

June 23, 1942.

A. S. WELLBORN ET AL  
BRIDGE CONSTRUCTION

2,287,210

Filed Nov. 14, 1939

3 Sheets-Sheet 1

Fig. 1

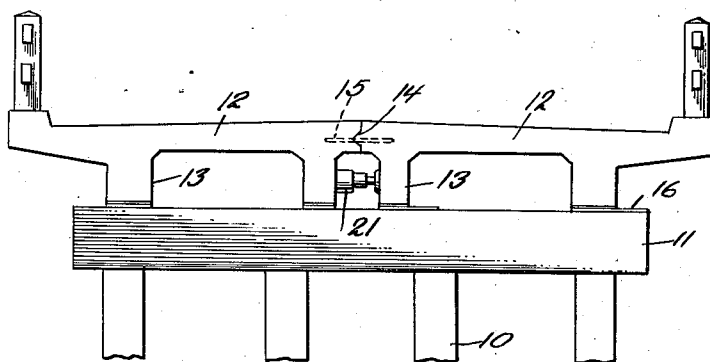


Fig. 2

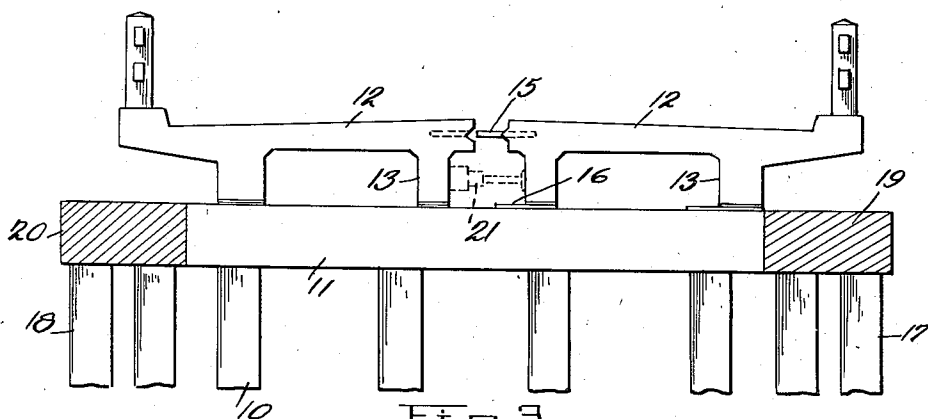
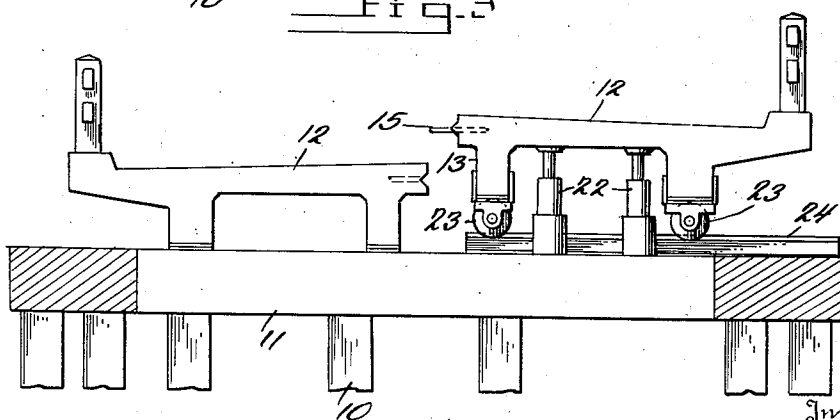


Fig. 3



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Fig. 4

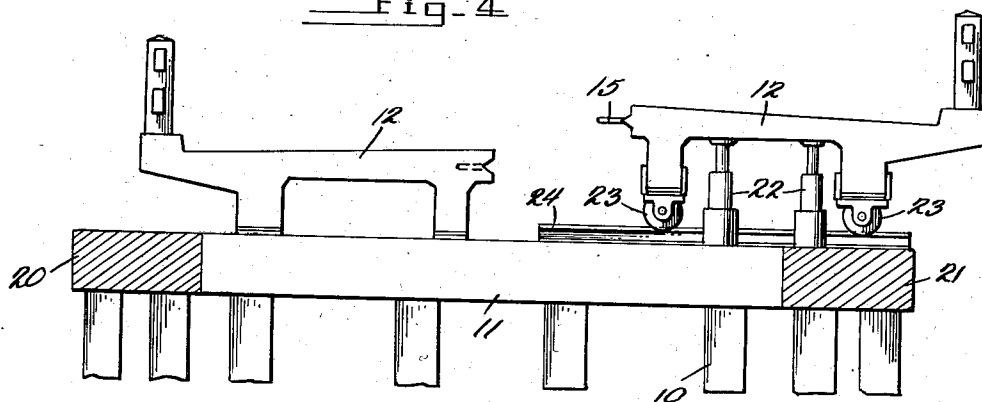


Fig. 5

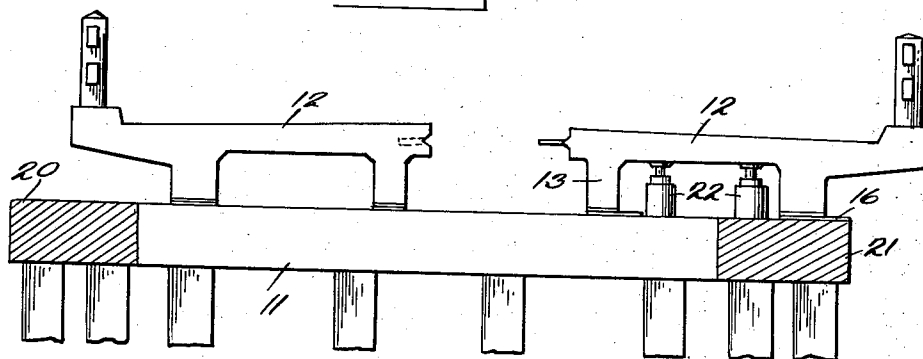


Fig. 6

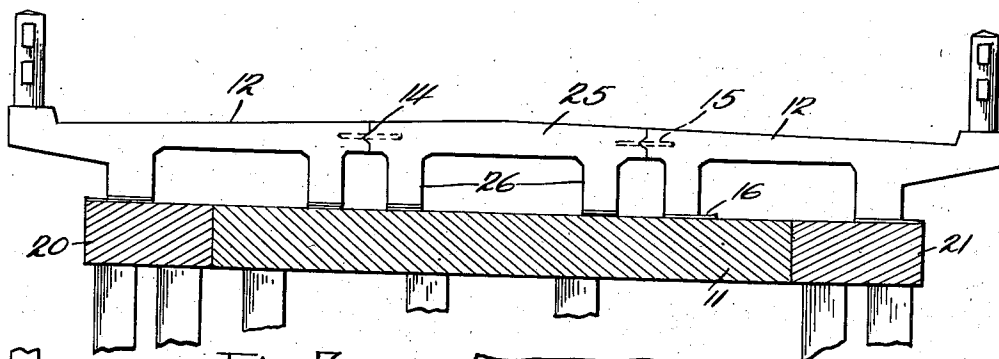


Fig. 7

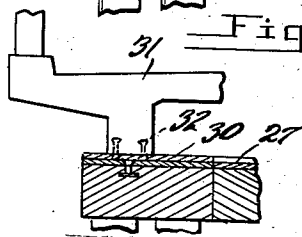
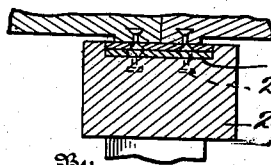


Fig. 8

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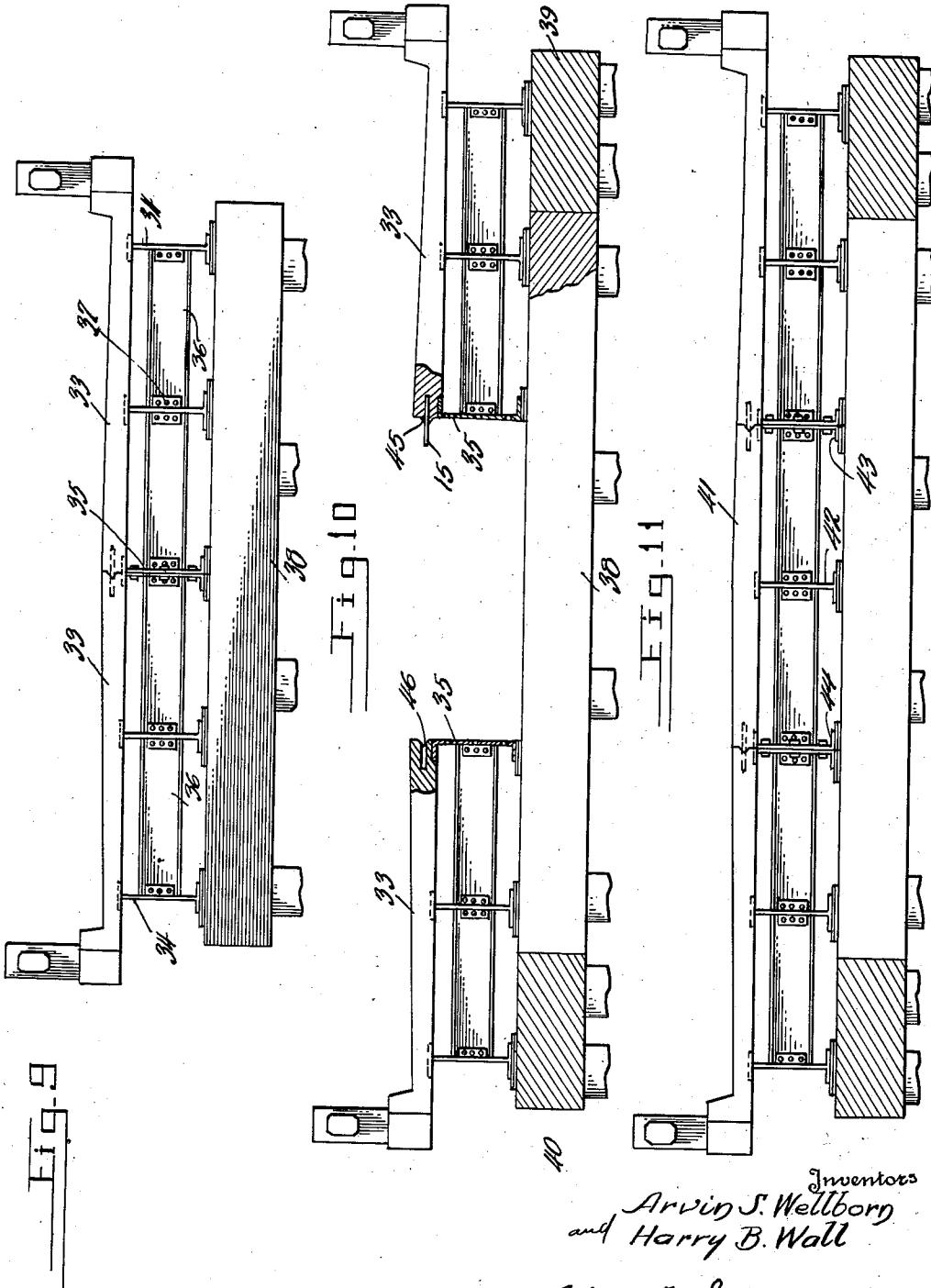
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BRIDGE CONSTRUCTION

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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,287,210

## BRIDGE CONSTRUCTION

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Application November 14, 1939, Serial No. 304,397

14 Claims. (Cl. 72-8)

Our invention relates to bridge construction and has for its primary object the provision of means whereby a bridge may be widened in convenient and relatively inexpensive manner the usual purpose being to increase the number of traffic lanes, as is frequently called for in connection with the widening of a road or street. According to conventional practice bridges are either originally built wider than required, with consequent increased cost, or they are left unchanged when the road or street is widened, thus making a bottle neck in the thoroughfare, or else they are torn down and rebuilt at heavy expense, though sometimes they are widened when the road is widened, also at heavy cost. The American Association of the State Highway Officials is said to have recommended in the past year the widening and rebuilding of almost twenty thousand bridges throughout the United States. According to our invention it is made possible to widen a bridge either at one side or at both sides, to widen it to such an extent as to correspond to the width of the widened roadway, and to do this without building a temporary bridge and without serious interruption to traffic, yet at comparatively little expense.

Our invention also contemplates various features of novelty in the method of widening and in minor expedients for facilitating the work and for perfecting the bridge structure.

Referring to the drawings, which are made a part of this application and in which similar reference characters indicate similar parts:

Figs. 1 to 6 illustrate the operation of widening a bridge in accordance with our invention, said views showing end elevations of a span, with parts shown in section for convenience of illustration.

Figs. 7 and 8 are respectively vertical sections taken transversely and longitudinally of the bridge, showing details of anti-friction means as may be used in connection with our invention to permit ready movement of girders along their supporting means.

Figs. 9 to 11 are end elevations, partly in section, of a bridge span, these figures showing a preferred form of span and indicating successive steps in the widening of a bridge.

In the drawings reference character 10 indicates posts or pillars forming parts of a pier of an original bridge structure, said posts or pillars carrying horizontal members 11 on which the floor structure is supported, this floor structure being shown in Fig. 1 as comprising in each span a pair of separate or separable floor sections or

blocks 12. The materials and the general structural features of the bridge are immaterial to our invention but in this embodiment the bridge is shown as being of the concrete deck girder type, having a concrete floor and concrete girders 13 supporting it on the piers or bents.

Such a floor and girders as shown in Fig. 1 may be poured as a unitary structure so as to make a monolithic structure including, in each section, the deck portion extending halfway across the width of the bridge, one or more hand rails, a sidewalk, curbing and floor beams, etc., or so many of such parts as are desired. A spacer 14, preferably of sheet steel, may be inserted in the mold to form a plane of weakness between the two inner girders, whereby the span sections will separate readily at this plane when the need arises. Preferably, but not necessarily, dowels 15 are provided, which dowels enter slots in the contiguous edges of these floor span sections and help to hold the sections in proper relative position. If the span sections are poured separately the spacer may be inserted when they are assembled or may be omitted altogether and the dowels may be similarly inserted during the assembling process. Preferably one end of each dowel is wrapped or lubricated so as to permit its ready separation from one of the span sections.

In the form of the invention shown in Fig. 1 short anti-friction plates 16 are located on the pier underneath each of the girders of one span section, it being contemplated that this span section will be moved in the process of separating the sections, the anti-friction plates facilitating movement of the section across the pier without damage to the contacting surfaces. These short plates are particularly desirable when dowels are used, since a considerable lateral sliding movement is then required. Obviously such plates may be provided under both span sections if there is likelihood that the bridge will have to be widened at both sides and they may extend over the entire width of the pier if desired.

It will be noted that the two inner girders 13 are narrower than the outer ones. The provision of two girders at the center of the bridge for supporting the adjacent parts of the floor sections, instead of a single girder in cases where center girders have heretofore been designed, requires some additional material but these girders may be made lighter than a single girder and will still provide the necessary strength, thus economizing on material.

Obviously a single girder could be used at the

center of a bridge that is divided into two sections, thus tying the two sections together in such a manner as to transfer the load from one to the other, yet leaving the sections separable.

Girders, in the case of bridges having no center girder, may be spaced in accordance with the usual designs, and the floor slabs may be designed to carry the load at the center of the bridge, the dowel bars and offset center joint transferring the load from one section to the other.

When occasion arises for widening the bridge so as to increase the number of traffic lanes, or for any other reason, the piers or bents will be widened by erecting additional posts, as at 17 and 18 and by adding sections 19 and 20 to the members 11, these sections being securely connected to the members 11. It is of course within the contemplation of our invention to widen the piers or bents in any conventional or desirable manner, the method here illustrated being merely for illustration and not for limitation. Thereafter jacks 21 are located between the span sections in convenient manner, as by placing them between the innermost girders 13 and, in a preferred method of operation, forcing one or both of the span sections outward to a convenient extent over their anti-friction plates 16 to a sufficient extent to withdraw the dowels from one floor section (if dowels are used). Now jacks 22 are placed under a span section and this span section is elevated sufficiently to permit location of rollers 23 underneath convenient parts such as girders 13 and to permit also the placing of suitable tracks 24 on which said rollers may travel. Then the jacks are backed off to lower the span section onto the tracks and it is moved farther outward to the desired position, as shown in Fig. 4, the jacks 22 being then repositioned to elevate the span section sufficiently to permit removal of rollers 23 and rails 24, after which the span section is lowered to position the same on the piers as shown in Fig. 5, the anti-friction plates 16 being preferably replaced under the girders to permit further widening later on, if necessary. We have shown only the widening of a bridge from a two lane width to a three lane width but if a highway is being changed from a two lane width to a four lane width, for example, and if then a bridge on that highway is to be changed correspondingly by widening it at both sides so as to provide an additional traffic lane at each side of the former double lane, a similar operation is performed on the lefthand side or span section, as indicated in Fig. 6. The two span sections being now located at the appropriate distance apart to provide a bridge of the width desired, a new span section 25 is constructed between the original span sections, preferably with spacers 14 and dowels 15 at each lateral edge of the new section to facilitate separation, if and when desired, and to aid in holding the floor surfaces level with one another, as before. The new section of course has its own girders 26, which may or may not be integral with the floor, as in the case of the other span sections and in accordance with the material used or with the construction desired. Anti-friction plates 16 may also be provided below these girders.

It will be understood that the crown of the road may be preserved throughout the bridge by forming the road surfaces on the new section 25 as continuations of the adjacent surfaces of original span sections 12 and that in

general the new bridge may be a duplicate of the old one for all practical purposes, except that it is wider so as to conform to the widening of the road, the new bridge being widened either at one side or at both sides according to whether the road is widened at one side or at both sides.

As one modification of the anti-friction plates previously described there is shown in Figs. 7 and 8 a construction comprising an anti-friction plate 27 located in a slot in the top of the bent or pier 28, this plate extending entirely across the pier or so far as may be deemed necessary, and being anchored to the pier by rivets 29. Plates 30 are anchored to the girders 31 as shown at 32, these plates being relatively short and resting on the plates 27. Preferably the slot or groove in the pier is of sufficient depth to guide the plates 30 and it will be noted in Fig. 8 that a plate is shown as being secured to a pair of longitudinally aligned span sections although it is contemplated that such section will ordinarily be provided with separate plate portions and that the plate portions will be relatively narrow so as to serve as expansion plates that can slide over plate 29 in the expansion of the span sections due to temperature conditions. Of course the other anti-friction plates above referred to also serve as expansion plates.

In the preferred construction of Fig. 9 our slide span bridge is shown as being of the I-beam type with a floor of concrete, although we do not limit ourselves to specific materials. In this form of the invention the floor sections 33, 33 are supported by steel I-beams 34 and by channel irons 35, 35. These channel irons are secured together to hold the span sections in place, one channel iron being attached to the righthand span section and the other to the lefthand span section. The I-beams and channel irons are connected by means of suitable structural iron members such as I-beams 36 and angle irons 37. In other respects the construction may be as in the form previously described or may vary in details in any conventional or desirable manner. In the form of the invention shown in Figs. 9 to 11, Fig. 9 shows an original bridge structure, while Fig. 10 shows the same bridge after the pier 38 has been widened by addition of side sections 39 and 40 and after the two span sections 33 have both been moved laterally outward and placed in desired position, either by a series of steps as previously described or in some other convenient manner. To complete the operation a new section 41 is now constructed between the original sections. For this purpose one or more I-beams 42 are located at suitable positions between the original sections and channel irons 43 and 44 are secured to the respective right and left hand channel irons 35, after which suitable intermediate parts are secured to the channel irons and I-beam or I-beams and the floor section 41 is completed as above described or in other suitable manner. It may be noted that one of each pair of contiguous span sections has a longitudinal rib adjacent the dowel 15 as shown at 45 in Fig. 10 while the other section has a corresponding groove 46 to aid in insuring proper positioning of the floor surfaces of the respective sections, though other means may be provided for this purpose, as will be obvious.

It will be obvious to those skilled in the art that many variations may be made in details of our invention without departing from the spirit

of the invention. Thus, each floor slab may be designed to carry its own weight over the full length of the span and the jacks may be used to lift the floor slab from its supporting beam, thus permitting rails and rollers to be placed between the bottom of the slab and the upper surfaces of the beams, in which case the beams or girders may be fixed to the piers, and another I-beam may be used in place of the bolted channel irons shown in Figs. 9 to 11, additional I-beams being placed over the added parts of the widened pier to support the outer portions of the floor. Instead of using rails and rollers small sets of rolling rods resting directly on the piers may be placed adjacent the bottom plates under the girders of the span section to be moved, thus avoiding the necessity of raising the span section so high, and hoist chains may be utilized by anchoring one end of the chain to a pier or to a dead-man, the other end being anchored to the span section to be moved. Various other methods of separating the bridge sections by pushing or pulling, etc., may be used and other methods of reducing friction may be provided. It should be noted that hand rails or side portions of the structure need not be removed or interfered with according to our invention and the designed crown of the deck need not be interfered with. Successive widening may be undertaken at any future time after the first widening, in the same manner as above described. Bridges of old type may be converted to the slide span type by dividing the floor slabs at or near the center of the bridge in any suitable way and placing girders under the unsupported portions of the floor slab. Thereafter such old bridges may be widened according to the methods above disclosed. All such expedients, as well as others that will occur to those skilled in the art, are within the intended scope of our claims and therefore we do not limit ourselves to what is shown in the drawings and described in the specification but only as required by the state of the prior art.

Having thus fully described our invention what we claim is:

1. A bridge structure comprising one or more spans each made of span sections, at least one of said span sections being movable laterally of the bridge away from the other, each span section comprising longitudinal girders and a floor section supported thereby, and transverse bents or piers supporting said sections, said girders being of the metal I-beam type, the girder spanning the line of separation of the floor sections consisting of channel irons secured together, said channel irons being secured respectively to the respective span sections.

2. A method of increasing the number of traffic lanes on a bridge comprising the steps of providing a bridge floor of sections separable from each other by lateral movement of a section away from the contiguous section, and then constructing another floor section between the two former sections.

3. A method of increasing the number of traffic lanes on a bridge of the type having transverse piers or bents supporting longitudinal floor-carrying girders, comprising the steps of providing longitudinally divided span sections, widening the piers or bents, moving one span section laterally away from the other, and constructing another longitudinal span section between the original span sections.

4. A method of increasing the number of traf-

fic lanes on a bridge of the type having concrete floors with longitudinal girders supported on transverse piers or bents, comprising the steps of providing a span section with a spacer strip extending lengthwise thereof to provide a weakened plane facilitating division of the span into sections, widening the piers or bents, moving a span section laterally away from its coacting section, and erecting another span section between the original sections.

5. A method as in claim 4, the spacer strip being made of metal.

6. A method of increasing the number of traffic lanes on a bridge having metallic I-beam floor-supporting girders mounted on transverse piers or bents, comprising the steps of providing span sections separable on planes extending lengthwise of the bridge, providing a central girder comprising channel irons secured to each other and each forming part of one span section, widening the piers or bents, disconnecting said channel irons, moving one of said span sections laterally away from the other in each span of the bridge, attaching to each of the separated channel irons another like channel iron, and erecting a span section between each pair of spaced-apart span sections, said new span section being secured to the added channel irons of the new span section.

7. A method of increasing the number of traffic lanes on a bridge of the type having transverse piers or bents supporting longitudinal floor-carrying girders, comprising the steps of providing spans each divided lengthwise, widening the piers or bents, elevating said span sections, placing rollers under a span section, moving said section laterally to the position desired, lowering said span section, and constructing a new span section to fill the space between the previous span sections.

8. A method of constructing concrete bridges comprising the steps of providing transverse piers, constructing a floor or riding surface of concrete on said piers with a zone of weakness extending lengthwise of the floor between traffic lanes thereon, and maintaining at least the floor portion forming one such traffic lane separate from the piers so that it can be moved away to permit addition of another floor section between the original sections to provide an additional traffic lane.

9. A bridge comprising piers or bents, and a concrete floor thereon comprising one or more spans having a line of weakness extending lengthwise of the bridge to provide separable longitudinal floor blocks each extending at least from one bent to another, the floor blocks along at least one side of the bridge throughout its length being free to be moved laterally on their piers, whereby a traffic lane may be added at an intermediate zone in the width of the bridge.

10. A laterally extensible bridge structure comprising one or more spans each made up of parallel laterally abutting span sections extending lengthwise of the bridge, piers extending transversely of the bridge and supporting said span sections, each span section comprising longitudinal girders and a floor section supported thereby and abutting the floor section of a laterally adjacent span section, at least one of said span sections being movable laterally upon its piers to permit another span section to be located between said movable span section and the opposite part of the floor.

11. A laterally extensible bridge structure com-

prising transverse piers or bents, and a floor supported by said piers or bents, said floor comprising sections arranged at opposite sides of a line of separation extending lengthwise of the bridge, a section at one side of said line of separation being movable laterally relative to said piers or bents so that another floor section may be constructed between said movable section and the opposite section at the other side of said line of separation, whereby the bridge floor may be widened.

12. A laterally extensible bridge structure comprising transverse piers or bents, a floor supported by said piers or bents, said floor comprising sections each extending at least over the distance between two adjacent piers or bents, laterally abutting floor sections being constructed of concrete in monolithic form and a spacer extending lengthwise of the bridge being embedded in the floor at the dividing line between said sections to provide a plane of weakness between said sections, at least the sections at one side of said plane being movable laterally of said bridge so that another floor section may be located between said movable section and the opposite section for widening the bridge floor.

13. A bridge structure having a laterally ex-

tensible floor consisting of floor portions each extending from end to end of the bridge, and transverse piers supporting said floor portions, at least one of said floor portions consisting of one or more floor sections each supported on a plurality of said piers, said floor sections being movable laterally on said piers away from the adjacent floor portion so that another floor portion may be constructed between said movable sections and said adjacent floor portion for widening the bridge floor.

14. A bridge structure comprising one or more spans each made of span sections, at least one of said span sections being movable laterally of the bridge away from the other, each span section comprising longitudinal girders and a floor section supported thereby, and transverse bents or piers supporting said sections, said piers being of sufficient length to allow for later expansion of the span, said girders being of the metal I-beam type, the girder spanning the line of separation of the floor sections consisting of channel irons secured together, said channel irons being secured respectively to the respective span sections.

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