Jan. 30, 1968 F. K. REINITZHUBER ETAL 3,366,020

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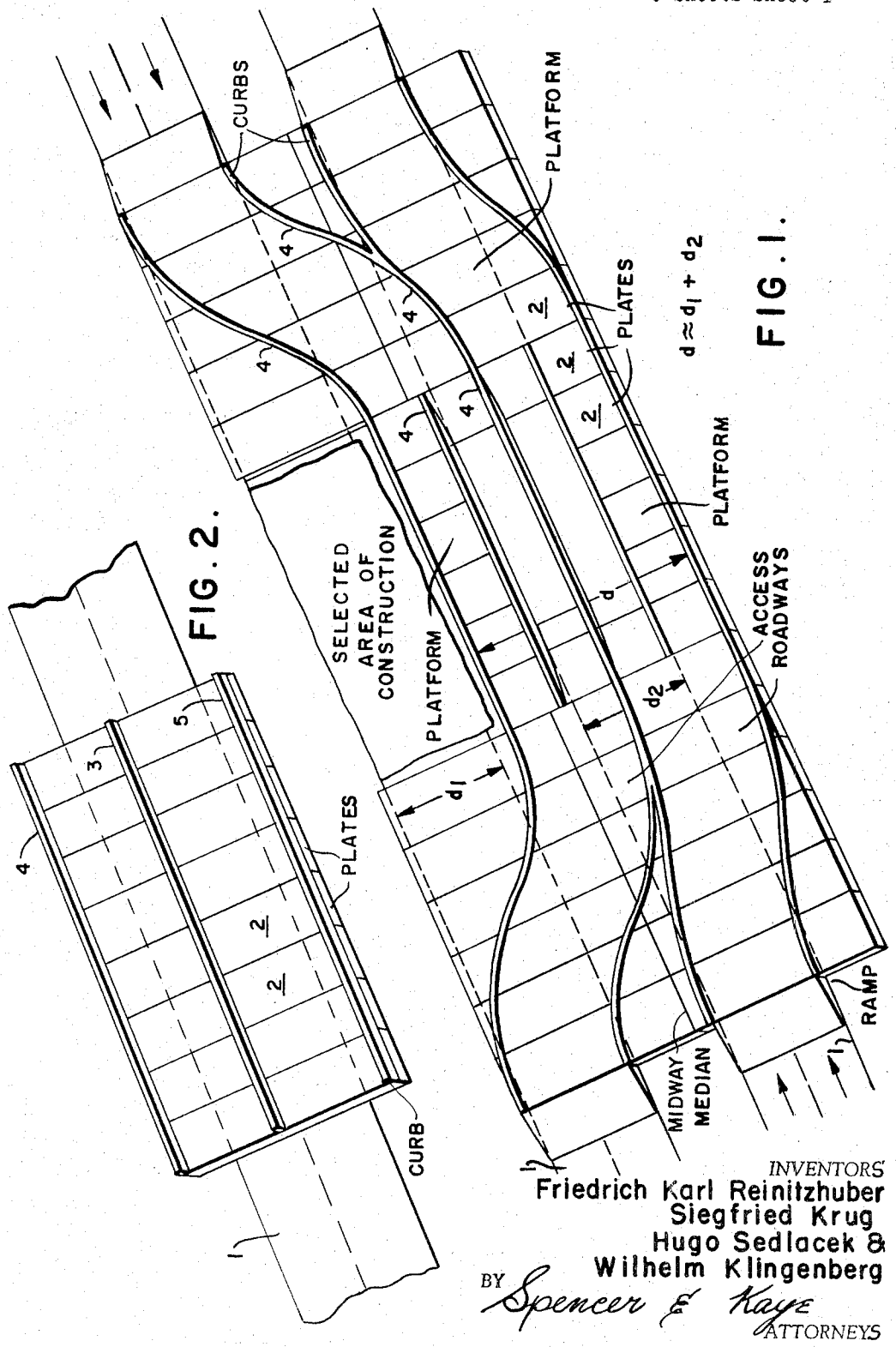


FIG. 1.

FIG. 2.

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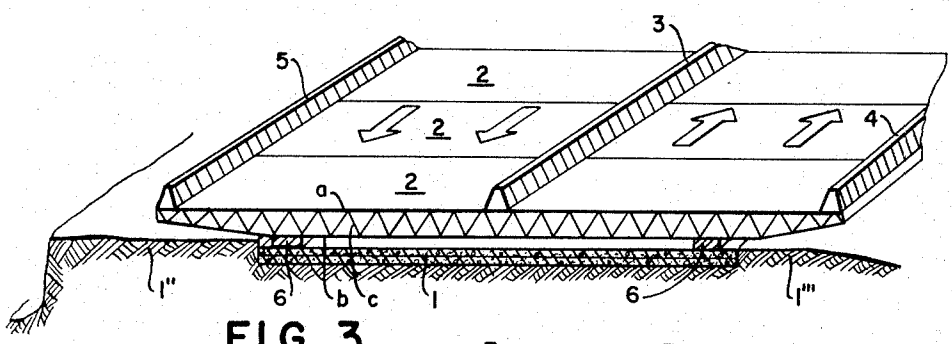


FIG. 3.

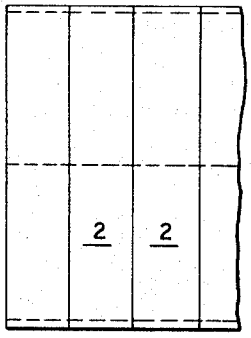


FIG. 4.

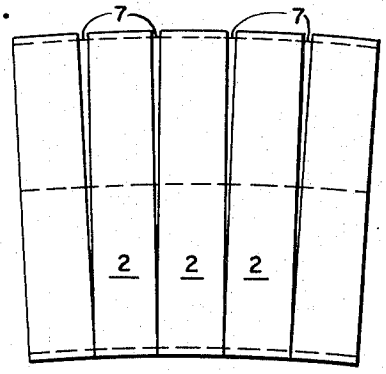


FIG. 5.

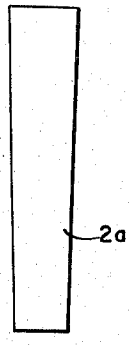
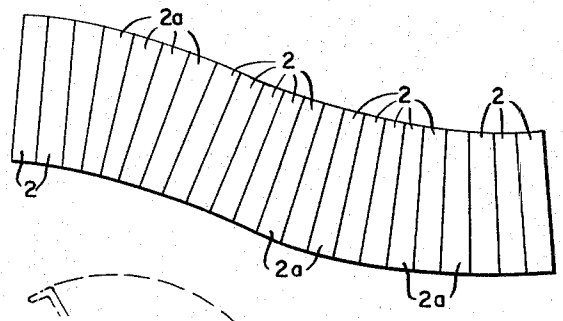


FIG. 6.

FIG. 7.



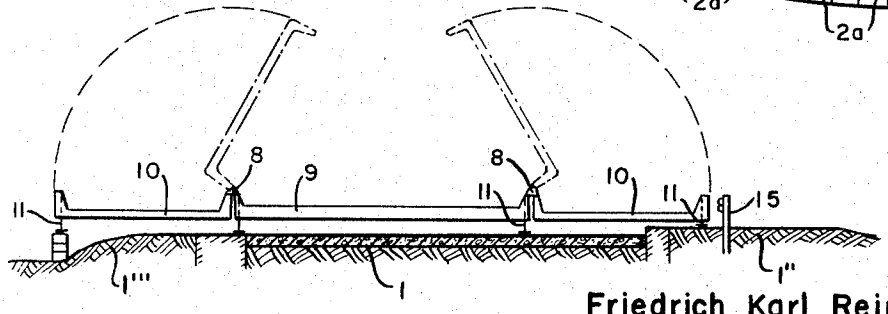


FIG. 8.

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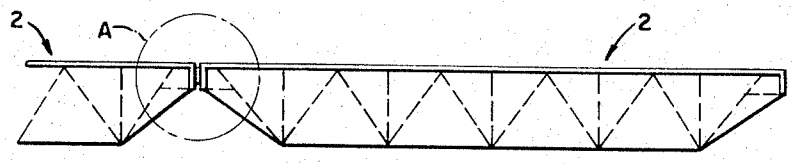


FIG. 9.

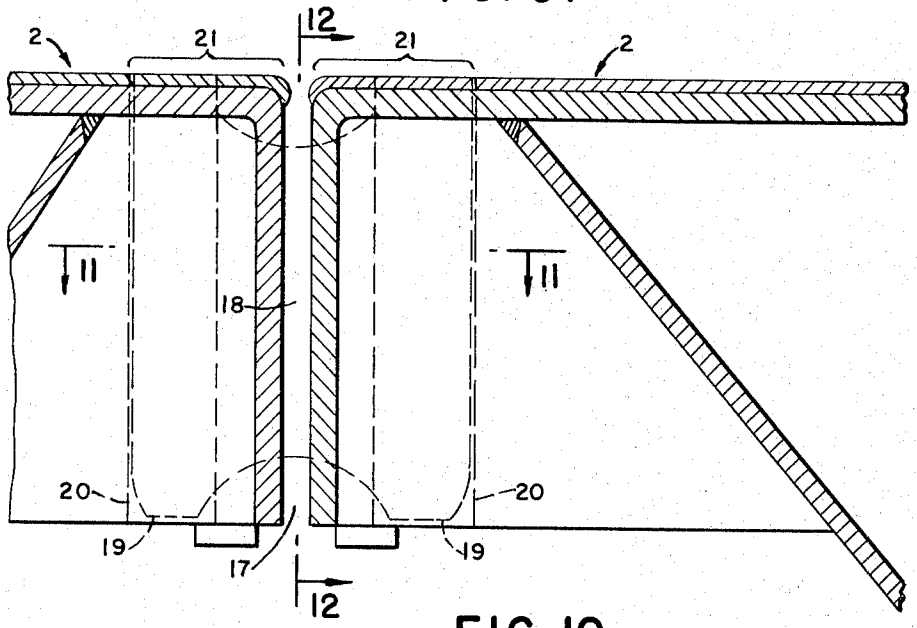


FIG. 10.

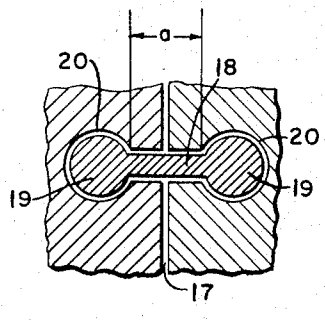


FIG. 11.

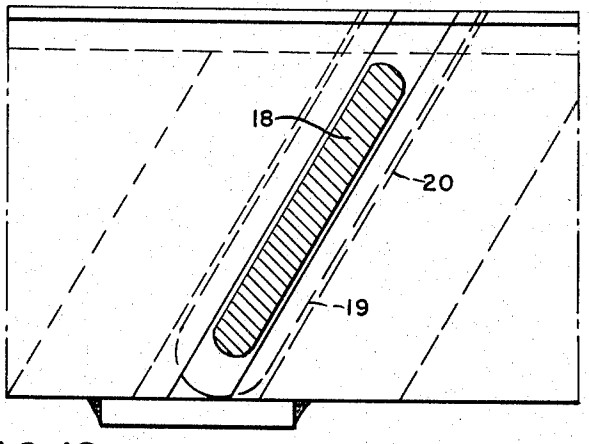


FIG. 12.

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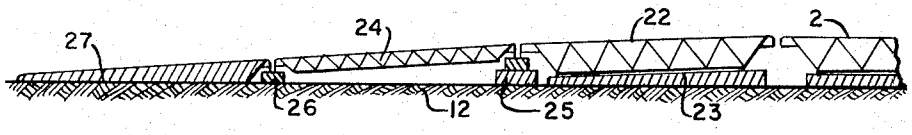


FIG. 13.

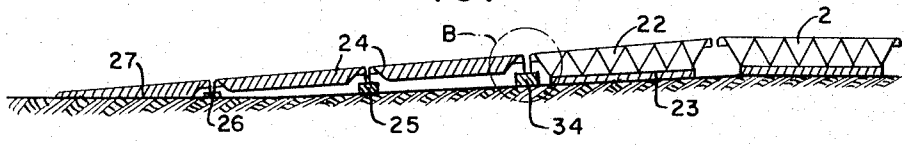


FIG. 14.

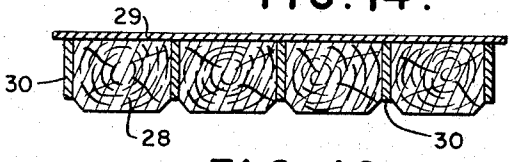


FIG. 16.

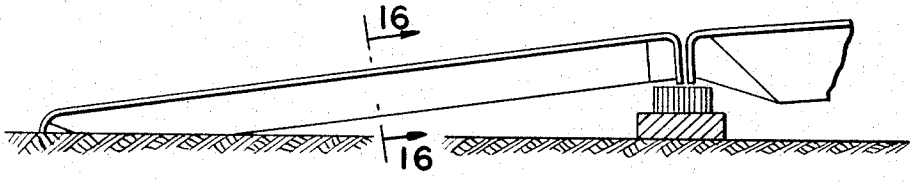


FIG. 15.

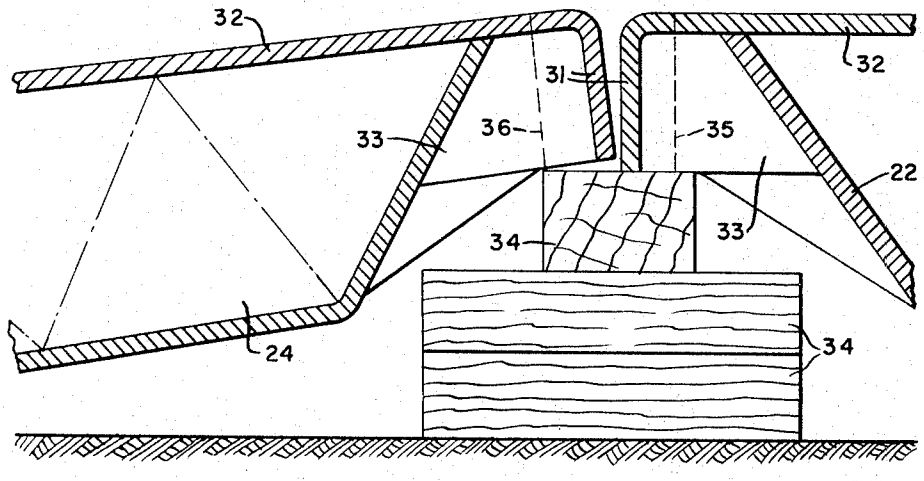


FIG. 17.

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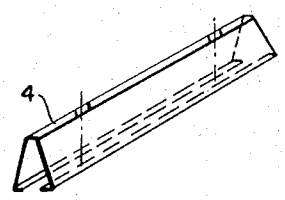


FIG. 18.

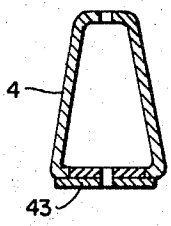


FIG. 19.

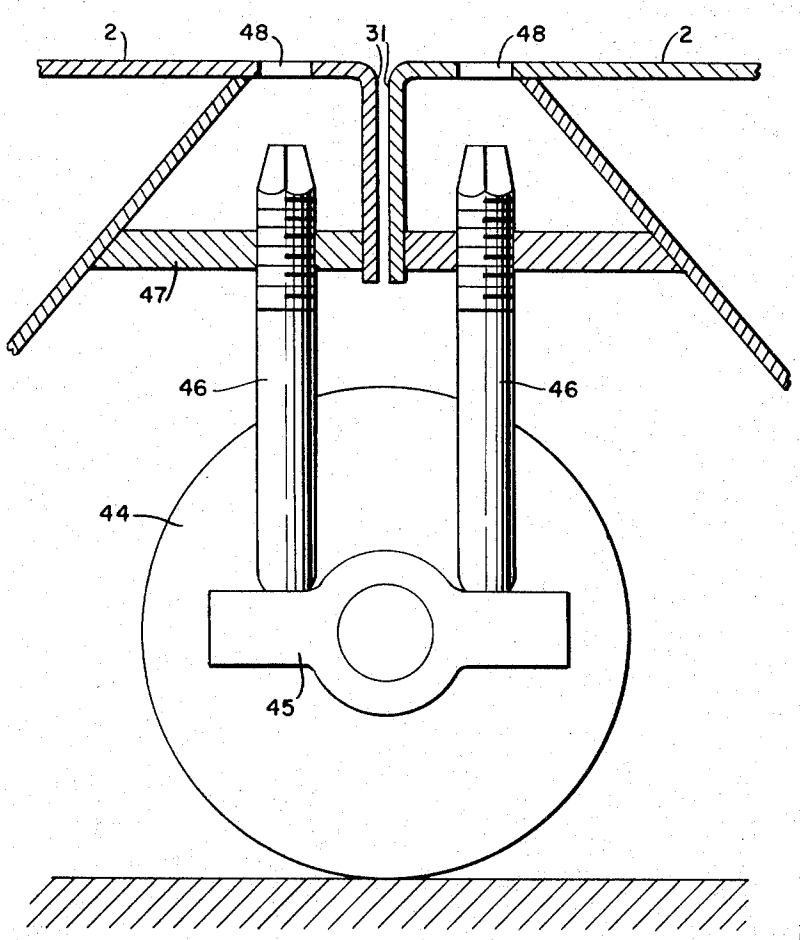


FIG. 20.

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United States Patent Office 3,366,020
Patented Jan. 30, 1968

3,366,020

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Filed Oct. 27, 1964, Ser. No. 406,858
Claims priority, application Germany, Nov. 13, 1963, B 74,248
19 Claims. (Cl. 94—1)

Background of the invention

The present invention relates to a bypass for use on motor vehicle highways and roads.

In particular, the present invention relates to a bypass which permits one roadway of a two-roadway divided highway to carry extra lanes of traffic.

The necessity of road construction on one roadway of a two-roadway well-travelled divided highway has, in the past, usually resulted in a traffic jam. Shutting down one lane or one entire roadway of a divided highway to permit the lane or roadway to be repaired or widened restricts the flow of traffic and, especially when the traffic is heavy, causes the vehicles using the highway either to considerably reduce their speed or come to a stand-still. A number of methods have been employed in the past to detour traffic around an area of construction on one roadway of a two-roadway divided highway. One method was simply to reduce the roadway in need of construction by one construction lane; this method restricted the traffic on this roadway, however, to the remaining roadway lane or lanes. A second method was to detour the traffic around the construction site over a parallel or nearly parallel secondary road. This method almost always required some separate and later superfluous road construction and led the traffic over a longer route. A third method was to divide in half the roadway not under construction leading traffic of both directions over this single roadway. All the methods of the prior art had one disadvantage in common: they seriously restricted the flow of traffic.

Summary of the invention

It is a primary object of the present invention, therefore, to provide a way in which traffic jams or the like may be avoided whenever repair work is performed on a heavily travelled stretch of highway.

This and other objects which will become apparent in the discussion that follows are achieved by providing a motor vehicle bypass for use on highways of the type having two roadways each of which accommodates traffic flowing in one direction. The present invention resides, mainly, in a way in which the usable width of one of the roadways is increased to such an extent that it is able to carry at least two extra traffic lanes. The invention involves providing portable plates arranged consecutively along a stretch of the one roadway and extending laterally over at least the edges of this roadway to form at least the extra traffic lanes.

More particularly, the present invention resides in the combination of a divided highway having two roadways for carying traffic in opposite directions, each roadway having one or more traffic lanes, with a bypass which comprises supplemental road means for enlarging the useful width of one of the roadways and access road means for diverting all the traffic over this one roadway. The supplemental road means include roadway means which pass over the two side edges of the roadway whose width is to be enlarged, the roadway means being arranged slightly above the roadway and being constituted by at least one series of plates which are positioned consecutively in the direction of the roadway. The access road means include further roadway means for guiding traffic to the enlarged one roadway and ramp means which form a smooth connecting surface between the two roadways and the elevated surface of the further roadway means.

A very significant advantage to the present invention is that it provides a means for forming a bypass which does not require elaborate equipment and which can easily be put in place anywhere along a desired stretch of highway.

In practice, the roadway means will be fashioned as isotropic or anisotropic plates, preferably as compartmented plates. The roadway plates may rest on longitudinal ties which extend in the direction of the roadway, these ties preferably being located at the edges of the actual roadway. In the case of a four-lane bypass the roadway plates may extend over the entire width of the four lanes, or each roadway plate may consist of two or more individual plates which are connected to each other by means of hinge joints whose axes extend in the direction of the roadway. In either event, if the roadway to be widened is a multiple-lane roadway, a single series of plates may be provided each plate having a length which extends over the entire roadway to be enlarged and beyond the side edges thereof. The length of each plate in a direction transverse to the roadway will then be sufficiently long to form a stretch of roadway having twice as many lanes as the original multiple-lane roadway which was to be widened. Alternatively, the bypass may include two series of plates, each series of plates forming a single lane road means. These two single lane road means are then arranged, respectively, along opposite sides of the roadway to be enlarged, the original roadway itself affording two lanes of traffic so that there will be obtained a four-lane stretch of roadway.

Brief description of the drawings

FIGURE 1 is a perspective view of a four-lane divided highway having a bypass according to one embodiment of the present invention.

FIGURE 2 is a perspective view of the two lanes of a four-lane divided highway carrying a platform according to one embodiment of the present invention, with the access ramps omitted.

FIGURE 3 is a partly sectional and partly perspective view of one embodiment of the platform according to the present invention.

FIGURE 4 shows the juxtaposition of a plurality of standard plates to form a platform along a straight stretch of highway.

FIGURE 5 shows how a plurality of these standard plates may be positioned to form a platform along a curved stretch of highway.

FIGURE 6 is a plan view of a special plate which has a trapezoidal outline and which is used for forming the platform over a more sharply curved stretch of highway.

FIGURE 7 shows how the standard and the special plates may be combined to form the platform over a curved stretch of highway.

FIGURE 8 is a sectional view of one of the embodiments of the platform according to the present invention.

FIGURE 9 is a side elevational view of a platform according to the present invention, the same depicting one entire plate as well as the juncture of this plate with an adjacent plate.

FIGURE 10 is a vertical sectional view, on an enlarged scale, showing the details of the juncture of adjacent plates; FIGURE 10 depicts the structure comprehended essentially within the circle A of FIGURE 9.

FIGURE 11 is a sectional view taken on the line 11—11 of FIGURE 10.

FIGURE 12 is a sectional view taken on the line 12—12 of FIGURE 10.

FIGURE 13 is a side-elevational view depicting the ramp onto a platform according to the present invention when the bypass is erected on a level stretch of highway.

FIGURE 14 is a side-elevational view depicting the ramp onto a platform according to the present invention when the bypass is erected on an inclined stretch of highway.

FIGURE 15 is a side-elevational view of a wedge-shaped end plate of the ramp.

FIGURE 16 is a sectional view taken on line 16—16 of FIGURE 15.

FIGURE 17 is a vertical sectional view, on an enlarged scale, showing the details of the juncture of the ramp with the standard plate of the platform; FIGURE 17 depicts the structure comprehended essentially within the circle B of FIGURE 14.

FIGURE 18 is a perspective view of the curbing used in conjunction with the bypass according to the present invention.

FIGURE 19 is a cross-sectional view of the curbing shown in FIGURE 18.

FIGURE 20 is a vertical sectional view showing how the juncture of two adjacent plates may be supported on a dolly or the like by means of which the plates may be moved.

Description of the preferred embodiments

Referring now to the drawings, and to FIGURE 1 thereof in particular, the same shows a four-lane divided highway, the highway being constituted by two two-lane roadways 1 and 1', separated by a dividing or median strip, the two roadways carrying the traffic moving in opposite directions. One roadway 1' has an area marked off which has been selected for construction. One embodiment of the bypass of the present invention, including access roadways and extra lanes, is shown which detours all traffic over the roadway 1 bypassing the area of construction.

The bypass according to the embodiment includes two curved access roadways connecting roadway 1' with the widened roadway 1 and two access roadways connecting roadway 1 with the widened roadway 1 marked off, by means of curbing 4, on a platform consisting of plates 2 arranged two abreast across the entire four-lane highway. It further includes two series of platforms one lane wide which extend the width of the roadway 1 from two lanes to four. These platforms are comprised of plates 2, provided with curbs 4, set down on both sides of the roadway 1 so as to extend over the roadway edges and allow the roadway itself to be used for two lanes of traffic. Since each platform accommodates an additional lane of traffic, the total width of the widened roadway d is made approximately equal to the combined widths d_1 and d_2 of the two roadways 1' and 1, respectively.

FIGURE 2 shows one embodiment of the present invention having plates 2 forming a platform which is the entire width of the four-lane bypass. These plates are carried by roadway 1 and extend over both sides of roadway 1 to provide the extra lanes. Curbs 3, 4 and 5 are shown guarding the center as well as each side of the platform.

The embodiment of the invention shown in FIGURE 2 is shown in greater detail in FIGURE 3. The right-hand roadway 1, which is the roadway opposite the one in which the construction site is located, is made to carry four traffic lanes, two in each direction, by means of the platform. To this end, the roadway 1 carries a series of consecutive plates 2 which are located slightly above the roadway, these plates 2 extending transversely to the direction of the length of the roadway and extending beyond the edges of the roadway 1 proper; that is to say, the plates 2 extend, at the left, over the median strip 1'' and at the right, over the shoulder 1''' of the roadway. The plates 2 do not, however, extend over the entire width of the shoulder of embankment and median strip so they do not interfere with the construction site.

The plates 2 accommodate four adjacent traffic lanes, so that there will be available two lanes in each direction. The lanes in opposite directions are separated from each other by a central dividing strip, constituted by curbing 3, as illustrated in FIGURE 3. Additional curbing 4 and 5 is provided at the outermost edges of the four-lane roadway constituted by the plates 2. As is shown in FIGURE 3, the plates are supported by longitudinal strips or ties 6 which are located in the region of the side edges of the basic roadway 1.

Each of the plates 2 together with the curbing 3, 4 and 5 extends transversely to the roadway and will, for example, have a length of 12.8 meters and width of 2.4 meters. The plates will consist, in practice, of steel construction and will form isotropic or anisotropic plates. The plates are preferably fashioned as hollow compartment plates, consisting of an upper sheet a and a lower sheet b between which is arranged a suitable truss or frame-type structure as, for example, the zig-zag reinforcements c shown in FIGURE 3. The internal reinforcement allows the forces exerted on the plate to be transmitted to all sides. The reinforcement may be constituted by corrugated sheeting which has either a triangular cross section configuration as shown or a trapezoidal cross-sectional configuration so that there will be formed hollow compartments of corresponding cross sections, which compartments extend throughout the entire width of each plate. If desired, the trussing may be three-dimensional and have pyramid-shaped rods and, if desired, posts which extend between the upper and the lower sheets.

In practice, the upper surface of the roadway constituted by plates 2 will be but 30 to 50 cm. above the surface of the original roadway 1. The longitudinal ties afford a continuous longitudinal support. At the same time, the ties are very inexpensive and can easily be put into place, it being unnecessary to provide any base plates. Moreover, no particular skills are needed in placing the ties 6, so that the platform can be positioned with the help of unskilled labor. Furthermore, this type of support for the four-lane roadway will protect the basic roadway 1 against overload.

The ties 6 are preferably made of wood and should be elastic enough but nevertheless sufficiently strong to support four lanes of traffic. In practice, the ties may consist of wood beams, or they may consist of individual, longitudinally and transversely glued together thin boards. Furthermore, the lower edges of the ties may be provided with a soft plastic layer, so that the ties will be able to take up any unevenness of the concrete roadway 1 and will also adapt themselves to any twisting of the plates 2.

The upper surface of the plates 2 will preferably be provided with a wear-resistant plastic layer which can easily be replaced, as and when necessary.

The standard plates 2, shown in FIGURE 3, normally have a rectangular cross section. If the platform is to be placed on a straight stretch of roadway, the plates 2 will be positioned parallel to each other, as shown in FIGURE 4. If the platform is placed on a stretch of roadway which has a slight curvature, i.e., a curvature whose radius of curvature is over 1000 meters, the rectangular plates 2 will be laid next to each other as shown in FIGURE 5, so as to form wedge-shaped slots 7. This means that the plates will be spaced from each other, at the outer periphery of the curve, at a distance of, for example, 3 cm. This is an acceptable distance insofar as vehicular traffic is concerned.

If the platform is to be placed on a stretch of roadway having a radius of curvature of less than 1000 meters, the platform may include special trapezoidal plates 2a as shown in FIGURE 6. These plates can be used in conjunction with the standard rectangular plates, as shown in FIGURE 7, so as to adapt the platform to the configuration of the particular roadway on which it is laid.

The plates thus far described constitute unitary elements which extend over the entire width of the roadway. Alternatively, each plate **2** can itself be constituted by two or more plate sections which are connected to each other by means of a hinge joint the axis of which extends in the direction of the roadway. In this way the hingedly connected together plate sections can be folded onto each other, thereby to facilitate the transport of the plates from one place to another. FIGURE 8 shows such a platform, the same incorporating plates which themselves are composed of three individual plate sections **9** and **10** which are hingedly connected by means of joints **8** whose axes extend in the direction of the roadway. Here, the center section **9** is sufficiently long to provide a two-lane road surface, while the outer plate sections **10** will each accommodate a single lane of traffic. These plate sections have upwardly directed edges which form the curbing. FIGURE 8 shows, in phantom lines, how the outer plate sections **10** can be swung upwardly over onto the center section **9**, so as to facilitate the transport of the composite plate. FIGURE 8 also shows that the plate sections **9** and **10** are supported by means of adjustable lifting devices, such as jacks **11**, which allow the bypass to be adapted to the particular configuration of the roadway on which it is placed. Also shown is a guard rail **15**.

The outer plate sections **10**, shown in FIGURE 8, can be used independently of center section **9** to form individual extra lanes of traffic on either side of the roadway **1** in the manner shown in FIGURE 1. These plate sections must then be provided on each side with adjustable lifting devices, such as jacks **11**, for their support; that is, the inner side of the section will not be supported by the hinge joint **8** but by a pack. Then, just as with the embodiment shown in FIGURE 8, the sections **10** can be rested on the two shoulders **1''** and **1'''** of roadway **1**.

The plates of the present invention can be provided with grooves and be connected next to each other without there being any special connecting means. If desired, however, the mounting of the roadway as a whole may be secured by means of dowel-type connectors or the like. If necessary, the plates may be coupled to each other in such a manner as to form a unitary structure which resists bending.

FIGURES 9 through 12 show how two roadway plates can be connected to each other by means of a plug-type connector, so as to afford resistance against bending. The connector is inclined with respect to the surface of the roadway and is connected to the two plates to be connected together. As is shown in FIGURE 11, the connector comprises a flat center web **18**, which bridges a gap **17**, and two adjoining beads **19**. The edge portions **21** of the plates to be connected together are provided with cut-outs **20** which have a cross-sectional configuration mating with that of the connector, these cut-outs being inclined. If such cut-outs are provided at two points of the gap **17**, which cut-outs are inclined in opposite directions, the coupling elements **18** and **19** will assure that the position of the plates is fixed in each direction. The coupling elements transmit both bending forces as well as bending moments of any type. The coupling elements are simply slid into the respective cut-outs from the top. The size of gaps **17** can be varied, depending on how large the free width (distance "*a*" in FIGURE 11) of the central web **18** of the coupling element is. Thus by making the gaps narrower on one side than the other, the platform may be given whatever curvature is needed.

The access roadways, four of which are shown in FIGURE 1, consist of standard plates **2**, and suitable ramp means. The standard plates are used two abreast to provide a road bed interconnecting the four lanes of the bypass section located on roadway **1** with the two lanes each of roadways **1** and **1'**. The ramp means provide a smooth connecting surface between the level of the concrete roadbeds and the tops of the plates.

FIGURE 13 shows a stretch of level highway carrying ramp means comprised of three plates. There is one plate **22** which has the same construction as the standard plates **2**. This plate is supported, at its ends, by wedge-shaped ties **23**. Next to the plate **22** is a plate **24** which itself is thinner but has the same width as plate **22**. This plate **24** is supported not on longitudinal ties but on transverse ties **25** and **26** whose thickness will be such as to provide the necessary inclination for the plate **24**. The end of the ramp is constituted by a wedge-shaped plate **27**, which can, as shown in FIGURES 15 and 16, be constituted by adjacent tapering wooden beams **28**, the same being faced with steel sheeting **29** and vertical wedge-shaped plates **30** interposed between adjacent beams.

In order to facilitate the flow of vehicular traffic on the access roadway the ramp is preferably curved. This can be accomplished by making the ramp plates **22**, **24** or **27** with the trapezoidal outline of the special plates **2***a* shown in FIGURE 6.

If the highway slopes at the point at which the bypass is to be erected, as shown in FIGURE 14, the length of the ramp will have to be somewhat longer in order not to exceed the maximum permissible gradient of, for example, 7%. Therefore, the single ramp plate **24** of FIGURE 13 is replaced by two consecutive ramp plates **24**.

FIGURE 17 shows the junction between the plates **22** and **24**, on an enlarged scale, this being the region indicated within the circle B in FIGURE 14. FIGURE 17 shows the plates as extending, in the region of the junctures, into two downwardly descending side flanges **31** which are in the nature of prolongations of the upper sheets **32** attached to additional web plates **33**. Below the flanges **31**, there remains sufficient space for the support means, the same being in the form of wooden ties **34** which are arranged in a direction transverse to the length of the highway. The bores of the cut-outs **35** and **36** for receiving coupling elements, for example, coupling elements of the type shown in FIGURES 10, 11 and 12, have to be adapted to the angle between plates **22** and **24**. To this end, the bore **36** in the edge of plate **24** is enlarged.

Curbing can be used, if desired, in conjunction with the mentioned coupling elements for purposes of connecting two of the roadway plates in such a manner as to make the roadway as a whole resistant to bending. Here, the curbing is, as shown in FIGURES 18 and 19, in the form of hollow bars of trapezoidal cross section. The curbing is affixed to the plates by bolts passing through holes in the top of the curbing and holes in the plates. FIGURE 19 shows that the curbing need not necessarily be placed into direct contact with the plates **2**; instead, there can be washer-type plates **43** made of plastic or wood which are preferably arranged at the junctures of consecutive plates **2**. The interspace between the plates **2** and the curbing will thus afford water drainage.

As shown in FIGURE 20, the space between two abutting flanges **31** of two consecutive plates **2** can accommodate a dolly, which may incorporate, for example, a roller **44** carrying a bearing **45** on which the flanged sides **31** are supported by means of threaded spindles **46**. The latter are threaded into robust closure plates **47** of the flanges **31**, there being suitable apertures **48** located above the spindles **46** and in alignment therewith so as to make it possible to turn the spindles. In this way, the plates **2** can be raised off the ground and be moved, by means of the dollies, to wherever the plates are needed. Experience has shown that entire groups of plates, of a length of, for example 50 meters, can thus be rolled from place to place.

If desired, the rollers **44** can be provided with flanges, in the manner of a railroad wheel. The tracks for such a wheel can then be constituted by the longitudinal ties **6** described above, these being the ties which support the plates **2**.

The bypass according to the present invention can

easily be erected on a roadway by first placing the longitudinal ties 6 on the roadway 1, and by then depositing the plates 2, for example, by means of a crane, onto the ties 6. In practice, the crane can be mounted on a truck which itself is used for transporting the plates to the stretch of roadway whereat the bypass is to be erected. If desired, the trucks can be routed over the other roadway, or the plates can be moved to the site via the already existing portion of the bypass roadway.

After the construction has been completed on one of the two roadways of the divided highway, the bypass can readily be transferred over the median strip to the other roadway, so that the stretch of roadway which previously served to accommodate the bypass can now be worked on. Alternatively, the bypass can be moved ahead on the same roadway; this can be done, for example, by means of light special-purpose vehicles, such as an electric vehicle or stacker which picks up a plate 2 at one end of the bypass and transports it to the other end.

It will be seen from the above that, irrespective of the particular embodiment involved, the bypass can easily be positioned and removed, in a minimum of time and with a minimum of labor. A particular advantage of the bypass according to the present invention is that it need not pass over such bridges as cross the highway on which the bypass is being erected. Because the bypass itself is more or less at the same level as the original roadway, it can readily be made to extend beneath the bridges crossing the highway. Furthermore, the bypass roadway according to the present invention will be able laterally to clear the pillars of existing bridges. If need be, the roadway according to the present invention can be interrupted at one point or another, and the lanes can be narrowed to the extent necessary.

It will be understood that the above description of the present invention is susceptible to various modifications, changes, and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

What is claimed is:

1. In combination with a divided vehicular highway having two roadways for carrying traffic in opposite directions;

(a) platform means supported on one of said roadways alongside a selected area of repair on the other of said roadways, said platform means extending beyond the edges of said one roadway, the distance between the outer edges of said platform means being approximately equal to the combined width of said two roadways so that there is provided on said one roadway a widened roadway;

(b) said platform means including at least one series of plates which are positioned consecutively on said one roadway and which are individually liftable from said one roadway; said plates, when lying on said one roadway, being arranged but slightly above the surface of said one roadway;

(c) curved access roadway means connecting one half of each end of said widened roadway with said other roadway, said curved access roadway means having a width which is generally equal to the width of said other roadway; and

(d) further access roadway means connecting the other half of each end of said widened roadway with said one roadway, said further access roadway means having a width which is generally equal to the width of said one roadway.

2. The combination defined in claim 1 wherein said plates are compartmented plates.

3. The combination defined in claim 1 wherein said platform means further comprise longitudinal ties arranged in the region of the sides of said one roadway and supporting said plates.

4. The combination defined in claim 1 wherein said platform means further comprise a plurality of jacks for supporting said plates at different points, said jacks being adjustable in height independently of each other.

5. The combination defined in claim 1 wherein said one roadway is a multiple-lane roadway, and wherein there is but a single series of plates, each plate having a length which extends over the entire width of said one roadway and beyond the side edges thereof, the length of each plate, in a direction transverse to said one roadway, being sufficient to form a stretch of roadway having twice as many lanes as the original multiple-lane roadway.

6. The combination defined in claim 1 wherein each one of said plates is constituted of a plurality of laterally adjacent sections, there being means for hingedly connecting said sections to each other, said connecting means having axes extending in the direction of the roadway, thereby to permit the sections of each plate to be folded toward each other.

7. The combination defined in claim 1 wherein there are two series of plates each series of plates forming a single-lane road means, said two single-lane road means being arranged, respectively, along opposite sides of said one roadway, said one roadway itself affording two lanes of traffic, whereby there is obtained a four-lane stretch of roadway.

8. The combination defined in claim 1 wherein said plates are rectangular and, when positioned next to each other edge-to-edge, form a straight stretch of supplemental roadway.

9. The combination defined in claim 1 wherein said roadway means includes additional plates of trapezoidal configuration, thereby to form, in conjunction with rectangular plates, curved stretches of roadway.

10. The combination defined in claim 1, further comprising coupling means for joining consecutive plates to each other and forming a coupling which is resistant to bending and to torsion, said coupling means including plug-type connectors which are insertable into two consecutive plates from the top.

11. The combination defined in claim 1 wherein said plates are provided with upturned edges for defining the boundaries of traffic lanes.

12. The combination defined in claim 1 wherein said plates carry upstanding curbing, there being means for connecting said curbing to said plates.

13. The combination defined in claim 1 wherein said connecting means comprise tie rods connecting said curbing to said plates, said tie rods incorporating bayonet-type couplings for joining said tie rods to said plates.

14. The combination defined in claim 1 further comprising connecting means for connecting consecutive plates to each other, said connecting means including curbing for defining the boundaries of traffic lanes.

15. The combination defined in claim 1 wherein said plates, in the region of the outermost edges of the platform means, are upwardly inclined on the underside.

16. The combination defined in claim 1 wherein said plates are provided, at those sides thereof at which they join with an adjacent plate, with downwardly depending flanges the same being continuations of the upper surface of each respective plate, the adjacent downwardly depending flanges of two consecutive plates forming a space beneath themselves, there being support means arranged in said space for supporting said two adjacent plates.

17. The combination defined in claim 16, further comprising dolly means arranged in said space and being adjustable in height for enabling said plates to be lifted and transported.

18. The combination defined in claim 1 wherein said plates comprise spaced apart upper and lower sheets, and trussing arranged between said plates.

19. The combination defined in claim 18 wherein said trussing comprises corrugated sheeting zig-zagging between said upper and lower sheets.

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