United States Patent

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[33] Germany
[31] P 16 58 587.8

[54] **APPARATUS FOR CONCRETING MULTIPLE SECTION STRUCTURES, PARTICULARLY BRIDGE SUPPORTS OF REINFORCED OR PRESTRESSED CONCRETE**
9 Claims, 11 Drawing Figs.

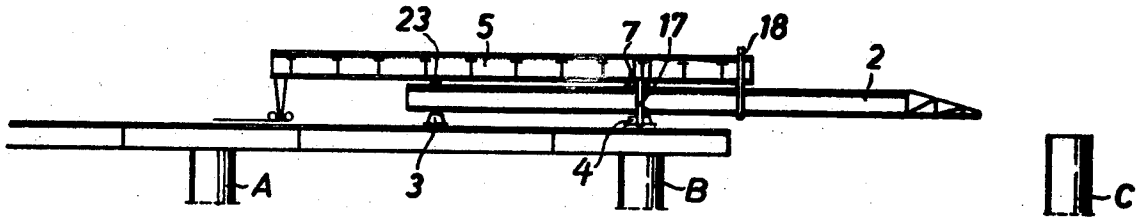
[52] U.S. Cl. 14/1, 25/131.6, 264/33
[51] Int. Cl. E01d 1/00
[50] Field of Search ..... 25/131X; 264/33, 34; 14/1; 52/122—127, 173, 632

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Primary Examiner—Jacob L. Nackenoff
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ABSTRACT: Apparatus for concreting multiple section or multipanel structures such as elevated highway and bridge structures of reinforced or prestressed concrete, comprising two girders that are movable relative to one another, one of which is a scaffold girder and the other an advancing girder that supports the scaffold girder as it is advanced, which girders are generally of the same length and disposed across a section being concreted where they absorb the load together, and which after hardening of the concrete can be shifted to a new section to be concreted, with the advancing girder moving across the new section first while supported on the scaffold girder, whereupon the scaffold girder is moved into position above the advancing girder with its front end supported thereon and the rearward end supported on a frame having rollers.



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SHEET 1 OF 4

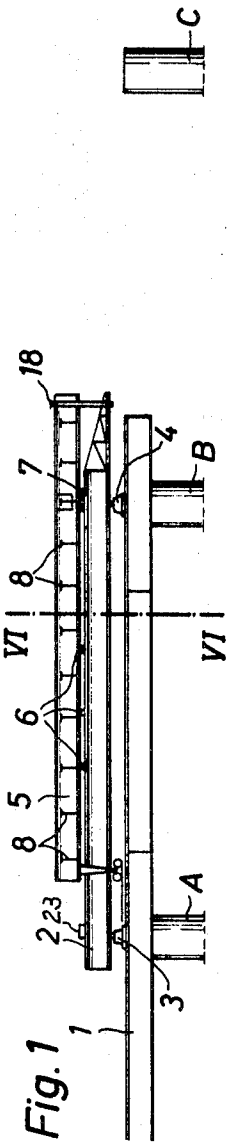


Fig. 1

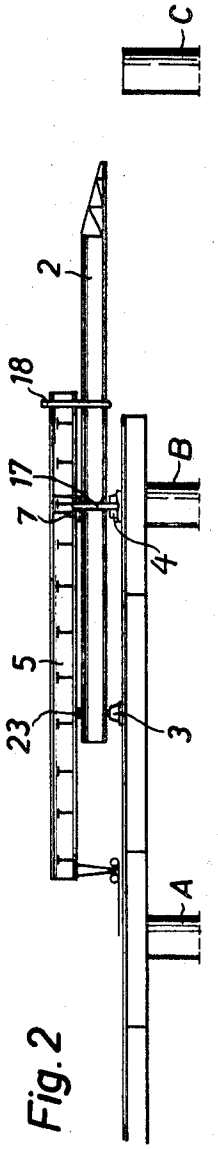
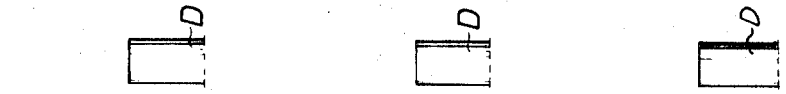


Fig. 2

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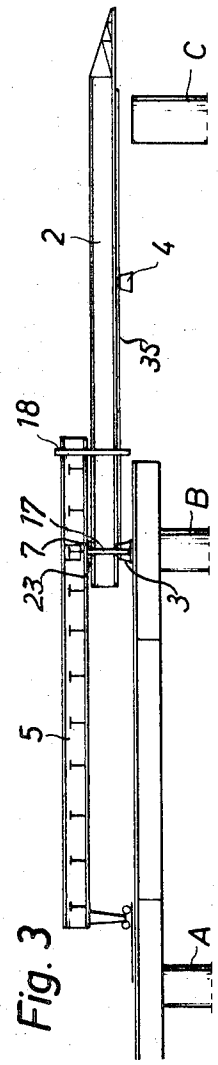


Fig. 3

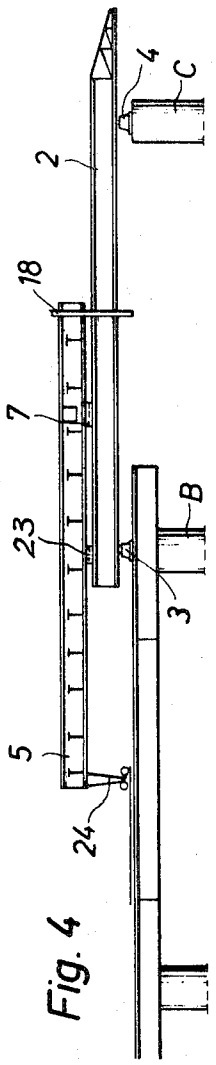


Fig. 4

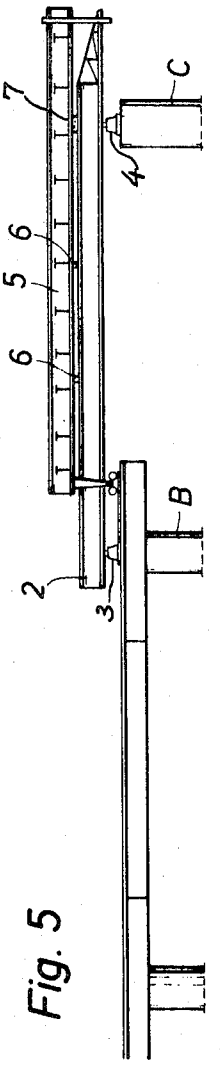
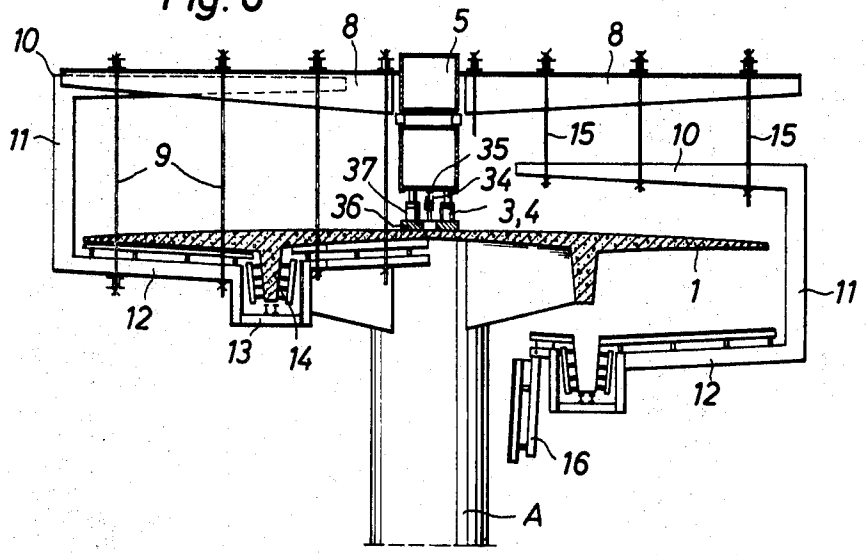


Fig. 5

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Fig. 6



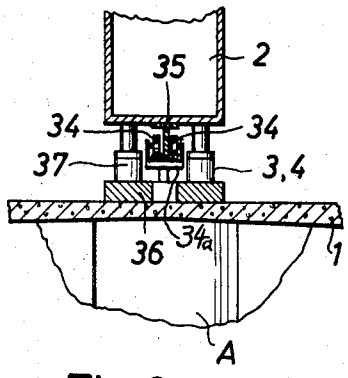


Fig. 6a

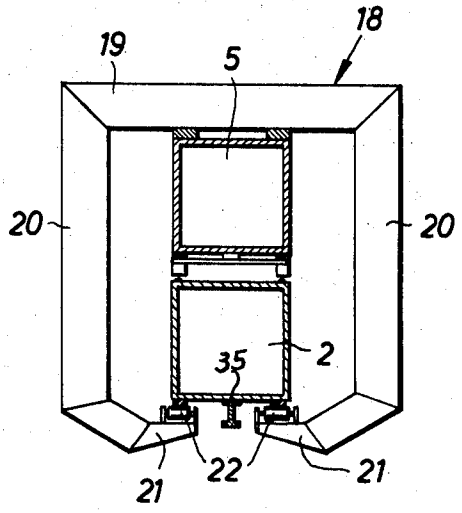


Fig. 7

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Fig.8

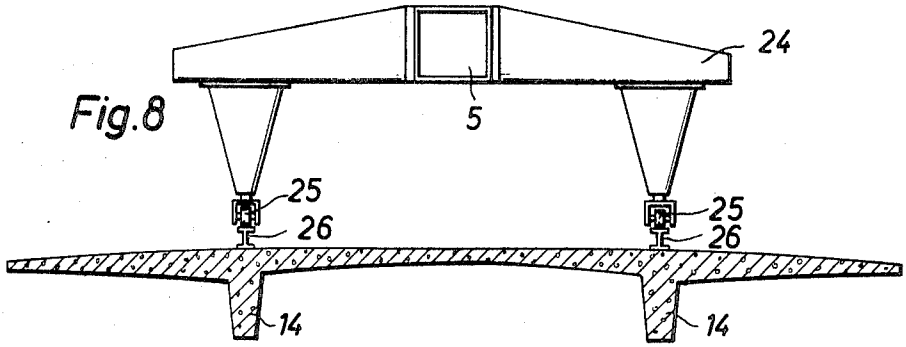


Fig.9

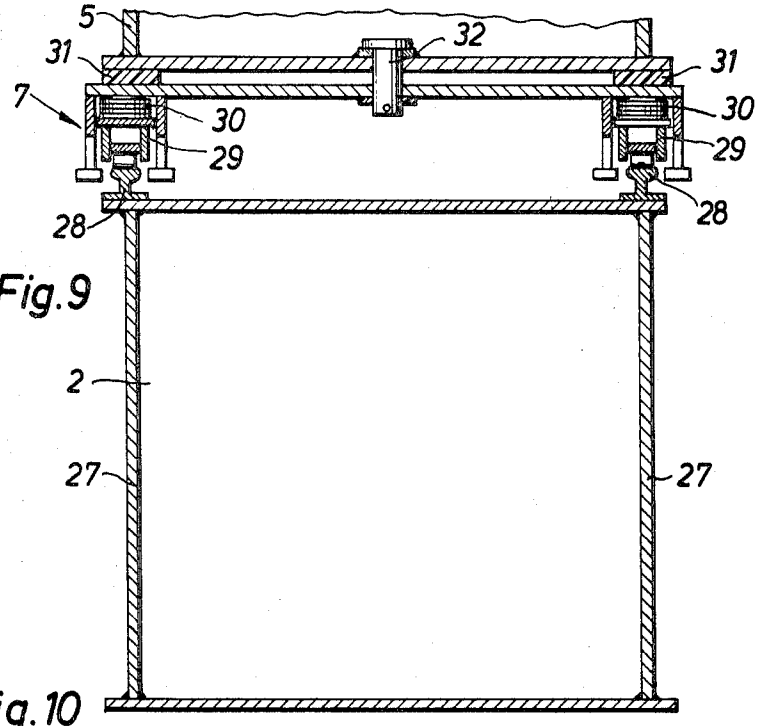
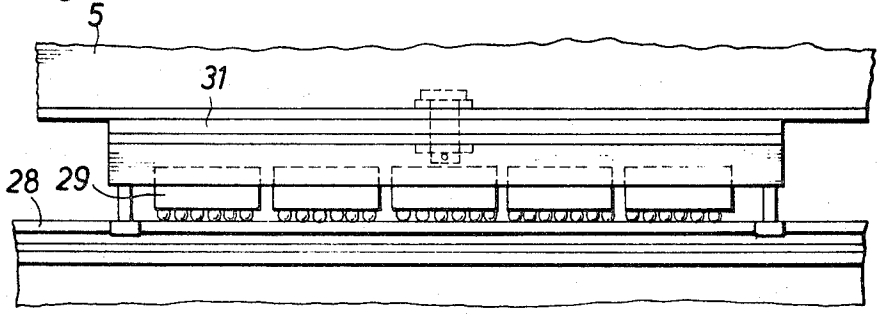


Fig.10



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APPARATUS FOR CONCRETING MULTIPLE SECTION STRUCTURES, PARTICULARLY BRIDGE SUPPORTS OF REINFORCED OR PRESTRESSED CONCRETE

BACKGROUND OF THE INVENTION

The present invention relates to equipment or apparatus for concreting multiple section elevated structures, particularly elevated highways and bridges. More in particular, the invention is concerned with equipment and apparatus for constructing bridge supporting structures of reinforced or prestressed concrete. The equipment comprises two girders that are displaceable or slidable relative to one another, one of which is in the form of a scaffold or casing girder and the other as an advancing girder for supporting the former while it is advanced as the construction progresses.

An arrangement for concreting elongated structural components is known from U.S. Pat. No. 3,003,219 which has at least one travelling or advancing girder that can be displaced longitudinally of the structure in freely cantilevering fashion, as well as one or more scaffold girders which can be connected with the scaffold girder. In this arrangement the travelling or advancing girder is provided above the roadway or surface of the bridge and arranged in a manner that with one part, which cantilevers out over the part of the structure which has already been concreted, it can hold the one end of the scaffolding girders that are held at both ends and disposed below the bridge plate, and that the scaffolding girders are displaceable on the advancing girder and on the concreted part of the structure by at least the distance between two columns.

The advancing girder in that arrangement serves merely for shifting the scaffold girder or girders after completion of a bridge section while the supporting rollers of the scaffold girder run on the advancing girder. In order to be safely advanced onto the roller block or support that has already been prepared on the next column, the advancing girder must span two sections. It serves only for the advancing of the scaffold or casing girder or girders and is idle while the concreting takes place.

The operation of this known arrangement takes place in that after completion of one bridge section the casing girder is advanced first, while it is suspended at its forward end on the advancing girder and at its rearward end on the bridge section already completed, and that then the advancing roller is advanced to cantilever out over the length of an entire section to be supported on the next following column.

While recognizing the principle of using mutually displaceable girders as advantageous for concreting multisection bridge supporting structures, it is an object of the invention to provide a possibility to decrease the expenses of the apparatus which can merely be utilized for concreting operations.

THE INVENTION

The problem is solved in accordance with the invention, in that the two girders, the scaffolding girder and the advancing girder, which during the concreting operation until the hardening of the concrete are located in the same bridge section, are substantially of equal length spanning a bridge section and are so constructed and arranged with respect to one another, that they can be connected with one another in a sense of absorbing the structural loads together and that this connection can be released for the subsequent advancing of the apparatus to the section of the bridge to be produced next.

For this purpose the scaffold girder is suitably disposed above the advancing girder which is mounted on the bridge roadway and supported thereon during the building operation, while for the displacing or advancing condition the scaffold girder is first firmly supported on the bridge plate or panel, and the advancing girder is adapted to ride on it, and then the advancing girder in the new position rests firmly on the bridge panel at one end and on the next following column at the other end, and the scaffold girder can ride with the forward end on that girder and with its rearward end on the bridge roadway by means of a support provided with rollers.

The basic concept of the apparatus in accordance with the invention is considered to be that for pure displacement problems, for which as a consequence of the absence of structural loads a smaller carrying capacity may be tolerated, they can each be shifted one relative to the other, while during concreting, i.e., at a time when no shifting movement occurs but when big loads must be absorbed, both girders are disposed in the same bridge section and take part in absorbing the structural loads.

Owing to its particular manner of construction the equipment in accordance with the invention provides the further advantage that due to the shorter length of the advancing girder as compared to that of the known arrangement, the same can be swung more readily in horizontal directions, so that also the construction of curved or angularly offset bridges is facilitated.

For supporting the scaffold girder on the advancing girder for construction operations, a plurality of equally spaced hydraulic presses are suitably distributed along the longitudinal extent of the girder.

The travelling or advancing girder itself is arranged to ride in a suspended frame that is firmly mounted to the forward end of the scaffold girder while it is supported at its rearward end against the bottom of the scaffold girder by way of intermediate rollers. The hanging frame may only have two ledges in lieu of a lower connecting bar, which are rigidly connected with the lateral or vertical bars, which ledges are provided with riding rollers for carrying the advancing girder.

The scaffold girder as well as the advancing girder are suitably in the form of torsion resisting box girders.

The scaffold girder is provided on both sides with freely cantilevering transverse beams for mounting the casings for the bridge structure which are suspended from the beams. Generally U-shaped frames are provided as casing carriers, whose upper horizontal leg is disposed parallel to one of the transverse beams to which it is connected in a manner to be adjustable in height, while the vertical connecting bar completes the connection externally of the roadway panel with the leg carrying the casing below the panel.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages and features of the invention will become apparent from the following description of an embodiment of the invention illustrated in the accompanying drawings, in which:

FIGS. 1 to 5 illustrate in schematic side views the construction of a bridge section in different phases,

FIG. 6 is a cross section taken along line VI–VI in FIG. 1,

FIG. 6*a* shows a detail of FIG. 6 to an enlarged scale,

FIG. 7 shows the front support of the advancing girder on the scaffold girder,

FIG. 8 shows the rear travelling mechanism of the scaffold girder supported on the roadway panel,

FIG. 9 is a section, and

FIG. 10 is a side view of the forward riding mechanism between the scaffold girder and the advancing girder.

DESCRIPTION OF A PREFERRED EMBODIMENT

FIGS. 1 to 5 illustrate schematically side views of the building procedure for a part of a superstructure 1 disposed between the supports or columns A and B of a multiple-section bridge structure and the subsequent displacing or sliding of the apparatus in accordance with the invention into the bridge section disposed between the supports B and C.

In the stage of construction illustrated in FIG. 1 the apparatus is in that position in which it carries the concrete loads of the bridge section bounded by columns A and B. For this the advancing girder 2 located at the bottom is supported on the runway of the bridge by two supporting jacks or blocks 3 and 4 and each, more particularly, in the area of a column A or B. The scaffold girder 5 which is of approximately the same length as the advancing girder 2 is supported by load distribut-

ing means in the form of hydraulic presses 6 arranged along its bottom side, and a carriage means 7 upon the upper surface of the advancing girder 2. Inasmuch as the scaffold girder 5 carries the frames or casings with the concrete loads on the transverse beams 8, which cantilever laterally outward from the girder to which they are secured, both girders cooperate at this stage of construction to absorb the structural loads.

In the cross section through the apparatus in accordance with the invention reflected by FIG. 6 the left half shows that condition in which the structural loads rest completely on the framework or casings. In the transverse beams 8 which freely cantilever out transversely from the scaffold girder 5 U-shaped frames are suspended by means of the suspension members 9. These frames are composed of a top leg 10 extending parallel to the transverse beams 8, a vertical connecting yoke 11 and a bottom horizontal leg 12. The invention is here explained with reference to the example of a plate beam. For that reason the leg 12 has a downwardly extending bight 13 for receiving the casing for the longitudinal girder 14 of the bridge supporting structure.

In the condition of construction, i.e., when the casing must carry the concrete loads, the suspension members 9 establish a direct connection between the transverse beams 8 and the lower frame legs 12. When the casing is lowered for advancing the casing girder, then shorter suspension members 15 are inserted which engage the upper legs 10 of the frames. At the same time the inner part 16 of the casing platform can be flapped or tilted over in order to travel past the column A. In this condition the entire casing structure is freely suspended on the transverse beams 8 so that the scaffold girder is freely displaceable.

With the lowering of the casing just described first the scaffold girder 5 is supported upon the bridge runway above the column B by a forward auxiliary support 17. Then the supporting means 4 of the advancing girder is released and the load of the girder is transferred at its forward end to the carrying capacity of the supporting frame 18 secured to the scaffold girder 5. This supporting frame 18 is illustrated in FIG. 7 in a front view of the arrangement in accordance with the invention. It has an approximate U-shaped configuration, is supported by means of an upper beam or bar 19 upon the scaffold girder 5 and is connected thereto. The laterally suspended bars 20 have connected thereto at their lower ends supporting brackets 21, the top side of which is provided with rollers 22 for supporting the advancing girder 2 at its forward end.

By journaling the advancing girder 2 upon these rollers 22 and by its support at the rearward roller block 3, the load on which is eased more and more as the advancing towards the column C progresses in favor of a roller bearing 23 which is disposed between the rearward end of the advancing girder 2 and the lower edge of the scaffold girder 5, the advancing girder is finally moved into the position above the column C as illustrated in FIG. 3. In this condition the advancing girder cantilevers out freely from the column B; the cantilever moment is absorbed solely by the supporting frame 18 and the support 23 against the bottom side of the scaffold girder 5 which is somewhat obscure in FIG. 3. The scaffold girder 5 must be anchored for this purpose at its rearward end in the surface of the runway. At this stage of construction the forward support 4 is simultaneously advanced to be supported on the column C.

The supporting blocks 3 and 4 on which the advancing girder 2 is supported during construction operations are provided with hydraulic presses 37. These presses are located in a frame 36. In the advancing condition of the advancing girder 2 which hangs on the scaffold girder 5 during this condition, this frame can be displaced by means of rollers 34 in a frame 34a while suspended on a riding rail 35 over the bridge section that has not yet been concreted onto the next column C. The riding rail 35 is secured to the advancing girder 2.

When the advancing girder 2 has been moved to its new position above the columns B and C, the forward auxiliary support 17 is removed, the riding rollers 22 on the supporting frame 18 are lowered in order to be free of the advancing girder, and the rigid connection in the area of the rearward support 24 of the scaffold girder 5 is removed. The scaffold girder 5 is then advanced by means of the rollers 25 arranged at the lower end of the portal shaped support frame 24, which rollers rest on the rails 26 above the longitudinal girders 14 of the bridge and by way of the carriage means 7 between the lower edge of the scaffold girder and the upper edge of the advancing girder 2.

The carriage means 7 is illustrated more in detail in FIGS. 9 and 10. FIG. 9 here is a cross section through the scaffold girder 5 and the advancing girder 2, while FIG. 10 is a side view of the travelling mechanism. Above the web sheets 27 of the box-shaped advancing girder 2 rails 28 are provided on which roller blocks 29 may roll, which consist of a plurality of rollers mounted in suitable housings with track followers. These roller blocks are provided with disc springs 30 at the top. Between the travelling mechanism 7 and the bottom side of the scaffold girder 5, sliding bearings 31 of plastic material, for example Teflon, are located which in cooperation with a pivot pin or stud 32 permit the mutual rotary displacement between the advancing girder 2 and the scaffold girder 5 in the manner of a rotating frame. This arrangement provides the possibility of constructing bridges by means of the apparatus in accordance with the invention which are located at curves or bends in a better and simpler manner.

After the scaffold girder 5 has assumed the position above the columns B and C as illustrated in FIG. 5, the hydraulic presses 6 are again inserted for supporting it with respect to the advancing girder 2 so that the casing can again be raised to the suitable position to receive concrete and to be loaded.

Having now described my invention with reference to the embodiment illustrated in the drawings, what I desire to protect by Letters Patent of the United States is set forth in the appended claims.

I claim:

1. Apparatus for concreting multiple-section structures, particularly elevated highway and bridge structures of reinforced or prestressed concrete, said apparatus comprising two girders that are displaceable relative to one another, one said girder being an advancing girder and the other said girder being a scaffold girder supported on said advancing girder during advancing operations, each of said girders being substantially of a length corresponding to a section of the structure being built and both being located together in the same section of the structure and jointly carrying the load during the concrete pouring and hardening stage, and load distributing means intermediate said girders distributing the load therebetween, said load distributing means being releasable to permit movement of the girders separately to a new section of the structure and retaining said scaffold girder during construction operations above said advancing girder; and supporting frame means operative during the advancing stage to support said scaffold girder on the roadway and to support said advancing girder movably on said scaffold girder, jack means operative to support said advancing girder in a new position at its rearward end on the roadway and at its forward end over a succeeding column in a series, girder support means for supporting said scaffold girder on the rearward end of said advancing girder and means including a support having rollers provided at the rearward end of said scaffold girder operative to ride on the roadway while moving said scaffold girder into position above said advancing girder.

2. Apparatus in accordance with claim 1, where said support means for retaining said scaffold girder include a plurality of hydraulic presses disposed at equally spaced distances along said girders.

3. Apparatus in accordance with claim 1, where said supporting frame means include a suspended frame depending from the forward end of said scaffold girder and movably supporting said advancing girder and rollers intermediate said advancing and said scaffold girder slidably supporting the rearward upper end of said advancing girder against said scaffold girder.

4. Apparatus in accordance with claim 3, where said suspended frame comprises downwardly extending bars and supporting brackets extending inwardly from said bars toward one another, and rollers on said brackets for movably supporting said advancing girder.

5. Apparatus in accordance with claim 1, where said scaffold girder and said advancing girder are torsion resisting box girders.

6. Apparatus in accordance with claim 1, where said support having rollers is in the form of a portal frame having legs on which said rollers are mounted.

7. Apparatus in accordance with claim 1 including transverse beams cantilevering outwardly from said scaffold girder

and suspension members supporting casting frames or shells on said beams and thereby on said girders.

8. Apparatus in accordance with claim 7 comprising U-shaped frames, each having an upper horizontal leg adjustably supported on one of said beams and parallel thereto, a vertical connecting yoke and a bottom horizontal leg supporting casting frames or casings, said vertical yoke being arranged in a location away from the panel of the roadway being constructed.

9. Apparatus in accordance with claim 1 including a pivot pin disposed in operation intermediate said scaffold girder and said advancing girder.