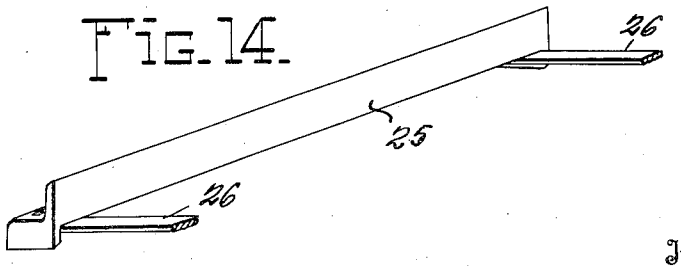


Fig. 14.



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UNITED STATES PATENT OFFICE

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UNIT SYSTEM GRADE SEPARATION STRUCTURE

John F. Robb, Cleveland Heights, Ohio

Application April 9, 1930, Serial No. 442,943

10 Claims. (Cl. 14—1)

The great number of accidents, resulting in deaths and injuries, which are happening throughout the country, due to collisions between railroad trains, vehicles, and pedestrians, at railroad grade crossings, and at road intersections, present a problem of grade separation that has not been successfully dealt with up to the present time.

Heretofore recourse has been had to what is known as grade separation primarily in connection with railroad grade crossings, the separation usually involving a considerable amount of engineering and special engineering construction in order that the railway tracks may be raised above the grade of vehicle travel, or the grade of the vehicle travel elevated above the railroad tracks.

It is quite evident that grade separation is becoming more and more necessary as a solution of the problems of railroad accidents, and also as a solution of the problems of collision of vehicles at busy traffic intersections of roads. Realizing that it would be practically impossible to build grade separation constructions all over the country pursuing the present plan of construction involving expensive special designs of grade separation improvements, I contemplate proceeding in a somewhat different manner from an engineering viewpoint, in carrying out the improvements representing the present invention. In this connection I have in mind the adoption of a standardized unit crossover system that may be employed very readily in conjunction with railroad crossovers and also adopted for the purpose of crossovers in one direction at busy intersections used primarily by automobile or vehicle traffic.

It is evident to one versed in the particular art above referred to that every grade separation must either involve tunneling or overhead bridge construction, and in the latter type of construction the primary improvement involves the erection of the approaches to the bridge or crossing structure proper.

Now in the carrying out of my invention hereinafter set forth in detail, I have in mind to design an overhead crossover construction and approaches for grade separation purposes involving a unit system. That is to say, it is known that trackage of railroads and also vehicular traffic road bases are of definite varying widths today. The clearances necessary for railroad crossovers are known. Therefore it is possible to make the crossover structure, which is of bridge-like form, of units of different predetermined sizes. Likewise the approaches to such crossover structure which are inclines, of course, may be similarly predetermined and made of units of predesigned size and structure. With the system of unit construction which I employ for my purposes of grade separation, and by reason of the unit system utilized wherein all units are constructed at the factory, and the necessary number and arrangement susceptible of being estimated in advance by simply knowing the dimensions of the trackage or road to be crossed, a tremendous saving in the building of road separations may be effected. By doing away with the need of special designing, special engineering counsel, and employment of special contractors, a great deal of the present overhead and expense of grade separation will be avoided and the movement of the public to enforce such separation will be given impetus to the end of the saving of life and limb throughout the country.

The accompanying drawings illustrate a system generally embodying my invention, though of course in detail so far as formation of structural units and the like may be concerned, modification of such details is clearly within the purview of the invention.

Figure 1 is a view in elevation of a unit system grade separation structure involving approaches and a bridge structure. This grade separation structure is illustrated as extending over railroad tracks but it might just as easily be used as a crossover of concrete or other type of road.

Figure 2 is a sectional view showing the anchorage means for the first inclined unit of the approach structure.

Figure 3 is a sectional view, and fragmentary showing, of a column having a special interlocking head with which units of the inclined approach connect and by which ends of said units are supported and attached to the column.

Figure 4 is a fragmentary view of the end portion of one of the side members of an approach unit, taken on the line 4—4 of Figure 3.

Figure 5 is a fragmentary sectional perspective view showing the side members at one of the approach units and the manner of mounting the road base in this instance made up of boards interlocked with said side members, the view being taken on the line 5—5 of Figure 3.

Figure 6 is a view similar to Figure 3 but illustrating a modified type of construction, using entirely standard angles and channels.

Figure 7 is a sectional view of the road base construction as contemplated by Figure 6, the view being taken on the line 7—7 of Figure 6.

Figure 8 is a view similar to Figure 5 but showing the mounting of the approach units side by side establishing separate traffic channels or roadways and bringing out also the manner of supporting the sides of the units upon the columns, the view being taken on the line 8—8 of Figure 3.

Figure 9 is a perspective view of one of the approach units.

Figure 10 is a transverse sectional view similar to Figure 8 but indicating a different type of road base structure wherein the approach units are interlocking plates and wherein the road base itself is made up of concrete deposited upon said plates.

Figure 11 is a section view longitudinal of the approach unit structure of Figure 10.

Figure 12 is a perpsective view of one of the approach units used for the construction of Figures 10 and 11.

Figure 13 illustrates another type of construction of approach or base unit indicating how concrete may be emplaced by suspending on the sides of the unit loops carrying temporary mold plates.

Figure 14 is a view of one of the sides of a unit such as shown in Figure 13.

Figure 15 is a fragmentary view of the connection of the units of the cross-over structure.

This application is directed primarily to the construction of my system of interlocking units to form the approaches to a crossover structure such as a bridge, and also involves the construction of units for the crossover itself. The grade separation structure of my invention comprises primarily the crossover structure or bridge A as shown in Figure 1, the approaches B, illustrated also in the same figure, and column structures C. The crossover structure A is contemplated to comprise interlocking sections united in a special manner but not forming the subject matter of the present invention. The approach structures or inclines B are made up of units of definite size both as to length and width, these units assembled in interlocked relation in the field, and made of their predetermined shapes in the factory. The columns C are made up of units of an interlocking nature also and the amount of inclination of the approaches will preferably be determined by the use of a desired number of sections for the various columns C. The approaches B of course not only involve inclines but involve road base structures over which vehicular and other traffic may pass.

I first describe Figure 2 where the anchorage for the first inclined approach unit B is shown. This anchorage preferably includes a suitable footing of concrete designated 1 at the top of which is anchored a supporting plate 2 carrying the riveted or otherwise fastened angle plate 3, the upper edge of which is flush with the surface of the road leading to the approach B. The approach unit B is fastened to the anchorage angle plate 3 by any suitable fastening means such as rivets or bolts 4 and said approach unit includes, as best shown in Figure 9, side members 5 having opposite longitudinal channels 6 and provided at their ends with downwardly extending lugs 7. The side members 5 are connected together by truss or brace rods 8 conforming with good engineering practice so that a rigid structure is provided for the approach unit B considered as a whole. The lugs 7 are shown in Figure 2 as capable of being fastened to the angle plates 3 in getting the anchorage for the first approach unit. The approach units making up the approach B are supported in an inclined position so that necessarily they must be carried at one end or both ends by columns and I show columns C which are designed to be of sectional construction comprising an upper single section 9 and one or more other double sections 10 and single sections 9. The first column at the left in Figure 1 is a single section column. The second column is a single and double section column and the third column from the left is one made up of one double section and two single sections. The sections 9 and 10 of the columns C are designed to fit one within the other, for which purpose there are riveted or fastened on the lower end of each section, receiving plates 11, that form a sort of boss at the lower end of each section receiving the upper end of the next lower section. Each column section which forms the upper section of a column is equipped with a head section 12 riveted or otherwise fastened thereto and having the interlocking channel 13 to receive the lugs or interlocking members 7 with which the opposite ends of each approach unit are formed, see Figure 9. For fastening the approach units to the columns I may employ different means and that illustrated in Figure 3 involves the use of cap plates 14 attached to the channel head members 12 by bolts 15 in the manner quite clearly illustrated. The cap plates 14 fit over the adjacent ends of the units B just above their lugs or downwardly projecting interlocking arms 7.

Now the purpose in providing the side members 5 of the approach units with the channels 6 at opposite sides is to enable heavy road base boards to be emplaced in these channels to establish the road base over which traffic will pass. Or, if desired, a road base may be cast of concrete, the ends of the concrete slab thus cast being received and interlocked in the channels 6 so as thus to create a slab beam, so to speak, extending between the side members 5 of each unit B. The reason that opposite sides of the members 5 are formed with the channels is because these units B will be set up side by side in spaced relation and when properly spaced a series of traffic bases or roads may be established simply by placing in position the road base boards 16 or concrete slabs case in place in the manner previously suggested. In Figure 6 I provide a structure which is similar to Figure 3 in general respects excepting that the interlock between the ends of the units B' is provided by using standard angles or shapes 7' fitting into the channel heads 13 of the columns 9. The connection between the columns and the approach units is obtained in a somewhat different manner by using angles 17 of special form which are riveted to the undersides of the ends of the approach units and also riveted to the ends of the channel head 13. In Figure 7 I illustrate how, if the approach units are made up of side angles comprising upper angles 18 and lower angles 19, the said units may be so designed as to receive concrete slabs 20 precast and set properly placed in position upon the angles 19. Thereafter the upper angles 18 may be attached to the lower angles 19 by the side plates 20' and the concrete slab 20 thus held in place in an evident manner. Of course wood traffic base structure may be substituted for the concrete slabs 20 if desired and moreover, if desired, the concrete slabs 20 might be cast in place instead of pre-cast.

In line with the last mentioned thought, Figure 11 illustrates a construction somewhat like

Figure 3 but wherein the road base structure is of concrete.

Figure 10 illustrates a modified form of the invention wherein I employ flat shapes in the form of plates 21, see Figure 12 for the shape of each individual plate, and these plates 21 are equipped at one side edge with an interlocking flange 22 to overlap and receive an upwardly extending interlocking flange 23 at the adjacent edge of a plate 21 set up next thereto. In other words, each plate 21 has at its opposite side edges a U-shaped flange 22 and a straight flange 23 and the method of interlocking is quite evident, it being borne in mind moreover that each plate 21 has at its end downwardly extending interlocking flanges or lugs 24 for the same purpose as lugs 7 described with reference to Figure 3. In Figure 13 I show how approach or base units of a structure of the type I have in mind may be set up with the side members 25 connected together by the cross bars 26. Then loops 27 may be hooked on to the side members 25 and plates 28 supported by said loops preliminary to pouring concrete in place to form permanent road bed sections.

It is to be understood that the columns C will be reinforced both laterally and longitudinally of the approach structure and the crossover structure by means of diagonal truss rods 29 and 30 of predetermined lengths that may be fastened to the columns in any suitable manner according to past engineering practice. The columns will then be braced against both longitudinal and lateral stresses.

It is also clear from the foregoing that the approach units of the general approach structure B are interlocked both longitudinally and laterally with similar units that may be used alongside them depending upon the width of the grade separation structure that is being built. Likewise it is to be understood that where crossover structures A are used to extend over vehicular roads of different widths, if desired, additional columns may be employed beneath the crossover structure to help support it, assuming that municipal or state regulations in this connection are observed. Such columns are not usually permitted on railroads and hence they are omitted in the illustration of Figure 1.

It is moreover to be understood that while I have called the units B approach units, under certain conditions such units may be horizontally disposed instead of inclined, and moreover if desired, suitable railings may be applied to these units and will be supplied from the factory making the units, in proper lengths to conform with the entire unit system of my invention.

When, as shown in Figure 8, two complete approach units are disposed in spaced relation, providing a third unit space therebetween, said two complete units are connected by interlock bars 30 which may have interlocking lugs or rivets to attach them to the units each of which is like that shown in Figure 9. Or the interlock bars may be as illustrated by Figure 4 where the bar is denoted 8′ and its interlocking lugs as 8″.

There is also partially shown in Figure 15 the mode of assembling the preconstructed and fabricated cross-over units or sections. These may be just abutted and riveted while so held, or they may be carried at their bases on longitudinal interengaging rods or shaft members disposed at their ends on the columns at the upper ends of the approaches B. Provision will always be made for the supporting of the cross-over A at its ends on suitable saddles, or other members movable to permit expansion and contraction of the elements of the cross-over relatively to the end supports thereof. Such provisions are already well known and universally used in bridge engineering.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is—

1. As a new article of manufacture for purposes of a unit system for grade separation structures, a pre-constructed base unit suitable for the approach of a grade separation structure, said base unit including means whereby it may be interlockingly connected with an associated base unit and also including a structural formation whereby floor means may be united thereto by interlocking action therewith, combined with a new article of manufacture of a supporting column having means to interlock with said base unit and other base units that may be assembled in conjunction therewith.

2. In a grade separation structure of the class described, adapted to be assembled at the site of use, a plurality of base units, each unit of a like structure and complete in itself, said units being arranged side by side and end for end, together with means to interlockingly connect the units together at their sides and ends when assembled into a general grade separation structure.

3. In a grade separation structure of the class described, adapted to be assembled at the site of use, a plurality of base units, each unit of a like structure and complete in itself, said units being arranged side by side and end for end, together with means to interlockingly connect the units together at their sides and ends when assembled into a general grade separation structure, the last named means including columns, and column heads having parts to interlock with cooperating interlocking portions of the said units.

4. A grade separation structure of the class described, comprising an approach structure and a cross-over structure, the approach structure including a series of approach units in alignment, having means interlocking each unit with the other, the units being complete in themselves, and each of said units being equipped with means at its side to interlock it with other units that may be placed next adjacent thereto.

5. In a grade separation structure of the class described adapted to bridge a roadway over railroad tracks or the like, an approach structure comprising a plurality of separate pre-constructed approach units, each unit being equipped with downwardly extending lugs at each end for interlocking the unit in position, a footing for the units positioned at each side of the approach unit and adjacent the roadway to be bridged, and instrumentalities for interlocking the approach unit to the footing, the said instrumentalities comprising a supporting plate secured to the footing, an anchorage angle plate secured to the supporting plate and having its upper edge flush with the roadway surface, and means for securing the lug of the approach unit to the angle plate for locking the unit in required position.

6. In a grade separation structure of the class described, an approach structure comprising a series of separate pre-constructed units, each unit being equipped with interlocking means at its ends and sides for interlocking it with the next adjacent units at its sides and ends at the location of erection, and pre-formed supporting units for the structure under each of the said units being cooperable for allowing the erection

of the structure at any location without alteration of any of the individual units and in conformity with existing traffic regulations at that location.

7. In a grade separation structure of the class described adapted to bridge a roadway over railroad tracks and the like, an approach structure comprising a footing, a supporting plate anchored thereto, an anchorage plate secured to the supporting plate, a preconstructed approach unit secured in an inclined position upon the supporting plate and held by the anchorage plate, and preconstructed supporting members of sectional construction for maintaining the approach unit in required position.

8. In a grade separation structure of the class described adapted to bridge a roadway over railroad tracks or the like, an approach structure comprising a plurality of separate preconstructed approach units, each of which comprises spaced apart side members adapted to receive a road base, a locking lug at each end of each side member, and locking instrumentalities on each side thereof whereby each unit may be interlocked with similar units in both end to end and lateral relationships, instrumentalities holding the units against displacement, and unit column structures supporting the units to interlock therewith and unite them together.

9. In a grade separation structure of the class described adapted to bridge a roadway over railroad tracks or the like, an approach structure comprising a plurality of separate pre-constructed approach units, each unit being equipped with interlocking means at its ends, a footing for the units positioned adjacent the roadway to be bridged, instrumentalities for interlocking one of the approach units to the footing in required inclined position, and pre-constructed supporting columns of sectional construction for supporting the units in position, the sections of the supporting columns interfitting one with another to give required height, a head section on the top column section secured thereto and having an interlocking channel adapted to receive corresponding lugs of adjacent approach units, and a footing for each column.

10. In a grade separation structure of the class described adapted to bridge a roadway over railroad tracks or the like, an approach structure comprising a plurality of separate pre-constructed approach units, each unit being equipped with interlocking means at its ends, a footing for the units positioned adjacent the roadway to be bridged, instrumentalities for interlocking one of the approach units to the footing in required inclined position, and preconstructed supporting columns of sectional formation for supporting the units in position, the sections of the supporting columns having receiving plates on the lower end of each for interfitting the sections one within the other to give required height thereto, instrumentalities interlocking the columns with the approach units, and a supporting footing for each column.

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