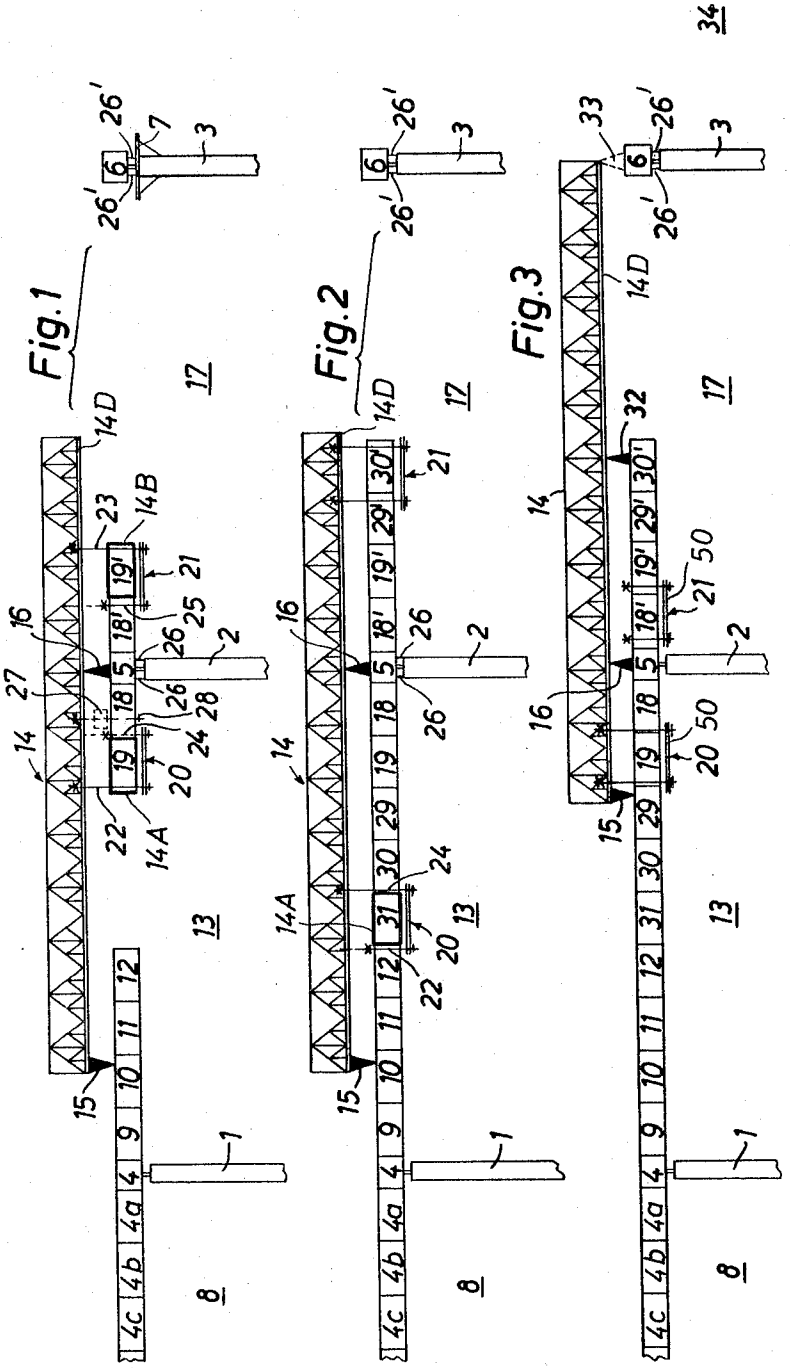
Jan. 17, 1967 A. MANTSCHEFF ETAL 3,299,191

METHOD AND MEANS FOR ERECTING BRIDGES

Filed Dec. 17, 1963



INVENTORS:
ALEXANDER MANTSCHEFF
HANS WITTFOHT
HELMUT OCHSENBAUER
BY Michael S. Striker
their ATTORNEY

United States Patent Office 3,299,191 Patented Jan. 17, 1967

3,299,191

METHOD AND MEANS FOR ERECTING BRIDGES

Alexander Mantscheff, Rodenkirchen, and Hans Wittfoht and Helmut Ochsenbauer, Cologne, Germany, assignors to Polensky & Zollner, Cologne-Bayenthal, Germany

Filed Dec. 17, 1963, Ser. No. 331,991
Claims priority, application Germany, Dec. 21, 1962, P 30,840
18 Claims. (Cl. 264—34)

The present invention relates to bridges in general, and more particularly to an improved method and means for erecting multispan bridges. Still more particularly, the invention relates to erection of bridges whose spans consist of sections, preferably of sections made of reinforced or prestressed concrete.

It is an important object of the present invention to provide a novel method of erecting the superstructure of multispan bridges in a time saving manner and in such a way that the building of spans is not influenced by the configuration of terrain which is bridged by the spans.

Another object of the invention is to provide a method of the just outlined characteristics according to which the spans may be assembled and mounted on their supports without necessitating the provision of a staging which extends from the one to the other end of the bridge, and according to which the spans may be assembled without necessitating the erection of temporary piers, abutments and similar supports.

A further object of the invention is to provide a method of erecting multispan cantilever bridges which may be practiced with equal advantage when the spans are assembled of prefabricated sections or when the spans consist of sections which are poured or otherwise built at the locale of actual use.

An additional object of the invention is to provide a method according to which the spans may be assembled in such sequence that the entire superstructure of the bridge may be completed within exceptionally short periods of time and which may be practiced with the help of simple, lightweight and easy-to-handle temporary staging.

A concomitant object of the invention is to provide improved means or arrangements, including a staging, for practicing the novel method and to construct the staging in such a way that it may facilitate delivery of construction materials to the point or points of use.

Still another object of the invention is to provide a staging which allows for simultaneous construction of two spans to thereby reduce the time necessary for completion of the superstructure in a multispan bridge, and whose length need not substantially exceed the length of the longest span so that such staging may be readily shifted to to different positions as the construction of the superstructure proceeds.

An additional object of the invention is to provide a staging which may be used in cooperation with the supports of a partially erected bridge to facilitate rapid, convenient and economical completion of the spans.

Still another object of our invention is to provide a novel bridge erecting arrangement including a staging which may be mounted above, below or at the level of the spans and which enables the crew to assemble the sections with utmost precision.

With the above objects in view, one feature of our invention resides in the provision of a method of erecting multispan bridges wherein each span preferably consists of a plurality of sections made of reinforced or prestressed concrete and arranged end-to-end. The method comprises the steps of building a support intermediate the ends of the bridge to be erected, mounting on the support an elongated temporary staging in such a way that the staging forms a cantilever whose arms extend from the support toward

both ends of the bridge whereby the staging enables the crew to work in the fields at the opposite sides of the support, and assembling portions of two spans in a simultaneous operation by working on the staging from the support in directions toward the respective ends of the bridge.

In accordance with a more specific feature of our invention, the bridge may be erected in the following manner: The crew erects at least two spaced supports at least one of which constitutes a pier and is located intermediate the ends of the bridge to be erected. In the next step, the crew assembles a portion of a first span by joining a plurality of sections in a direction from the other support toward the pier so that the thus completed portion of the first span bridges a portion of the field between the pier and the other support. The staging is then mounted on the pier in such a way that one of its arms bridges the gap between the pier and the completed portion of the first span whereas its other arm extends beyond the pier in a direction away from the other support so that the staging enables the crew to work in the fields at the opposite sides of the pier. In the next following step, the crew completes the first span by working on the staging from the pier toward the other support and simultaneously assembles a portion of a second span by working on the staging from the pier in a direction away from the other support.

If the bridge is rather long and comprises at least one additional pier between the first mentioned pier and the respective end of the bridge, the crew shifts the staging endwise so that it is supported by the additional pier and that one of its arms bridges the gap between the additional pier and the completed portion of the second span whereas the other arm of the staging extends from the additional pier in a direction away from the first mentioned pier. The staging is now in a position to enable the crew to complete the second span by working from the additional pier toward the completed portion of the second span to simultaneously complete at least a portion of a third span by working from the additional pier in a direction away from the second span.

The same procedure is repeated if the bridge comprises one or more supports between the additional pier and the respective end thereof, i.e., the staging is shifted endwise onto each consecutive support and the crew works in directions from each consecutive support toward the ends of the bridge so that portions of two spans may be assembled in a simultaneous operation. It is also possible to work with two stagings so that the superstructure is erected from both ends of the bridge.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved method itself and the arrangement for practicing the same, however, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of the accompanying drawings, in which:

FIG. 1 is a schematic elevational view of a partially completed cantilever bridge which is erected in accordance with the method of our invention;

FIG. 2 is a similar elevational view and illustrates the bridge in a further stage of completion; and

FIG. 3 is another elevational view and shows the bridge in a third stage of completion.

Referring to the drawings, and first to FIG. 1, there is shown a partially erected bridge which comprises a plurality of spaced supports including a centrally located pier 2 and two outer piers 1, 3. The bridge comprises four spans 8, 13, 17, 34 and its abutments (not shown in the drawings) are respectively located to the left and to the right of the supports 1 and 3. In this description, the expression "support" is intended to denote a pier or an abutment.

The bridge of FIG. 1 is erected as follows: In the first step, the crew erects the abutments and the supports 1, 2 and 3. In the next step, sections 4, 5, 6 are mounted at the upper ends of the respective supports. In the illustrated embodiment, the sections 4, 5, 6 consist of reinforced or prestressed concrete and may be produced in situ, i.e., in concrete casings or forms at the locale of use. The manner in which the sections may be poured and secured in position is illustrated in the right-hand part of FIG. 1. Thus, the support 3 carries at its upper end a temporary cantilever platform 7 which enables the crew to pour the section 6 and to locate it at the upper end of the support 3.

The span 8 between the support 1 and the left-hand abutment is already completed, and this span consists of a series of concrete sections 4*a*, 4*b*, 4*c* . . . assembled end-to-end and extending to the left of the section 4. It is further to be noted that the crew has completed the left-hand portion of the second span 13 which extends between the supports 1 and 2. This left-hand portion of the span 13 comprises concrete sections 9, 10, 11, 12 which are assembled end-to-end and extend from the section 4 in a direction toward the support 2.

In order to complete the span 13 and to assemble a portion of the third span 17 which latter extends between the supports 2 and 3, the crew resorts to a temporary staging 14 here shown as comprising an elongated frame or truss whose length exceeds substantially the distance between the sections 5 and 12. In the illustrated embodiment, the staging 14 comprises an overhead truss forming a cantilever one arm of which rests on the sections 9–12 of the partially completed span 13 and the other arm of which extends beyond the support 2 in a direction toward the support 3, i.e., across a portion of the field of the span 17. A knife edge bearing 16, mounted on the section 5, supports an intermediate portion of the staging 14 and the left-hand end of this staging carries a similar bearing 15 which rests on one of the sections 9–12. It is normally of advantage to connect the bearing 15 with the staging 14 so that this bearing may be shifted, when the staging is moved endwise to another position, for example, to the position shown in FIG. 3.

Once the staging is located in the position of FIG. 1, the crew may proceed with completion of the span 13 and simultaneously assembles and completes the left-hand portion of the span 17. In the first step, two sections 18, 18′ are poured and then secured to the section 5 at the opposite sides thereof so that the section 18 constitutes the rightmost element of the span 13 and the section 18′ constitutes the leftmost element of the span 17. The crew then proceeds to pour the sections 19, 19′ which are secured to the sections 18, 18′ in the next following operation. The sections 18, 18′, 19, 19′ are formed in frames or casings 14A, 14B (shown by heavy lines) which are mounted on working platforms 20, 21 suspended from the staging 14. The lower part of this staging comprises guideways or rails 14D for dollies or similar carriages (not shown) which may travel in the longitudinal direction of the staging and which may carry heavy rods 22, 23, 24, 25 or similar attaching means to support the working platforms 20, 21. The platform 20 is suspended on rods 20, 24 and the platform 21 is suspended on rods 23, 25. For example, each or some of these rods may be provided with external threads to mesh with suitable spindle nuts which are rotated by hydraulic adjusting apparatus mounted on the staging 14 and serving to adjust the position of the platforms 20, 21. The rods 22, 23 are provided with threads and respectively carry the outer ends of the platforms 20, 21, i.e., such ends which are more distant from the support 2. The rods 24, 25 may but need not be directly secured to the staging 14; in FIG. 1, these rods are respectively fixed to the sections 18, 18′ by means of suitable traverses or straps (not shown). Consequently, the staging 14 merely takes up

about one-half of the total weight of the sections 19, 19′ and the remainder of the weight of these sections is taken up by the support 2 through the intermediary of sections 5, 18, 18′ which are already mounted thereon.

It is preferred to begin the pouring of sections 19, 19′ at the ends thereof which are more distant from the sections 18, 18′, i.e. to proceed in a direction toward the support 2. This is of particular advantage when the rods 24, 25 are fixedly secured to the previously completed sections 18, 18′ because the deformation of the staging 14 (if any) cannot affect the accuracy of connection between the sections 18, 19 and 18′, 19′. This will be readily understood since, if the inner ends of the working platforms 20, 21 are rigidly secured to the permanently installed sections 18, 18′ the inner ends of the casings 14A, 14B will remain properly aligned with the sections 18, 18′ even if the staging 14 undergoes some deformation under the weight of the sections 19, 19′, platforms 20, 21 and casings 14A, 14B. In other words, the deformation of staging 14 affects little or does not affect at all the accuracy of connection between a completed, permanently secured section (18 or 18′) and the inner end of a freshly completed section (19 or 19′). Eventual deformation of the staging 14 is compensated for by adjustments in the axial position of the rods 22, 23 so that the sections 19, 19′ may be connected to the sections 18, 18′ with utmost accuracy. Thus, the rods 22, 23 serve to support and to adjust the angular position of the platforms 20, 21 (in the event that the staging 14 undergoes some deformation) in such a way that each freshly completed section may be placed end-to-end and in face-to-face abutment with the previously completed section. The rods 22–25 may be replaced by hydraulic presses or other combined attaching and adjusting means.

Owing to the fact that the spans 13 and 17 are erected simultaneously and in opposite directions, as seen from the support 2, the load upon the staging 14 is distributed substantially evenly at both sides of the bearing 16 so that the staging may be of lightweight construction. In use, the staging 14 resembles a cantilever beam whose arms are subjected to balanced loads whereby the bearing 15 subjects the left-hand portion of the span 13 to minimal stresses. Consequently, and if the sections of the spans 8, 13, 17 are of average length and weight, the staging 14 may comprise a lightweight truss which is easy to shift and which may be constructed at reasonable cost. On the other hand, and especially if the bridge is to be erected without delay, a reasonably heavy staging will allow for assembly of exceptionally long sections, for example, with a length of 10–20 meters. It is obvious that a bridge whose spans consist of long concrete sections will be erected much faster than a bridge utilizing shorter sections, mainly because little time is spent in allowing concrete to set when the sections are poured on the platforms 20, 21, and because less time is spent for connecting the sections to each other.

Another important advantage of our method is that the bridge may be erected with the help of a comparatively short staging. Thus, the overall length of the staging 14 need not exceed 1.2 times the length of the span 13 or 17. In FIG. 1, the length of the staging 14 exceeds the length of the span 13 by about 25 percent. This is possible because the sections 18–18′, 19–19′ etc. are assembled from opposite sides of that support (2) which carries the staging. Such method brings about the aforementioned advantage that the completed portion of the span 13 (sections 9–12) is subjected to minimal stresses. The bearing 15 merely transmits such stresses which are due to the fact that the length of the staging between the bearings 15, 16 exceeds the distance between the bearing 16 and the right-hand end of the staging as well as any such stresses which are due to eventual imbalance between the weights of the platforms 20, 21. Also, such highly advantageous distribution of loads remains unchanged when the platforms 20, 21 are moved

away from the support 2 upon completion and attachment of sections 18–18', 19–19' etc. It will be readily understood that all movements of the platforms 20, 21 longitudinally of the rails 14D may be synchronized in such a way that the platforms remain mirror symmetrical with reference to the support 2.

In order to stabilize the section 5, we often prefer to provide temporary fastening means 26 which secure this section to the upper end of the support 2 in such a way that the section 5, the sections 18, 18', 19, 19' and the bearing 16 will be held against tilting. Alternatively, or in addition to the provision of such fastening means 26, the cantilever including the sections 5, 18, 18', 19, 19' may be stabilized by ballast 27 secured to heavy rods 28 which connect the section 18 with the staging 14 at the left-hand side of the bearing 16 so that the cantilever is held against tilting and eventual overturning in a clockwise direction. The ballast 27 may be omitted if the bridge is erected in such a way that the combined weight of the sections 18, 19 exceeds the combined weight of the sections 18', 19', i.e., if the cantilever consisting of the sections carried by the support 2 tends to tilt in a counterclockwise direction, as viewed in FIG. 1.

The provision of stabilizing means, such as the fasteners 26, ballast 27 and rods 28, is of particular advantage when the spans are very long so that the cantilever formed by the sections extending to both sides of a support is very heavy.

Once the sections 19, 19' harden (or are properly stressed if their material is prestressed concrete), the platforms 20, 21 are separated therefrom and the rods 22, 24 and 23, 25 are shifted away from each other by moving the respective dollies along the rails 14D. The platforms 20, 21 are arrested in requisite positions to to permit completion of the next pair of mirror symmetrical sections 29, 29' which are shown in FIG. 2 and which are subsequently secured to the sections 19, 19'. Of course, during completion and attachment of the sections 29, 29' the rods 24, 25 are respectively fixed to the sections 19, 19' and the ballast 27 may be shifted to the left, as viewed in FIG. 1 or 2. The same procedure is then followed preparatory to, during, and after completion of the next pair of sections 30, 30', shown in FIG. 2, which are respectively secured to the sections 29, 29'.

Upon completion and attachment of the section 30, the platform 20 is shifted into the gap between the sections 12 and 30 so that the crew may complete a further section 31. FIG. 2 illustrates this section in the casing 14A with the rods 22, 24 respectively secured to the sections 12, 30 to insure that the section 31 is properly aligned with these sections and may be fixed thereto to complete the span 13. If desired, the rods 24 may be fixed to the staging 14 while the crew assembles and secures the section 31 in the position of FIG. 2. The rods 22 may be secured to the section 12 and/or to the staging 14. The section 31 actually constitutes a short suspended span between the arms 9–12 and 18–19, 29, 30 of the span 13.

As a rule, the length of the rods 22, 23, 24, 25 is selected in such a way that each may be secured to a fixed section or to the dollies on the staging 14.

During completion and attachment of the section 31, the platform 21 is preferably detached from the section 30' to constitute a counterweight at the right-hand end of the staging 14.

FIG. 3 illustrates a further step in the erection of the bridge. The staging 14 has been shifted endwise so that the bearing 15 rests on the section 29 (i.e., at a point close to the support 2) and that the right-hand end of the staging overlies the section 6 on the support 3. In order to reduce the overall weight of the staging during such endwise movement toward the support 3, the platform 21 is preferably disconnected from the staging and is carried by one of the sections which constitute the completed left-hand portion of the span 17 (e.g., the platform 21 may be carried by the section 18' which is close to the support 2). The platform 20 has been moved all the way to the bearing 15 and constitutes a counterweight to balance the staging during shifting. Actual transfer of the staging 14 from the position of FIGS. 1 and 2 to that of FIG. 3 is effected with the help of suitable hydraulic presses, winches or other types of apparatus whose construction forms no part of our invention. In its new position, the right-hand arm of the truss rests on a bearing 33 which is carried by the section 6. This section is then held against tilting by temporary fastening means 26' in the same way as described in connection with the section 5. The fastening means 26 may be detached from the section 5 as soon as the span 13 is completed. An intermediate portion of the staging 14 rests on a bearing 32 which is placed on the section 30', i.e., on a section which is close to the end of the completed portion of the span 17 and which is distant from the bearing 16. The bearings 15, 33 carry the actual weight of the staging whereas the bearings 16, 32 mainly hold the staging against excessive deformation.

The platform 21 is then reattached to the staging 14 and is moved to a position next to the section 30' so that the crew may complete the span 17 by working from the section 30' toward the section 6 or vice versa. Of course, it is equally possible to work simultaneously in two directions, namely, from the section 30' and from the section 6 so that the remaining sections of the span 17 may be assembled in half the time.

The platforms 20, 21 are preferably provided with pivotable bottom walls 50 so that they may bypass the supports. For example, when the bottom wall 50 of the platform 20 is pivoted downwardly, it enables the platform 20 to pass along the support 2 and to be moved into the field of the span 17 so that it may be used with the platform 21 in completing the right-hand portion of this span.

Since the bridge of FIGS. 1 to 3 comprises an additional span 34 shown to the right of the support 3, the staging 14 is preferably shifted to the right and beyond the poistion of FIG. 3 so that the crew may complete the right-hand portion of the span 17 simultaneously with assembling the left-hand portion of the span 34 in the same way as described in connection with FIG. 1. Thus, the bearing 15 then comes to rest on the sectoin 29' or 30' and the right-hand arm of the truss extends beyond the support 3. The staging is now ready to allow for simultaneous erection of two spans (17 and 34) beginning at the section 6 and working from both sides of this section toward the section 30' and toward the right-hand abutment (not shown) which is to hold the right-hand portion of the span 34. The platform 21 is then moved to the right and beyond the support 3 and the platform 20 is moved in position next to the left-hand end of the section 6 so that the two platforms are ready to permit completion and attachment of two sections corresponding to the sections 18, 18' of FIG. 1.

It is to be noted that the staging 14 may perform another important function, namely, it may serve as a temporary bridge for delivery of construction materials to the platforms 20, 21. Thus, all such materials may be transported along the completed span or spans and thereupon along the staging 14. In FIG. 1, materials necessary for construction and attachment of sections (or prefabricated sections) will be delivered along the span 8, thereupon along the completed left-hand portion (sections 9–12) of the span 13, along the left-hand arm of the truss, and onto the platforms 20, 21. In FIG. 3, the materials may be delivered from the left-hand end of the bridge, along the spans 8, 13, and along the left-hand arm of the truss. Thus, the delivery of materials is independent from the configuration of terrain since a road or railroad normally connects to each end of the bridge so that the problem of delivering material for the span is solved as soon as the supports for the bridge are

completed. This is of utmost importance when the bridge must extend across a deep canyon, a rapidly flowing river or across another obstacle which would prevent delivery of construction materials beneath the spans.

The staging preferably comprises a truss composed of a series of adjoining triangles. Such construction is of light weight and is sufficiently rigid to withstand all stresses which arise during the erection of spans. In addition, the triangles provide sufficient room for transport of bulky construction materials.

As mentioned hereinabove, the overhead staging **14** may be replaced by a staging which is suspended from the supports so that the platforms are located at a level above the suspended staging or, alternatively, the staging may be carried by one or more supports in such a way that it extends laterally thereof (for example adjacent to and at the level of a span). Also, it goes without saying that a multispan bridge may be erected by simultaneous utilization of two stagings, especially when the bridge comprises a large number of piers and if both ends of the bridge are readily accessible.

The method of our invention may be practiced in erection of many types of bridges independently of the cross-sectional configuration of the sections. Thus, the sections may be of the hollow box type (bridge of airproof cases) or the spans may be assembled of sections which resemble flat slabs. Also, the sections may be prefabricated so that the working platforms merely serve as a means for transporting the prefabricated sections to the locale of actual use and as assembly stands during connection of freshly delivered sections to the sections which are already mounted on one or more supports. In other words, and insofar as the method of the present invention is concerned, it is of no importance whether the spans are assembled of prefabricated sections or whether the sections are made in situ.

In certain instances, it may be desirable to use a staging whose length is such that its truss forms a cantilever mounted on the support **2** and having one arm supported by the completed portion **9–12** of the span **13** whereas the other arms of the truss finds support on the section **6**, i.e., on the pier **3**.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a method of erecting multispan bridges including one and another spaced support, at least said one support being located intermediate the ends of the bridge to be erected, the steps of building a portion of a first span extending from said other support toward said one support; shifting from said other support onto said one support an elongated double-armd temporary staging one arm of which bridges the gap between said one support and said built portion of the first span and the other arm of which forms a cantilever extending beyond said one support in a direction away from said other support whereby the staging enables the crew to work on opposite sides of said one support; building the remainder of said first span by working on said staging from said one support toward said other support; building a portion of a second span by working on said staging from said one support in a direction away from said other support; and repeating said steps—with the exception of the first one—towards at least one additional support.

2. In a method of erecting multispan bridges wherein each span consists of sections arranged end-to-end, the steps of building one and another spaced support, at least said one support being located intermediate the ends of the bridge to be erected; building a portion of a first span extending from said other support toward said one support; shifting from said other support to said one support an elongated double-armed temporary staging one arm of which is supported by said built portion of the first span and the other arm of which forms a cantilever extending beyond said one support in a direction away from said other support whereby the staging enables the crew to work on opposite sides of said one support; building the remainder of said first span by working on said staging from said one support toward said other support; simultaneously assembly a portion of a second span by working on said staging from said one support in a direction away from said other support; and repeating said steps—with the exception of the first one—towards at least one additional support.

3. The steps as set forth in claim **2**, wherein said staging comprises an overhead truss.

4. In a method of erecting mulitispan bridges including two outer supports and a third support located intermediate said outer supports; the steps of building a portion of a first span extending from one of said outer supports toward said third support; arranging on said third support an elongated double-armed temporary staging one arm of which is supported by said built portion of the first span and the other arm of which forms a cantilever extending beyond said third support in a direction toward the other outer support whereby the staging enables the crew to work on opposite sides of said third support; building the remainder of said first span by working on said staging from said third support toward said one outer support; building a portion of a second span by working on said staging from said third support toward said other outer support; shifting the staging from said third support onto said other outer support so that one arm of the staging is supported by said built portion of the second span; and building the remainder of said second span by working on said staging in a direction from said other outer span toward said third span.

5. The steps as set forth in claim **4**, wherein the length of the staging exceeds the distance between said third support and one of said outer supports.

6. In a method of erecting multispan bridges including two outer supports and a third support located intermediate said outer supports, the steps of building a portion of a first span extending from one of said outer supports toward said third support; arranging on said third support an elongated double-armed temporary staging one arm of which is supported by said built portion of the first span and the other arm of which forms a cantilever extending beyond said third support in a direction toward the other outer support whereby the staging enables the crew to work on opposite sides of said third support; building the remainder of said first span by working on said staging from said third support toward said one outer support; simultaneously building a portion of a second span by working on said staging from said third support toward said other outer support; shifting the staging from said third support onto said other outer support so that one arm of the staging is supported by said built portion of the second span and that the other arm of said staging forms a cantilever extending beyond said other outer support in a direction away from said third span; building the remainder of said second span by working on said staging in a direction from said other outer support toward said third support; and building a portion of a third span by working on said staging in a direction from said other support away from said third support.

7. An arrangement for use in erection of multispan bridges whose spans consist of a plurality of sections connected end-to-end and wherein the spans extend across the fields between a plurality of supports at least one of which is located intermediate the ends of the bridge to be

erected, comprising a temporary staging including an elongated double-armed frame whose length exceeds at least slightly the maximum length of a span, said frame being arranged to be carried by said one support and having a first arm including a bearing supported by a partially built first span extending from another support toward said one support and a second arm forming a cantilever extending beyond said one support in a direction away from said other support so that the crew may work on opposite sides of said one support by mounting pairs of sections on said one support so as to build the remainder of said first span and to simultaneously build a portion of a second span which extends from said one support in a direction away from said other support, said staging including a second bearing supported by said one support and said elongated frame being longitudinally shiftably supported by said bearings; and working platforms secured to said frame and movable in the longitudinal direction thereof so as to enable the crew to secure consecutive pairs of sections to the sections already mounted on said one support.

8. An arrangement as set forth in claim 7, further comprising means for attaching said platforms to said frame and means for attaching said platforms to built portions of said spans.

9. An arrangement as set forth in claim 7, further comprising means for attaching one of said platforms to said frame and means for attaching said one platform to said partially built first span during securing of the last section of said first span to the built portions thereof.

10. An arrangement as set forth in claim 7, further comprising first rods for attaching said platforms to said frame and second rods for attaching said platforms to built portions of said spans.

11. An arrangement as set forth in claim 7, further comprising first hydraulic press means for attaching said platforms to said frame and second hydraulic press means for attaching said platforms to built portions of said spans.

12. An arrangement as set forth in claim 7, further comprising temporary fastening means for connecting the last mounted pair of sections to said frame during securing of the next pair of sections to said last mounted pair of sections.

13. An arrangement as set forth in claim 7, further comprising a ballast secured to said first arm to prevent overturning of said frame.

14. An arrangement as set forth in claim 13, further comprising attaching means for temporarily securing to said frame such sections of said first span which are assembled in a direction from said one support to said other support, the weight of said attaching means being such that said frame is held against overturning in that said first arm is caused to bear against the partially built first span.

15. An arrangement as set forth in claim 7, wherein said platforms constitute counterweights to balance said frame during shifting of said staging from said one support onto another support.

16. An arrangement as set forth in claim 7, further comprising stabilizing means for balancing such portions of said spans which are mounted on said one support, said stabilizing means comprising a ballast secured to said frame and to that portion of said first span which extends from said one support toward said other support.

17. In a method of erecting multispan bridges including one and another spaced support, at least said one support being located intermediate the ends of the bridge to be erected, the steps of building a portion of a first span extending from said other support toward said one support; supporting on said one support an elongated double-armed temporary staging one arm of which is supported by said built portion of said first span and the other arm of which forms a cantilever extending beyond said one support in a direction away from said other support whereby the staging enables the crew to work on opposite sides of said one support; building the remainder of said first span by working on said staging from said one support toward said other support; building a portion of a second span by working on said staging from said one support in a direction away from said other support; and repeating said steps—with the exception of the first one—towards at least one additional support.

18. In a method of erecting multispan bridges including one and another spaced support, at least said one support being located intermediate the ends of the bridge to be erected, the steps of arranging an elongated double-armed temporary staging on the other of said supports; shifting said elongated staging from a position in which the main portion of its weight is carried by said other support to a position in which the main portion of its weight is carried by said one support, one arm of said staging bridging the gap between said one support and said other support and being supported in part by said other support and the other arm of said staging forming a cantilever extending beyond said one support in a direction away from said other support whereby the staging enables the crew to work on opposite sides of said one support; building a portion of a first span by working on said staging from said one support toward said other support; building a portion of a second span by working on said staging from said one support in a direction away from said other support; and repeating said steps—with the exception of the first one—towards at least one additional support.

References Cited by the Examiner

UNITED STATES PATENTS

2,963,764	12/1960	Finsterwalder	52—223
3,027,633	4/1962	Murphy	14—1 X

OTHER REFERENCES

Engineering News Record, November 1960, pp. 28–29.

JACOB L. NACKENOFF, *Primary Examiner.*