Dec. 17, 1940. N. C. SORENSEN 2,225,186

ELEVATED HIGHWAY STRUCTURE

Filed March 17, 1939 2 Sheets-Sheet 1

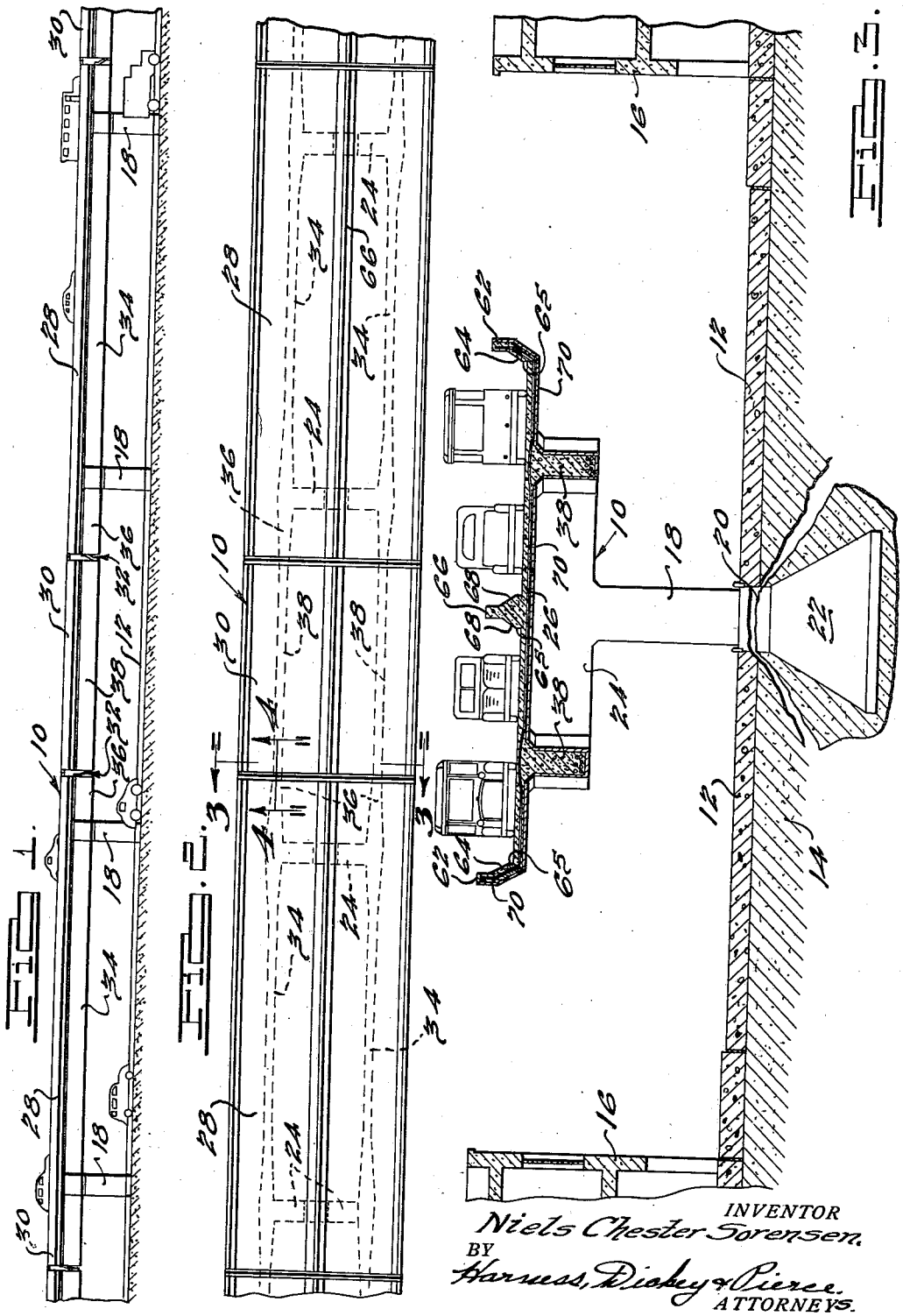


Fig. 1.

Fig. 2.

Fig. 3.

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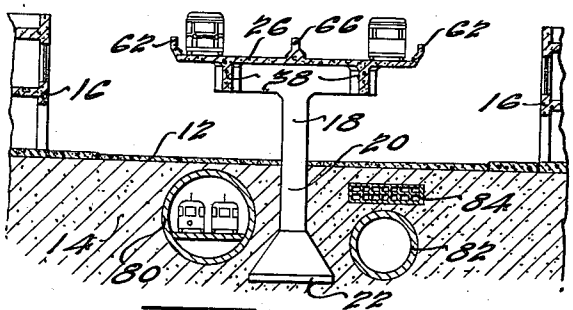


FIG. 7.

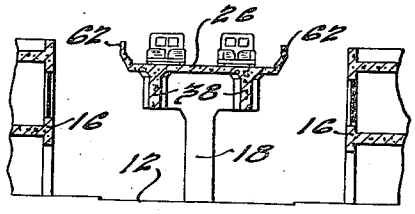


FIG. 8.

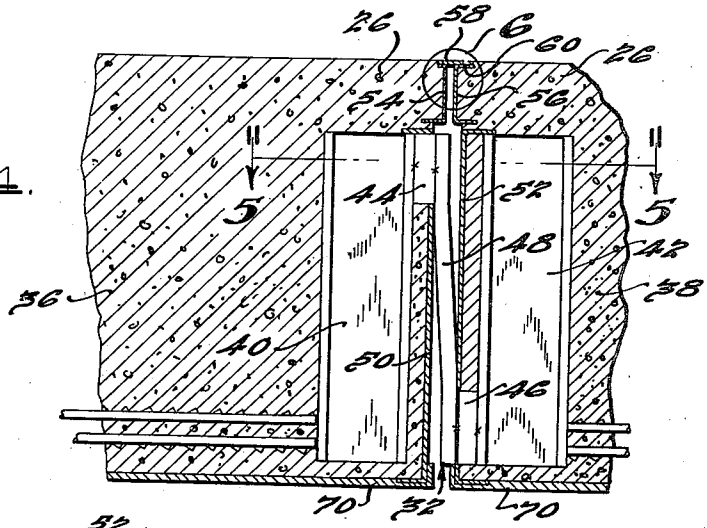


FIG. 4.

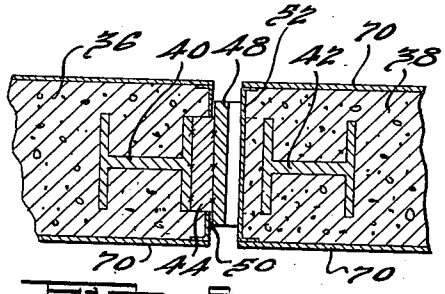


FIG. 5.

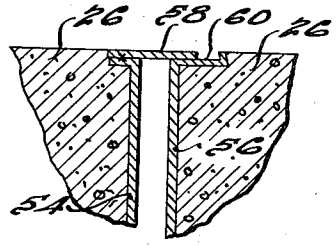


FIG. 6.

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2,225,186

ELEVATED HIGHWAY STRUCTURE

Niels Chester Sorensen, Detroit, Mich.

Application March 17, 1939, Serial No. 262,455

3 Claims. (Cl. 94—1)

This invention relates to highways and particularly relates to improvements in overhead highways.

One of the primary objects of the present invention is to provide improved overhead highway constructions which separate fast from slow traffic and make possible rights of way with no intersections.

A further object of the invention is to provide an improved overhead highway construction which causes a minimum of interference with traffic on the ground level highway and also with underground service structures, such as subways, sewers, cable tunnels, and the like.

Another object of the invention is to provide an improved overhead highway construction which prevents headon collisions.

Another object of the invention is to provide an improved overhead highway construction which does not interfere with vision or block light on the ground surface highway.

Another object of the invention is to provide an improved overhead highway construction having a relatively low initial cost and also relatively low maintenance cost, particularly on the surface highway over which the overhead highway is constructed.

Another object of the invention is to provide an improved highway construction which need not follow the contour of the surface highway and may, therefore, be more nearly a dead level highway than in prior constructions.

Another object of the invention is to provide an improved overhead highway construction which is less noisy than prior constructions because it is solid and the noise is deadened, and in which drainage may be better handled.

Another object of the invention is to provide an improved highway construction having long spans so that there is less obstruction on the surface highway.

Another object of the invention is to provide an improved highway construction having improved expansion joints making the long spans possible and providing a smooth highway surface.

Another object of the invention is to provide an improved highway construction which lends itself to various types of decorative effects at low cost.

Other objects of the invention will become apparent from the following specification, the drawings relating thereto, and from the claims hereinafter set forth.

In the drawings, in which like numerals are used to designate like parts in the several views throughout:

Figure 1 is a fragmentary side elevational view of an overhead highway construction embodying features of the present invention;

Fig. 2 is an enlarged, fragmentary, top plan view of the overhead highway illustrated in Fig. 1;

Fig. 3 is an enlarged cross-sectional view taken substantially along the line 3—3 of Fig. 2 showing the surface highway and adjacent property in cross-section;

Fig. 4 is an enlarged cross-sectional view taken substantially along the line 4—4 of Fig. 2;

Fig. 5 is a cross-sectional view taken substantially along the line 5—5 of Fig. 4;

Fig. 6 is an enlarged view of the structure shown within circle 6 of Fig. 4;

Fig. 7 is a view similar to Fig. 3 on a reduced scale showing the manner in which the columns for the overhead highway are constructed or anchored within the ground; and,

Fig. 8 is a view similar to Fig. 7 illustrating a modified form of overhead highway.

According to the present invention, an overhead highway construction is provided in which all of the sections thereof are formed of reinforced concrete. The highway is supported above the ground surface highway by a plurality of longitudinally spaced columns, each of which is disposed centrally of the overhead highway; and such columns, which are aligned in single file, provide the sole means of support for the highway. The highway is generally of cantilever construction and is formed of alternate continuous and broken beam sections between alternate adjacent columns. In this way, a construction is provided in which the stresses on the overhead highway members are more determinate than would be the case if all sections between the columns were continuous.

Referring to the drawings, and referring particularly to Figs. 1 to 6 thereof, an embodiment of the present invention is illustrated in which an overhead highway, generally indicated at 10, is disposed above a ground surface highway 12 supported on the ground 14. The property adjacent the surface highway is indicated at 16 in order that applicant's invention may be more clearly illustrated.

The overhead highway 10 includes a plurality of longitudinally spaced, reinforced concrete columns 18 which are centrally disposed and aligned in single file longitudinally of the highway. The columns are extended downwardly under the ground as indicated at 20 by construction, and the lower end of each column is bulged outwardly into bell shape as indicated at 22 for footing. The columns extend under the ground approximately twenty feet below grade for a purpose that will be pointed out in detail hereinafter.

Transversely extending beams 24 of reinforced concrete are formed integral with the tops of each column 18 and extend laterally therebeyond at each side.

The overhead highway surface indicated at 26 is formed of solid slab members of reinforced

concrete which are integral with the transverse beam members 24 and extend laterally therebeyond at each side of the highway. The highway surface 26, of course, extends between adjacent columns 18; and in the embodiment illustrated the spans between adjacent columns are alternately continuous and broken between alternate adjacent columns as indicated at 28 and 30, respectively. The broken spans include cantilever portions having an intermediate span therebetween which is connected to the cantilever portions by means of expansion joints generally indicated at 32 in Fig. 1.

Longitudinally extending girders or beams are formed integral with the undersides of the members forming the highway surface and also integral with the transverse beams 24; and such girders or beams are disposed on opposite sides of the columns 18 and are located adjacent the ends of the transverse beams 24 and located substantially midway between the outer edges of the highway 26 and the center thereof. On the continuous span 28 the longitudinally extending beam members extend continuously between the columns 18 and are indicated at 34. Similar beam members are also formed integral with the under surface of the cantilever portions of the broken sections 30 and are indicated at 36. Also, similar girders or beams are provided on the span between the girder portions 36 and are indicated at 38. It will thus be evident that the longitudinally extending girders or beams 34, 36 and 38 form continuous beams longitudinally of the highway, and the broken sections are connected together by the expansion joints 32.

The cantilever portions 36 extend beyond their adjacent columns a distance of approximately one-fifth of the span between adjacent columns. By way of illustration, it is pointed out that the present construction is designed for spans of a hundred feet between the columns 18, so that the broken cantilever sections extend approximately twenty feet beyond their adjacent columns and the suspended section connected to the cantilever beams by the expansion joints is, therefore, approximately sixty feet long.

The expansion joints 32 are formed by imbedding metal I-beams 40 and 42 in the facing portions of the beams 36 and 38, respectively. The outer faces of I-beams 40 and 42 are inset from the faces of their respective beams 36 and 38 so that the beams are substantially enclosed within the reinforced concrete. A portion of the outer face of beam 40 adjacent the top thereof is left exposed, and a portion of the outer face of beam 42 adjacent the bottom thereof is left exposed. A metal plate member 44 is fixed to the exposed portion of I-beam 40 by welding, for example, and a similar metal plate member 46 is similarly fixed to the exposed portion of the outer face of I-beam 42. Metal hangers or plate members 48 are fixed to the plate members 44 and 46, respectively, by welding, for example. The upper end of the plate member 48 is welded to plate member 44 and the lower end thereof is welded to plate member 46. The hanger 48 is so constructed that the ends thereof are offset from each other so that an expansion space is provided between the adjacent broken sections of the highway.

A relatively thin metal member 50 covers the exposed face of concrete of beam member 36; and a similar plate member 52 covers the exposed portion of concrete of the face of beam member 38. These plate members serve to protect the concrete from the absorption of moisture and otherwise serve to protect the exposed concreted joints from fracture.

Metal channel members 54 and 56 are imbedded in the facing portions of the highways above the beams 36 and 38. The members 54 and 56 extend completely across the highway; and the member 54 has a transversely extending plate 58 fixed thereto by welding, for example, which is substantially flush with the highway surface. The member 56 is provided with a complementary shoulder upon which one edge of plate member 58 slidably rests so that as the broken sections expand relative to each other the plate member 58 slides along the shoulder 60 and provides a continuous unbroken surface on the highway.

The highway 26 is provided with guard rails 62 extending longitudinally of the side edges thereof which form curbs 64 joining upstanding walls 65 at angles of approximately 60 degrees. The walls 65 extend slightly above the highway surface and serve as guards against which vehicle wheels may rub, but the inclined portions 64 do not interfere with the vehicle in the event that the wheels inadvertently rub against the wall 65. The highway is also provided with a longitudinally extending central guard 66 which separates the highway for traffic moving in opposite directions; and the guard 66 also provides a curb with portions 68 which join upstanding walls 65 at angles of approximately 60 degrees. The portions 64 and 68 are formed of smoothed concrete and may be maintained smooth by oil, paraffin, paint, smooth metal, or the like. By having the portions 64 and 68 at angles of approximately 60 degrees and having the faces thereof smooth, it will be evident that the guard rails 62 and 66 are thereby protected because, in the event that the wheels of a car override the walls 65 and strike against the portions 64 or 68, the relatively steep angle and smooth surface would cause the car to slip off and throw it back to its position on the horizontal highway surface.

The overhead highway construction is solid throughout so that the noises found in open work overhead highway constructions are substantially reduced. In order to further prevent the noise incident to an overhead highway construction, the under surfaces of the members forming the highway 26 and the exposed surfaces of the members 34, 36, and 38 are covered with a suitable sound proofing material indicated at 70.

There are other advantages of having solid constructions in that such solid constructions prevent grease, dirt and water from running through to the surface highway onto the moving traffic therebelow; and, also, provision for drainage is relatively simple. Such drainage is not shown, but it is evident that suitable openings may be provided in the surface highway at suitable intervals and drained through to a drain duct which could carry the foreign material and water to a suitable location for discharge, for example, down the columns 18.

The provision of the single central columns 18 in single file longitudinally of the highway and the construction and arrangement of the longitudinally extending beams 34, 36 and 38 relative to the highway surface 26 have a number of advantages. By having the single line of posts in the center, a more dead level roadway can be obtained for it need not follow the contours of the street level. It may go over other roadways and intersections at very little cost as the different heights of the post would not add mate-

rially to the cost of construction. Also, by using the single line of posts, there is very little obstruction to light on the ground highway. The position of the longitudinally extending beam members 34, 36 and 38 substantially midway between the outer edges and center of the highway provides a sufficiently strong construction and at the same time the longitudinal beam members are positioned inwardly of the edges of the highway so that they offer no obstruction to the passage of light under the highway.

As stated above, by reason of the provision of continuous and broken beam sections between alternate adjacent columns, the stresses in the structure are more determinate as the expansion joints fix the points of inflection. By this structure also any supporting column may move up or down without changing moments in the structure, and at the same time offers less abrupt change in level of the pavement.

Fig. 7 illustrates the construction shown in Fig. 3 on a reduced scale in order to bring out one of the advantages of having the single file of single column 18 in the particular manner in which the columns are disposed in the ground. In Fig. 7 a subway tunnel is indicated at 80, a sewer conduit is indicated at 82 and a cable tunnel is indicated at 84. These tunnels are shown in the positions they normally assume; and it will be seen that the columns 20 extend under the ground a substantial distance and the bell bottoms 22 do not interfere with the service tunnels. At the same time the construction is sufficiently strong to support the overhead highway structure and may be installed without disturbing the operation of any of the service tunnels in existence.

In Figs. 1 to 7 the highway illustrated is of the four lane type in which two of the lanes are for traffic moving in one direction and the other two lanes are for traffic moving in the opposite direction. In Fig. 8 a modified form of the invention is shown in which an overhead highway for two lane traffic is illustrated for use on relatively narrow streets. The highway there shown is particularly for one-way traffic; but the highway is of sufficient width that by placing a longitudinally extending center guard such as that shown at 66 above the traffic could safely move in opposite directions for one lane traffic.

Formal changes may be made in the specific embodiments of the invention described without departing from the spirit and substance of the invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. An overhead highway construction disposed above a ground surface highway comprising a plurality of longitudinally spaced reinforced concrete columns centrally disposed of said overhead highway; transversely extending reinforced concrete beams integral with each of said columns adjacent the tops thereof and extending laterally therebeyond; longitudinally extending, reinforced concrete beams integral with said first named beams adjacent the outer ends thereof; cantilever reinforced concrete members above and integral with said beams and extending laterally therebeyond forming the overhead highway surface, said members and said longitudinally extending beams being alternately continuous and broken between alternate adjacent columns forming alternate, continuous and broken beam sections; portions of said broken beam sections being fixedly connected to said columns through said transversely extending beams, and other portions being disposed between said first named portions; and expansion joints connecting said broken beam sections together; said expansion joints including metal members imbedded in adjacent faces of said portions in the broken beam sections in facing relation to each other, and a vertically disposed metal strap member having its upper end connected to the metal member imbedded in the first named portion and its lower end connected to the metal member imbedded in said other adjacent portion, said metal strap having its ends relatively offset to span the space between said broken sections.

2. An overhead highway construction disposed above a ground surface highway comprising a plurality of longitudinally spaced reinforced concrete T sections forming supporting columns; longitudinally extending reinforced concrete beams integral with the outer ends of said T sections; slab members above and integral with said longitudinal beams and the tops of said T sections forming the overhead highway; said longitudinal beam members being alternately continuous and broken to form alternate continuous and broken beam sections between alternate adjacent columns; portions of said broken beam sections being integral with said T-sections and other portions being disposed between said first named portions; expansion joints connecting said broken beam sections together; and said expansion joints including metal members imbedded in adjacent faces of said portions in the broken beam sections in facing relation to each other, and a vertically disposed metal strap member having its upper end connected to the metal member imbedded in the first named portion and its lower end connected to the metal member imbedded in said other adjacent portion, said metal strap having its ends offset to span the space between said broken sections.

3. An overhead highway construction disposed above a ground surface highway comprising a pair of longitudinally spaced reinforced concrete columns; transversely extending reinforced concrete beams integral with each of said columns adjacent the tops thereof; longitudinally extending reinforced concrete beams integral with said first named beams; reinforced concrete slab members above and integral with said beams forming the overhead highway surface; said longitudinally extending beams being broken between said columns to provide a suspended section therebetween with portions of said longitudinally extending beams fixedly connected to said columns through said transversely extending beams, and another portion disposed between said first named portions; expansion joints connecting said suspended section to the adjacent sections; said expansion joints including metal members imbedded in adjacent faces of said portions in the broken beam sections in facing relation to each other, and a vertically disposed metal strap member having its upper end connected to the metal member imbedded in said first named portion and its lower end connected to the metal member imbedded in said another adjacent portion, said metal strap having its ends offset to span the space between said broken sections.

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