United States Patent [19]

Wagner et al.

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[54] **BRIDGE LAYING DEVICE**

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[52] **U.S. Cl.** **14/1**

[51] **Int. Cl.** **E01d 1/00**

[58] **Field of Search** 14/1, 71

[56] **References Cited**

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Attorney, Agent, or Firm—Walter Becker

[57] **ABSTRACT**

A bridge laying device in which a vehicle carries a tiltable and extensible beam, and carried on the beam are at least two bridge sections adapted to be coupled in end to end relation to form a bridge. The device includes an arrangement for moving one bridge section out along the beam when the latter is extended and at the end of the beam nearest the vehicle is a mechanism for manipulating the other bridge section to effect coupling of the bridge sections together while still resting on the extended beam. Thereafter, the end of the bridge formed by the coupled together sections is engaged with a stationary support on one side of the space to be bridged and the beam is then retracted and the other end of the bridge formed by the coupled together sections is deposited on a stationary support at the adjacent side of the space being bridged. The bridge sections are of the same dimensions and substantially identical and the bridge can be returned to the vehicle from either end of the bridge.

10 Claims, 9 Drawing Figures

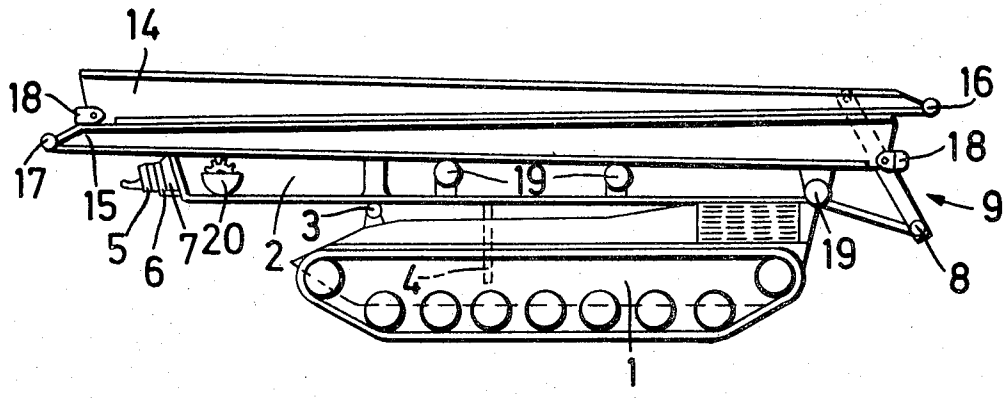


FIG. 1

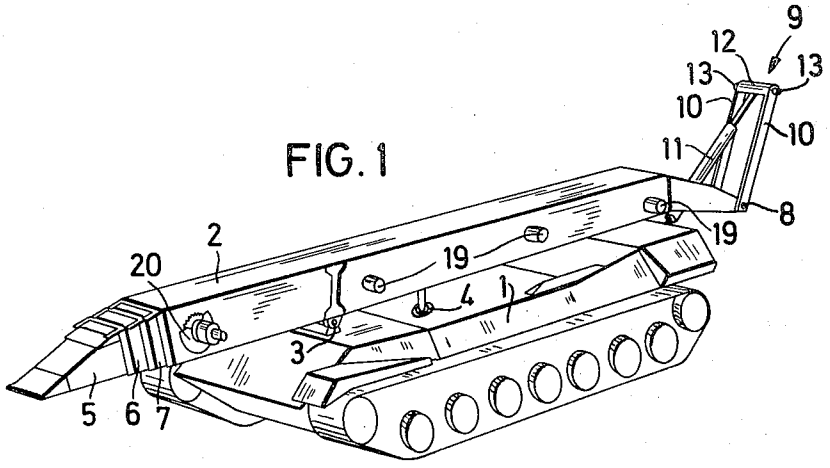


FIG. 2

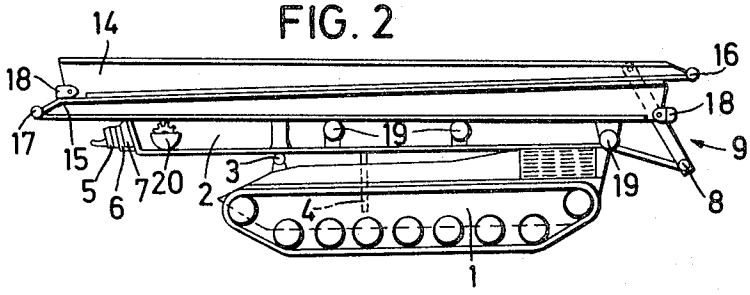
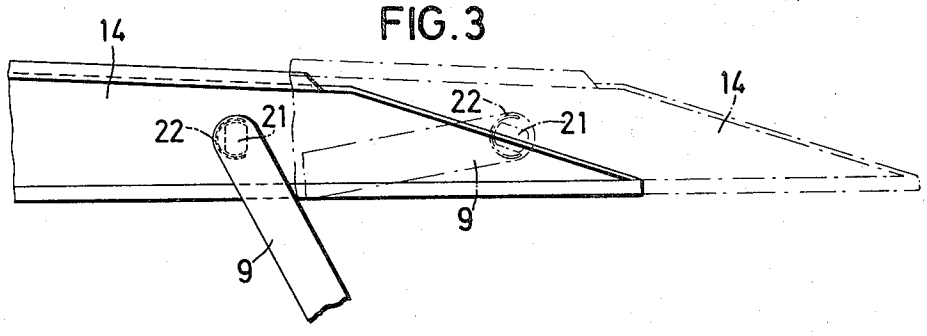


FIG. 3



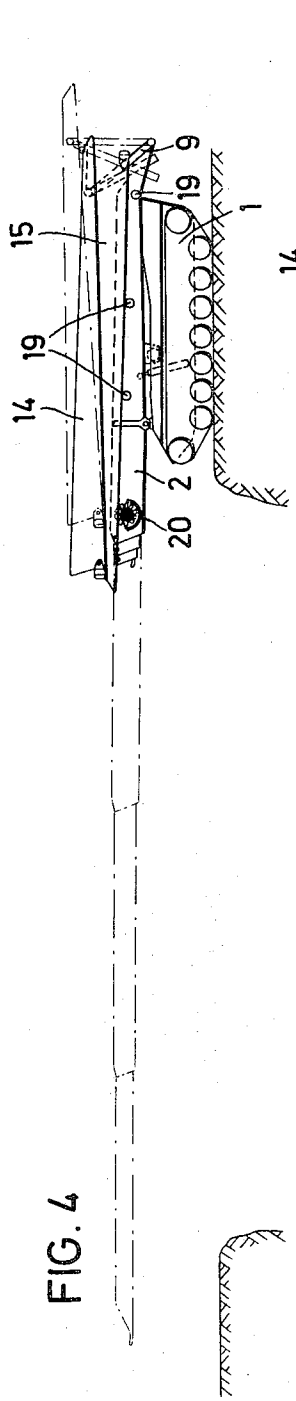


FIG. 4

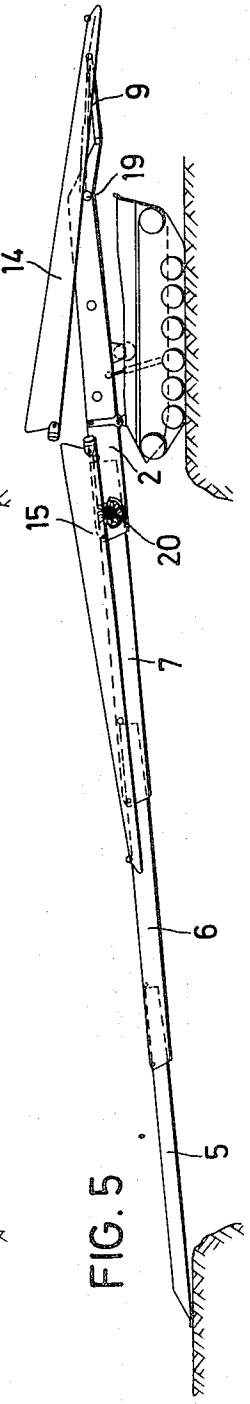


FIG. 5

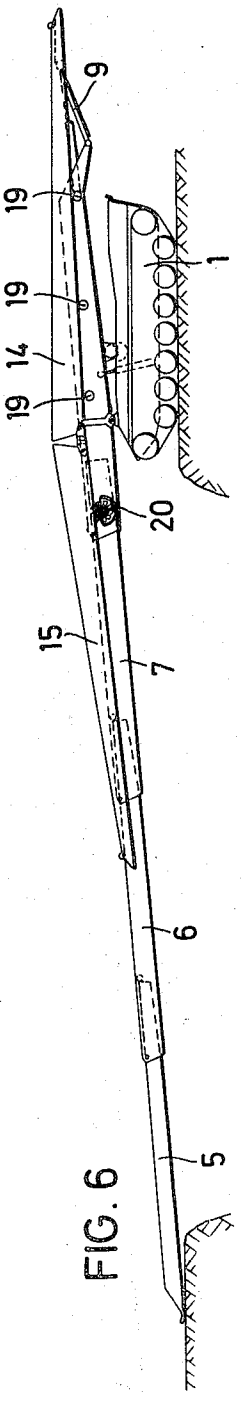


FIG. 6

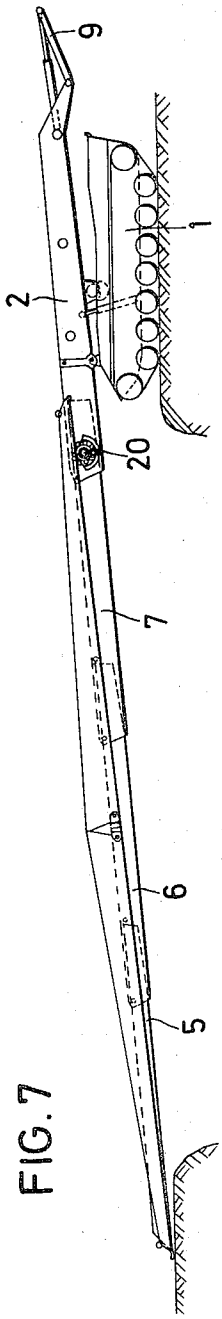


FIG. 7

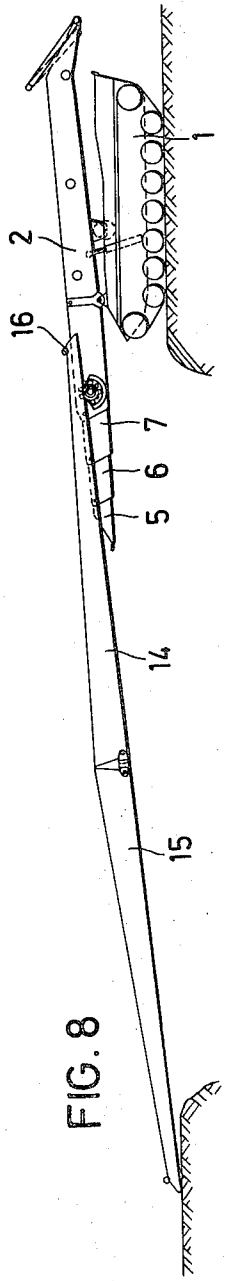


FIG. 8

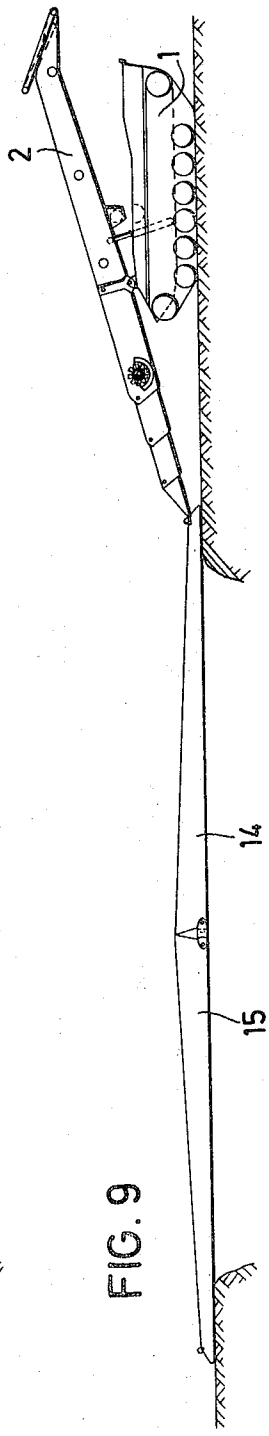


FIG. 9

BRIDGE LAYING DEVICE

The present invention relates to a bridge laying device which comprises a track laying vehicle the top side of which has arranged thereon a beam which extends in the longitudinal direction of the vehicle and is pivotable about an axis extending transverse to the longitudinal axis of the vehicle. The beam is composed of a plurality of beam sections which are telescopically arranged one within the other. Upon this beam there are arranged two bridge sections which extend in the longitudinal direction of the beam and are located one upon the other while being adapted to be composed to a bridge. Each of the bridge sections has one end adapted to be coupled to another end and also has a free end, a coupling device being provided for interconnecting the bridge sections.

With a heretofore known bridge laying device, the pivotable arm for coupling the two bridge sections to each other is rotatably journalled on the front beam section of the beam which is adapted to be moved outwardly farthest and is pivotable about a vertical axis. This heretofore known arrangement of the pivotable arm has the drawback that the conduits to be placed within the telescopically expandable beam sections are rather expensive as to their construction. The reason for this is that when the beam sections are pulled out or pushed in, the length of the conduits must be variable. If, for instance, a hydraulic cylinder piston drive is employed for pivoting the pivotable arm, the conduit arranged within the beam sections must be of a telescoping constructions, or flexible pressure fluid conduit means must be provided which must be adapted to be wound upon a hose reel. These conduit constructions have to be serviced from time to time and are liable to disorders in operation. Furthermore, this known construction has the additional drawback that for the coupling action of the two bridge sections the telescopic beam sections have to be moved back and forth until the coupling operation has been completed. This continued back and forth movement of the telescopic beam sections requires additional power and brings about a greater wear of these beam sections. Finally, also the weight of the pivotable arm with the hydraulic drive in moved-out condition has a disadvantageous effect on the beam sections and the rollers therefor.

It is, therefore, an object of the present invention so to improve the bridge laying device of the above described general character that the drawback outlined above will be eliminated.

This object and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 is an isometric view of a bridge laying device according to the invention without the bridge sections.

FIG. 2 is a side view of the bridge laying device of FIG. 1 with the bridge sections resting on the beam.

FIG. 3 illustrates a side view of the free end of the lower bridge section with partially shown pivotable arm.

FIGS. 4 to 9 respectively illustrate the individual phases of the laying of a bridge with the bridge laying device accoding to FIGS. 1 and 2.

The bridge laying device according to the present invention is characterized primarily in that as coupling

device there is provided a pivotable arm which, when viewed in the driving direction of the vehicle, is pivotally connected to the rear end of the beam. This feature, to arrange the pivotable arm at the rear end of the non-expandable beam, has the advantage that for the drive of the pivoting mechanism only simple conduits are needed which do not require any servicing and are safe in operation to a highly satisfactory degree. Moreover, the arrangement of the pivotable arm according to the present invention has the additional advantage that the time required for laying the bridge is considerably reduced inasmuch as already during the coupling operation for the two bridge sections the beam sections are moved out up to the oppositely located bank, are there deposited, whereupon the coupled together bridge sections can immediately be pushed over the beam sections to the other bank. The saving in weight at the tip of the front beam section permits a lighter construction of the beam sections or a greater useful length of the bridge at the same weight.

with the heretofore known bridge laying device referred to above, the bridge laying process proper proceeded in such a way that after the coupling together of the two bridge sections to form a bridge, the beam sections were first moved up to the oppositely located bank, and subsequently the two bridge sections were rolled over the beam sections to the other bank.

According to a further development of the invention, it is advantageous so to design the pivotable arm that it forms a U-shaped yoke the two legs of which have their free ends pivotally connected to the rear end of the beam.

According to a still further feature of the invention, a lifting cylinder is used for moving the pivotable arm and has one end in engagement with the web or transverse arm of the U-shaped pivotable arm. The other end of the lifting cylinder is pivotally connected to the beam in spaced relationship to the point of rotation of the pivotable arm.

In order to facilitate the moving out of the rear bridge end from the horizontal pivotable arm during the displacement of the bridge on the beam, the free end of the pivotable arm is equipped with rollers mounted outwardly on the end faces of the web or transverse arm.

According to a still further development of the invention, it is expedient for the coupling process so to journal the bridge sections on the beam that the free end of the lower bridge section which rests directly on the beam points forwardly in the driving direction while the free end of the upper bridge section points rearwardly in opposite direction to the driving direction.

Referring now to the drawings in detail, the bridge laying device illustrated in FIGS. 1 and 2 primarily consists of a track laying vehicle 1 the top side of which has arranged thereon a box-shaped beam 2 which extends in the longitudnal direction of the track laying vehicle 1. The beam 2 is through the intervention of a horizontal axle 3 pivotally connected to the track laying vehicle 1 by means of a hydraulic cylinder piston drive 4. Within the beam 2 there are provided three additional beam sections 5, 6 and 7 which likewise have a rectangular cross section and can be pulled out in a telescopic manner. The rear end of the beam 2 has pivotally connected thereto an arm 9 which is pivotable about an axle 8 extending transverse to the vehicle. Arm 9 forms a U-shaped yoke the two legs 10 of which have their

free ends pivotally connected to the beam 2. For purposes of pivoting arm 9, there is provided a hydraulically operable cylinder piston drive 11 which has its end in engagement with the web or transverse arm 12 of the U-shaped arm 9 while the other end is in engagement with the beam 2 in spaced relationship to the pivot point of the arm 9. Rollers 13 are arranged on the outside on transverse arm 12.

As will be seen from FIG. 2, the bridge sections 14 and 15 which are identical to each other are mounted one above the other on the non-displaceable beam 2. Each of the bridge sections has a free end and an end which is adapted to be coupled to another end of a bridge section. The bridge sections, in conformity with bending stresses to which they are exposed, have the height of their cross sections increase toward the connecting point. The location of the bridge sections is so selected that in each instance one free end is located opposite to an end to be coupled while the free end of the lower bridge section which rests directly on the beam points forwardly in the driving direction of the track laying vehicle 1.

The drawings do not show that the bridge sections are composed of two beams each of which carries a track and each of which has two plate-shaped webs and double box-shaped lower girders. The bridge beams arranged adjacent to each other in a torsion elastic manner are connected to each other by hinge rods so that in case of contact with an uneven ground, an equalization of the individual tracks under load is possible within certain limits.

The free ends of the bridge sections 14 and 15 are equipped with supporting rollers 16 and 17 which are arranged at steps between the tracks and by means of which the bridge sections coupled together to form a bridge rest upon the individual supporting parts during the forward movement of the bridge. The connection between the bridge sections is effected by jaw clutches 18 which are arranged at the lower girders of the bridge sections within the region of the ends to be coupled. Rollers 19 are arranged on the outside of the side walls of beam 2. It is these rollers on which the bridge is moved during the bridge lowering operation. The forward movement of the bridge is effected by driving gears 20 which are journalled on the sides of the beam 2 and mesh with racks at the lower girders of the bridge sections. The gears 20 are driven by non-illustrated oil motors. In driving position, the two bridge sections are secured by special devices against undesired displacement. The pivotable arm 9 is in transporting position pivoted between the tracks of the upper bridge section as shown in FIG. 2. Within the region of the web or transverse arm 12, bolts are provided on the outside of arm 9 which engage special recesses on the inner web side of the two tracks of the upper bridge section 14.

Instead of the bolts adapted to be moved outwardly, the arm 9 may on the outside thereof be provided with stationary cams 21 as shown in FIG. 3 which are adapted to move into recesses 22 on the inner web sides of the bridge section 14. The location of the cams relative to the pivotable arm 9 is so selected that in driving position of arm 9, as illustrated in FIG. 3 by solid lines, the cams 21 automatically lock the bridge sections. In coupling position of the bridge sections (indicated by dot-dash lines), the cams 21 occupy such a position that the locking of the bridge is made ineffective and the lowering of the bridge can be effected.

The individual phases of the bridge lowering process are in a simplified manner illustrated in FIGS. 4 to 9.

After the lowering device has been moved toward the area to be bridged, the upper bridge section 14 with its free end is lifted by pivoting arm 9 from its transporting position into a vertical position as shown in FIG. 4, and the upper bridge section 14 is pulled back to a certain extent as indicated by dot-dash lines.

Simultaneously with the pivoting of arm 9, the individual beam sections are moved outwardly, and the foremost beam section 5 is lowered to the opposite bank. After the foremost beam section 5 rests on the opposite bank, the arm 9 is further pivoted in a direction opposite to the driving direction of the bridge lowering device into its end position which means into an approximately horizontal position. During the movement of arm 9, simultaneously the lower bridge section 15 is moved outwardly into the position of FIG. 5. This is effected by means of the driving gears 20. By pivoting arm 9, the bridge section 14 was pulled further toward the rear while simultaneously its end which is adapted to be coupled was pivoted in an upward direction. When the bridge section 15 was moved forwardly, the end of the bridge section 14 which end is adapted to be coupled moved in the direction toward the beam 2 until the lower girders had half of their length resting on the rear guiding roller 19 on beam 2. By means of a slight pivoting movement of arm 9 in upward direction, that end of the bridge section 14 which is adapted to be coupled is lowered, and both bridge sections 14 and 15 are coupled to each other to form a bridge.

FIG. 6 shows the bridge sections 14 and 15 in assembled condition. The bridge is then by means of the driving gears 20 moved outwardly over the area to be bridged. The front end of the bridge moves over the inclination at the tip of the front beam section 5 until it rests on the oppositely located bank (FIG. 7).

As shown in FIG. 8, the beam sections 5, 6 and 7 have been retracted to their starting position. The track laying vehicle 1 now moves backwardly until the rollers 16 of the bridge end on the vehicle side rest on the arched portion which is slightly inclined toward the bottom side of the beam section 5.

According to FIG. 9, the beam 2 is pivoted downwardly and thus has placed the bridge upon the bank on the vehicle side. The track laying vehicle can now move backwards, and subsequently after a slight pivoting movement of the beam 2 in upward direction can move over the installed bridge. After the bridge has served its purpose, it can be picked up again from the other side of the bridged area in which instance the above described steps are followed in a reverse sequence.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawings but also comprises any modifications within the scope of the appended claims.

What is claimed is:

1. A bridge laying device comprising in combination: a caterpillar track vehicle, a beam mounted upon the vehicle and extending in the longitudinal direction of the vehicle so as to have forward and rearward ends, said beam comprising sections in telescopic engagement adapted to be extended forwardly in the longitu-

dinal direction of the beam, transverse pivot means connecting outermost section of said beam to the vehicle for tilting of the beam in the vertical plane of the beam, at least two bridge sections supported in superposed substantially coextensive relation on top of said beam and moveable longitudinally on the beam, cooperating elements of coupling means on the one end of one bridge section which is nearest the rearward end of said beam and on the one end of the other bridge section which is nearest the forward end of said beam, said bridge sections having free ends adapted to rest on stationary supporting means at opposite sides of the space to be bridged, means for moving said one bridge section longitudinally on said beam while said beam is extended to dispose the said one ends of said bridge sections in adjacent relation preparatory to coupling the bridge sections together, means for manipulating at least the other of said bridge sections during the coupling together of the said one ends of said bridge sections comprising arm means pivotally connected to the rearward end of said beam and detabhably connected to the said other of said bridge sections, said arm means being in the form of a "U" shaped yoke including a transverse arm interconnecting legs having one end pivotally connected to said beam and the other end including means for detachable connection to said other bridge section, said beam being retractable after said bridge sections are coupled together and disposed over said space to leave the bridge formed by said bridge sections in bridging position relative to said space, and fluid operable motor means connected between said arm means and said beam with spacing from pivot location thereof for pivoting said arm means about the pivotal connection thereof to said beam.

2. A device in combination according to claim **1** in which said arm means at the end opposite the end pivotally connected to said beam comprises roller means projecting laterally therefrom for engagement with said other bridge section.

3. A device in combination according to claim **2** in which said arm means at the end opposite the end pivotally connected to said beam comprises cam elements projecting laterally therefrom and adapted for engagement with socket means carried by said other bridge section.

4. A device in combination according to claim **3** in which said cam elements releasably engage said socket means in one position of said arm means and nonreleasably engage said socket means in other positions of said arm means.

5. A device in combination according to claim **4** in which the said one end of the upper one of said bridge sections is toward the forward end of said beam while the said one end of the lower one of said bridge sections is toward the rearward end of said beam.

6. A device in combination according to claim **5** in which said beam includes support rollers on the sides rollingly supporting said bridge sections, and cooperating elements of drive means on said beam and said bridge sections for driving said bridge sections longitudinally of said beam.

7. A device in combination according to claim **6** in which said coupling together of said bridge sections is accomplished by relative vertical movement of the said one ends of said bridge sections when in adjacent relation, said arm means being operable to tilt said other bridge section on said beam during the coupling together of said bridge sections to cause interengagement of said elements of coupling means.

8. A device in combination according to claim **6** in which each bridge section is open toward the bottom so as to fit over said beam from above and the said support rollers on the sides of said beam are disposed for engagement with the lower edges of the bridge sections.

9. A device in combination according to claim **8** in which said support rollers are on the said outermost beam section and each bridge section has roller means on the free end adapted rollingly to engage the top of the beam when the beam is extended and the bridge sections are disposed along the beam out of the range of said support rollers.

10. A device in combination according to claim **8** in which said bridge sections have the same dimensions whereby the bridge formed by said sections can be returned to said vehicle from either end of said bridge.

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