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Dlugosz

[11] **3,907,201**

[45] **Sept. 23, 1975**

[54] **INSTALLATION OF CONCRETE CONTAINING RAILROAD TIES INFLATED IN SITU**

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[21] Appl. No.: **345,277**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 198,660, Nov. 15, 1971, abandoned.

[52] **U.S. Cl.** **238/84**

[51] **Int. Cl.** **E01b 37/00**

[58] **Field of Search** 104/10, 11; 238/83, 84, 238/91, 30, 29, 1, 107

[56] **References Cited**

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Assistant Examiner—Richard A. Bertsch

[57] **ABSTRACT**

An inflatable railroad tie includes an elongated, inflatable porous housing which first is inserted in a track bed transversely beneath the rails and longitudinally between the existing deteriorated wooden ties in deflated or collapsed condition, and then is inflated in situ into load bearing relationship with the rails by injecting a concrete forming mixture which upon setting produces a hardened concrete mass filling the housing and supporting the rails, such mass being prestressed by an embedded reinforcing rod extending through and fastened to the housing as well as being secured to the rails by embedded anchors.

24 Claims, 13 Drawing Figures

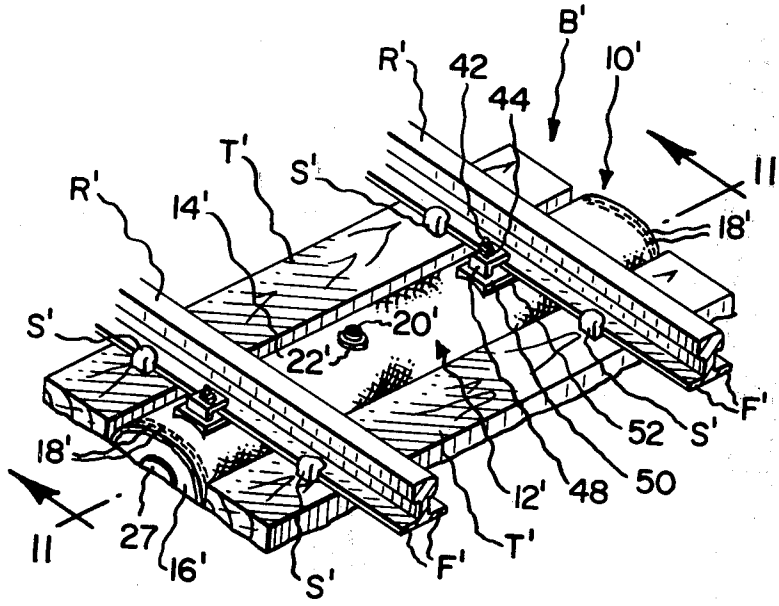
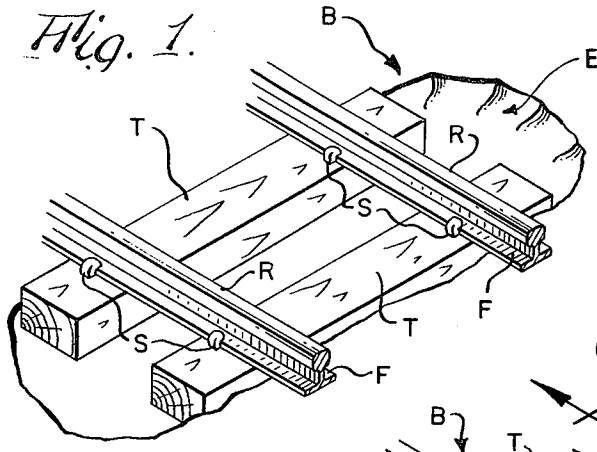


Fig. 1.



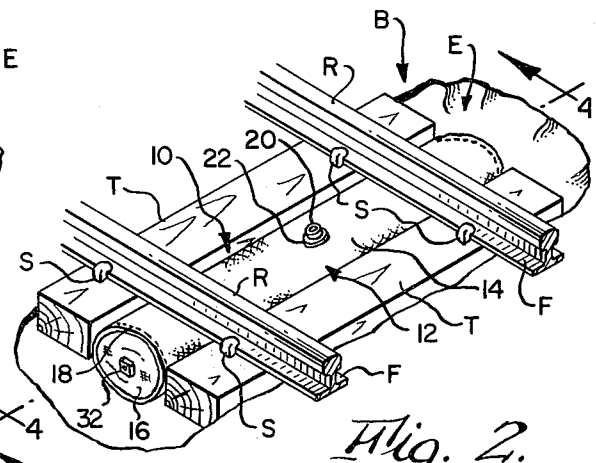


Fig. 2.

Fig. 3.

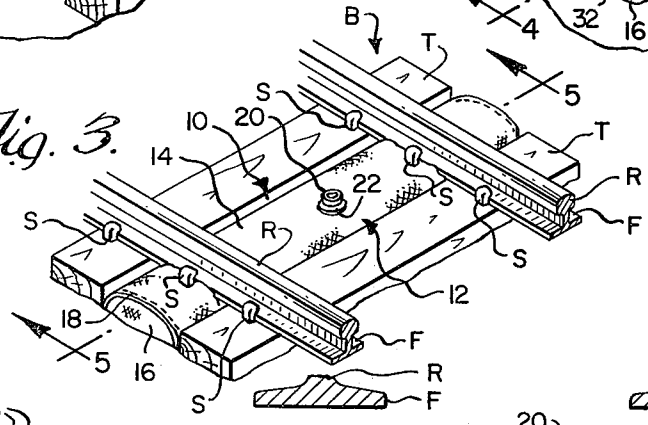
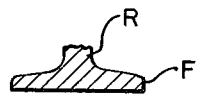


Fig. 4.



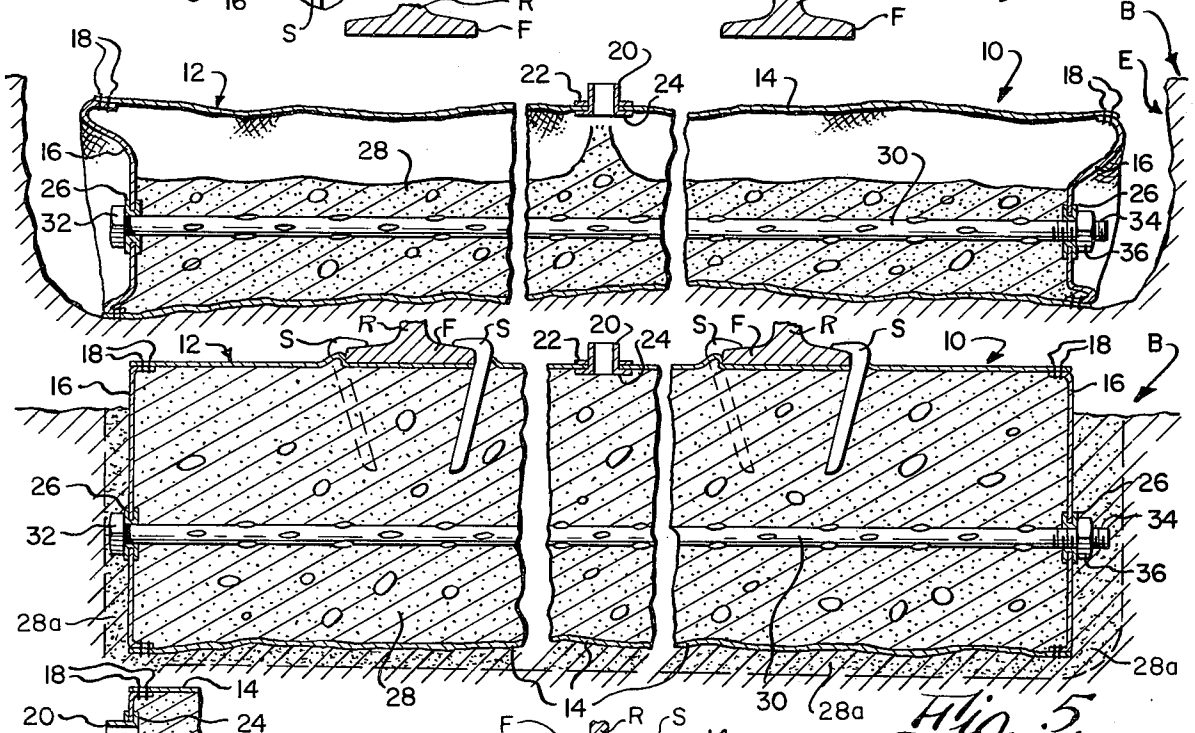


Fig. 5.

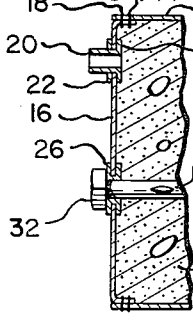


Fig. 6.

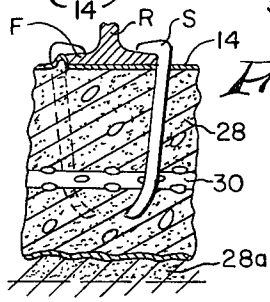


Fig. 7.

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Fig. 9.

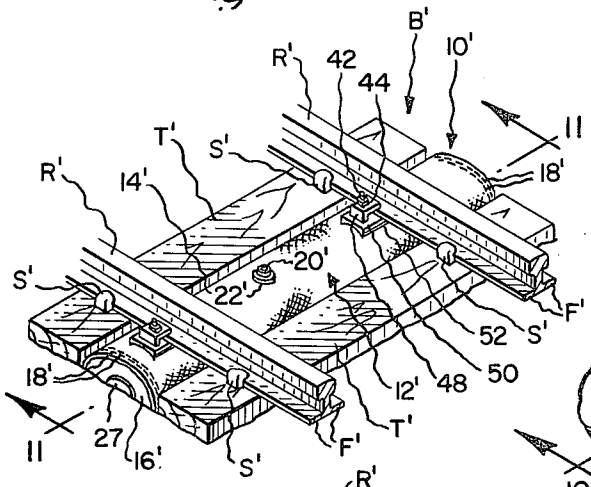
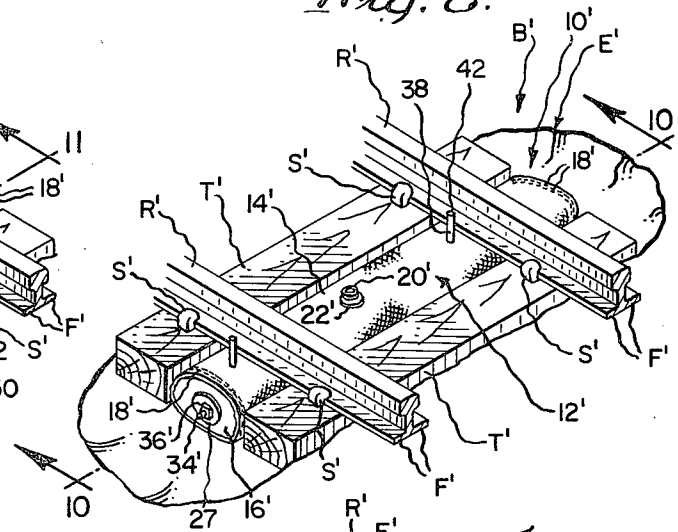
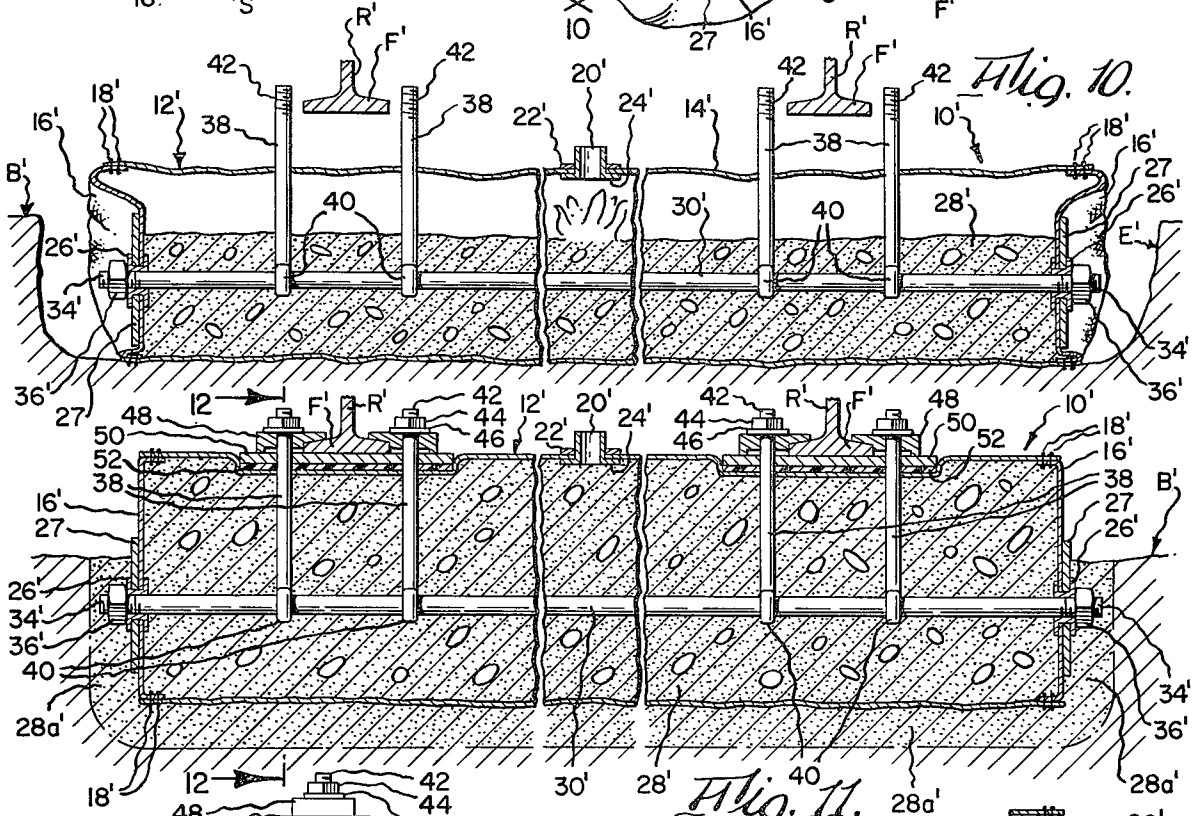


Fig. 8.





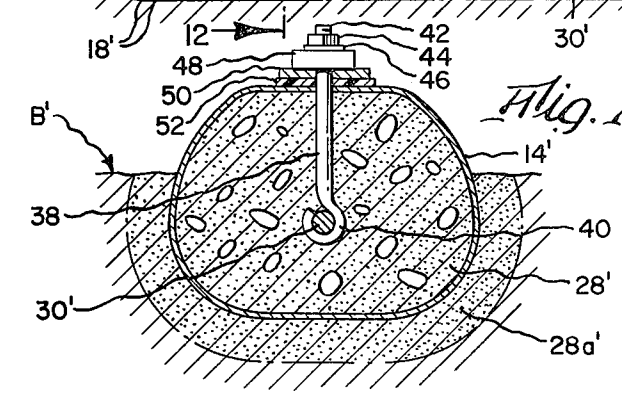


Fig. 12.

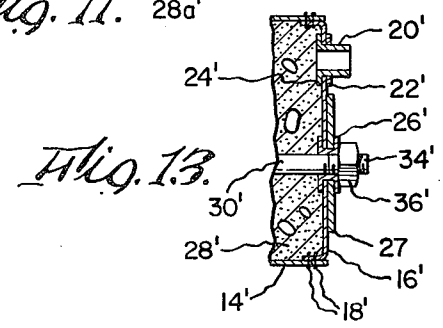


Fig. 13.

INSTALLATION OF CONCRETE CONTAINING RAILROAD TIES INFLATED IN SITU

This application is a continuation-in-part of my prior copending application Ser. No. 198,660, filed Nov. 15, 1971, and now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to improvements in railroad tie installations, and more particularly to a new and improved inflatable railroad tie adapted to be inserted in a railroad track bed beneath the rails and between the existing ties and inflated with concrete in situ; a new and improved inflated concrete containing railroad tie which is so inserted and inflated in situ; a new and improved installation of such inflated concrete containing railroad tie, and a new and improved method of installing such inflated concrete containing railroad tie.

2. Prior Art

In the railroad industry roday, a serious problem exists in the widespread deterioration of roadbeds; primarily caused by rotting of the older wooden railroad ties. This situation is not only hazardous to high speed travel, as can be attained by modern trains, but also often results in derailment of freight cars and extensive loss of cargo. The problem is further complicated by a shortage in supply of the appropriate wood for making the standard wooden ties, and the long delays involved in obtaining such replacement ties.

One proposed alternative is to employ precast concrete replacement ties, but the use thereof is tremendously expensive because of the great weight of such precast concrete ties and the expensive equipment and labor costs involved in installation thereof. Another proposed alternative is to cast in situ integral concrete sleepers and cross ties, as disclosed in U.S. Pat. No. 1,109,267. However, this invention is not really applicable to worn out individual tie replacement or reinforcement, because it requires the preassembly of the rails and a supporting reinforcing rod and channel network, as well as the use of removable forms to construct a complete railroad bed and rail support. Obviously, the use of such patented system also would be tremendously expensive, particularly when considering the labor and material costs involved in building or rebuilding the railroad bed and rail supports.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a new and improved inflatable railroad tie, the elongated inflatable housing of which readily can be inserted in the track bed beneath the rails and between the existing deteriorated wooden ties in deflated or collapsed condition and then readily inflated in situ into load bearing relationship with the rails by filling such housing with a concrete forming mixture which upon hardening will form a concrete mass adequately supporting the rails, all at substantially less cost than that involved in removal and replacement of the deteriorated wooden ties either by newer wooden ties or precast concrete ties, as well as that involved in rebuilding the complete railroad bed and rail support.

Another primary object is to provide a new and improved inflated concrete containing railroad tie so inserted and inflated in situ and including an elongated reinforcing rod embedded in the concrete mass and fastener means engaging the outer ends of the housing and rod, placing the rod in tension and the mass in compression to properly prestress the tie and enhance its load bearing characteristic.

A further primary object is to provide a new and improved installation of such inflated concrete containing railroad tie wherein the latter readily is secured to the rails by anchor means embedded in the concrete mass either in the form of spikes driven in place prior to setting of the concrete forming mixture or in the form of preinstalled eyebolts connected to the reinforcing rod.

Still another primary object is to provide a new and improved method of installing such inflated concrete containing railroad tie including inserting the elongated inflatable housing into the roadroad track bed transversely beneath the rails and longitudinally between the existing ties, and inflating such housing in situ by injecting therein a concrete forming mixture until the housing is fully inflated into load bearing relationship with the rails, such concrete forming mixture being injected either as a premixed wet slurry or in a dry state simultaneously with water injected separately and/or sprayed through the housing to form a wet slurry in situ.

Additional objects and advantages of the invention will become evident upon consideration of the following detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial perspective view of a railroad track bed, rails, and existing ties, with part of the bed removed to receive the inventive inflatable tie.

FIG. 2 is a view similar to FIG. 1, but following insertion and during inflation of the inventive tie in situ.

FIG. 3 is a view similar to FIG. 2, but after the inventive tie has been completely installed and the bed has been refilled around the installation.

FIG. 4 is an enlarged broken section taken on line 4—4 of FIG. 2.

FIG. 5 is an enlarged broken section taken on line 5—5 of FIG. 3.

FIG. 6 is a fragmentary section similar to FIG. 5, but showing an alternate fill tube location in the inventive tie.

FIG. 7 is a fragmentary reduced section similar to FIG. 5, but showing modified anchoring spikes.

FIG. 8 is a partial perspective view similar to FIG. 2, but illustrating a modified inventive tie following insertion and during inflation in situ.

FIG. 9 is a view similar to FIG. 8, but after the modified inventive tie has been completely installed and the bed has been refilled around the installation.

FIG. 10 is an enlarged broken section taken on line 10—10 of FIG. 8.

FIG. 11 is an enlarged broken section taken on line 11—11 of FIG. 9.

FIG. 12 is a section taken on line 12—12 of FIG. 11.

FIG. 13 is a fragmentary section similar to FIG. 11, but showing an alternate fill tube location in the modified inventive tie.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1–7

Structure of Installation

Referring first to FIG. 1, a railroad track bed is generally indicated at B with part of the bed forming fill, slag

or aggregate being removed to form a shallow excavation E exposing a pair of existing conventional wooden ties T, one or both of which is deteriorated, beneath the two rails R, the lower flanges F of which are secured to the ties by the usual spikes S, the well known "fish plates" between the rails and ties being omitted for simplicity.

Turning to FIGS. 2–5, a preferred embodiment of the inventive inflatable tie is generally indicated at **10**, with FIGS. **2** and **4** showing the inventive tie after insertion but during inflation, while FIGS. **3** and **5** illustrate the same following inflation in situ. Inventive tie **10** includes an elongated inflatable housing **12** which preferably is of cylindrical shape and circular cross-section, but obviously could be of any other suitable shape and cross-section, such as rectangular, like wooden ties T. Preferably, entire housing **12** is formed of porous woven fabric and includes an elongated tubular casing portion **14** preferably made of burlap, and a cap portion **16** preferably made of canvas and closing each open end of the casing portion, with the cap portions being secured in place preferably by stitching **18.**

The terms "woven fabric" are employed herein to include the use of natural and/or synthetic fibers, as well as to include extruded or spun mesh type fabrics, such as polypropylene plastic filaments wherein the fill and warp filaments are arranged in overlying bonded relationship as opposed to the usual interlaced relationship. Typical of such mesh fabric would be that sold by E. I. DuPont de Nemours & Co. (Inc.) as plastic netting under the trademark "Vexar". The "weave", at least in casing portion **14**, must be open enough to permit migration of the concrete forming mixture through such casing portion as shown in FIG. **5**, for a purpose to be described below, and preferably also through cap portions **16.** However, the latter, while preferably formed of porous woven fabric, could be formed of imporous woven fabric or other material, if desired.

Casing portion **14** also is provided, preferably in its upper side, with at least one inlet port in the form of a central upstanding fill tube **20** extending outwardly through and secured to the casing portion by any suitable means such as a crimped washer **22** or the like clamping the casing against the lower outstanding flange portion **24** of tube **20.** Each cap portion **16** also is provided with means forming at least one opening and preferably in the form of a hollow grommet **26** which suitably is clinched or crimped in place, preferably below the central longitudinal axis of housing **12** for a purpose to be described below. Alternatively, one or both cap portions **16** could be provided in its upper side with fill tube **20** and washer **22**, in place of or in addition to casing **12**, as shown in FIG. **6.**

As best shown in FIG. **5**, inventive tie **10** is completed by a concrete mass **28** which is hardened or set from a concrete forming mixture injected through fill tube **20** to inflate housing **12** into the illustrated load bearing relationship with rails R, and by at least one elongated reinforcing rod **30** inserted through grommets **26** and casing **14** and embedded in mass **28** preferably during such injection, although rod **30** could be preinstalled, if desired. Rod **30** has an integral head **32** at one end and is threaded at its other end **34** for engagement by a nut fastener **36.** Thus, upon tightening of nut **36** against the adjacent grommet **26**, it draws head **32** against the left grommet **26** to place rod **30** in tension and the lower portion of mass **28** in compression for proper prestressing of tie **10** to enhance its load bearing characteristic.

The installation of tie **10** is completed by anchors in the form of spikes S (FIG. **5**) or S'' (FIG. 7) which are driven into concrete mass **28** before setting thereof. Such spikes may be provided with preformed head portions or they may be peened or bent over lower rail flanges F following setting, in either event to secure the rails R and tie **10** together. Although not shown, as noted above, the usual fish plates could be placed between the rails and tie **10** with the spikes passing therethrough, if so desired.

As shown in FIG. **7**, the modified spikes S'' are longer and curved at their lower ends. Hence, when driven into place, their lower ends hook beneath rod **30** to further enhance their embedment into concrete mass **28** and the securement between the tie and rails.

Method of Installation

Returning to FIG. **1**, bed B readily is prepared for installation of tie **10** by removing sufficient aggregate or fill to produce excavation E, thereby exposing wooden ties T and the space therebetween. Housing **12** then is inserted in collapsed or deflated condition transversely beneath rails R and longitudinally between ties T, there being no need to remove or replace the latter.

Next, tie **10** is inflated in situ by injecting a concrete mixture through one or more fill tubes **20** (FIG. **4** or FIG. **6**) until housing **12** is filled and inflated into the desired load bearing relationship with rails R (FIG. **5**). This concrete mixture may be fluidized in a number of ways. For instance, the mixture may be injected as a premixed wet slurry through the fill tube (s) or a dry mixture of sand, cement and aggregate may be injected from one pipe or hose (not shown) while simultaneously water is injected from another hose (not shown), and/or water may be sprayed through porous housing **12**, to form a slurry in situ. In each instance, the proportions of sand, cement, aggregate and water are adjusted as desired, to produce "concrete", this term, as employed herein, being construed broadly to include not only conventional concrete forming mixtures incorporating heavy aggregate such as stone or gravel, but also those containing light aggregate such as vermiculite or pearlite. Whatever inflation procedure is employed, it is but a simple matter to mount the readily available economical equipment and tie forming materials on a flat car or the like which readily may be moved along the track as needed, by any suitable prime mover, such as a yard locomotive or the like.

Either before, or during such inflation, such as when the housing is about half full, rod **30** is inserted longitudinally through grommets **26** and housing **12**, followed by the aforesaid tightening of nut **36** so that upon setting or hardening of concrete mass **28** the lower portion thereof is placed under compression and the rod in tension for properly prestressing the tie. Also, following such inflation, and prior to setting of mass **28**, anchors in the form of spikes S (FIG. **5**) or S'' (FIG. 7) are driven through casing **14** into the mass to secure the tie and rails together. When preformed, their heads automatically are engaged over the lower rail flanges F by such driving. However, when such heads are not preformed, they preferably are not peened over rail flanges F until after hardening occurs, say after about **24** hours or so of air drying time.

As shown in FIGS. 3 and 5, the weight of the work train (not shown) passing over the rails, together with the driving of the spikes S or S'', particularly when their heads are preformed, allow the same to properly seat themselves in the top of tie **10**, in addition to causing the bottom of the tie to assume the contour of the supporting ground, as shown in FIGS. 5 and 7. Also the process of oozing some of the concrete forming matrix or mixture into the slag or stone ballast of bed B beneath and at the ends of tie **10**, as shown at **28***a* in FIGS. 5 and 7, assures a good bond or anchor between the tie and bed.

The final step is to replace the road bed fill or aggregate around the installed tie **10**, as shown in FIG. 3, with the inventive tie providing the proper support for the rails, instead of the adjacent deteriorated wooden ties T.

FIGS. 8–13

Structure of Installation

Inasmuch as the railroad track bed remains substantially the same as shown in FIG. 1, neither the illustration nor the description of this Figure will be repeated, it being sufficient to note that the same or similar parts are designated by the same numerals followed by a prime (') in considering FIGS. 8–13, and with different parts being given different numerals.

Turning now to FIGS. 8–13, another preferred embodiment of the inventive inflatable tie is generally indicated at **10'**, with FIGS. 8 and 10 showing the inventive tie after insertion but during inflation, while FIGS. 9 and 11 illustrate the same following inflation in situ. Inventive tie **10'** includes an elongated inflatable housing **12'** which preferably is of cylindrical shape and circular cross-section, but obviously could be of any other suitable shape and cross-section, such as rectangular, like wooden ties T'. Preferbly entire housing **12'** is formed of porous woven fabric and includes an elongated tubular casing portion **14'** preferably made of burlap, and a cap portion **16'** preferably made of canvas and closing each open end of the casing portion, with the cap portions being secured in place preferably by stitching **18'**. The definition of the terms "woven fabric" as well as the descriptions of the "weave" and cap portion structure with reference to FIGS. 1–7 are equally applicable to the present embodiment.

Casing portion **14'** also is provided, preferably in its upper side, with at least one inlet port in the form of a central upstanding fill tube **20'** extending outwardly through and secured to the casing portion by any suitable means such as a crimped washer **22'** or the like clamping the casing against the lower outstanding flange portion **24'** of tube **20'**. Each cap portion **16'** also is provided with means forming at least one opening and preferably in the form of a hollow grommet **26'** which suitably is clinched or crimped in place, preferably below the central longitudinal axis of housing **12'** for a purpose to be described below. In addition, each cap portion is provided, preferably on its outer side, with a reinforcing end plate **26**, each grommet **26'** being of sufficient axial length to accomodate such end plate, which adds stabilizing rigidity to each cap portion **16'**. Alternatively, one or both cap portions **16'** could be provided in its upper side with fill tube **20'** and washer **22'**, in place of or in addition to casing **12'**, as shown in FIG. **13**.

As best seen in FIG. **11**, inventive tie **10'** is completed by a concrete mass **28'** which is hardened or set from a concrete forming mixture injected through fill tube **20'** to inflate housing **12'** into the illustrated load bearing relationship with rails R', and at least one elongated reinforcing rod **30'** extending through grommets **26'** and casing **14'** and embedded in mass **28'** during such injection, together with two pairs of eyebolts **38** forming part of the anchoring structure described below. Rod **30'** is threaded at each end **34'** for engagement by a nut fastener **36'**. Thus, upon tightening of nuts **36'** against the adjacent grommets **26'**, rod **30'** is placed in tension and the lower portion of mass **28'** is placed in compression for proper prestressing of tie **10'** to enhance its load bearing characteristic.

In addition, eyebolts **38** have their eyes **40** slidably surrounding rod **30'** and extend laterally outwardly and upwardly therefrom and through casing **10'** to expose their threaded outer ends **42**. As will be evident, rod **30'** and eyebolts **42** are preinstalled in housing **12'** during assembly of casing portion **14'** and cap portions **16'**.

The installation and anchoring of tie **10'** is completed by nuts **44**, washers **46**, rail clips **48**, tie or fish plates **50**, and an underlying insulation pad **52**, of glass fibers or the like, when conductivity may be a problem. The eyebolts extend upwardly through openings in casing portion **14'** pads **52** and fish plates **50** underlying rails R', as well as through openings in clips **48** which, upon tightening of nuts **44** and washers **46**, are clamped or engaged over lower rail flanges F' to secure the tie and rails together, with eyebolts **38** being placed in tension and locked to rod **30'** for enhancing such securement.

Method of Installation

Returning to FIG. **8**, bed B' readily is prepared in the same manner as described above with reference to FIG. **1**. Housing **12'** with the preinstalled rod **30'** and eyebolts **38**, then is inserted in collapsed or deflated condition transversely beneath rails R' and longitudinally between ties T', there being no need to remove or replace the latter. Of course, care is taken to see that each pair of eyebolts **38** properly straddle the appropriate rail R'.

Next, tie **10'** is inflated in situ by injecting a concrete forming mixture through one or more fill tubes **20** (FIG. **10** or FIG. **13**) until housing **12'** is filled and inflated into the desired load bearing relationship with rails R' (FIG. **11**). This concrete mixture may be fluidized, injected and proportioned to produce "concrete", all as described and defined in detail above with reference to FIG. **5**. However, prior to and/or during inflation, pads **52** and plates **50** are properly mounted on eyebolts **38** and beneath rails R' in any suitable manner. During and/or upon completion of such inflation, rail clips **48**, washers **46** and nuts **44** are suitably installed, with the latter being tightened upon completion of such inflation. This tightening, together with the weight of the work train (not shown) passing over the rails, allow plates **50** to properly seat themselves in the top of tie **10'**, as shown in FIGS. **9** and **11**, in addition to causing the bottom of the tie to assume the contour of the supporting ground, as shown in FIGS. **8** and **12**. Also, the process of oozing some of the concrete forming matrix or mixture into the slag or stone ballast of bed B' beneath and at the ends of tie **10'**, as shown at **28***a'* in FIGS. **11** and **12**, assures a good bond or anchor

between the tie and bed, just as noted above for the embodiment of FIGS. 1–7.

Thus, upon setting or hardening of concrete mass **28'**, the lower portion thereof is placed under compression and rod **30'** in tension for proper prestressing of tie **10'**. In addition, eyebolts **38** are likewise placed in tension upon tightening of nuts **44** to enhance the securement between the rails and tie, and if necessary, nuts **44** can be tightened further following such setting.

The final step is to replace the road bed fill or aggregate around the installed tie **10'**, as shown in FIG. **9**, with the inventive tie providing the proper support for the rails, instead of the adjacent deteriorated wooden ties R'.

It now is seen how the invention accomplishes its various objects, and numerous advantages inherent in the invention likewise are evident. For example, both the construction and the installation of the invention ties are simple, effective, efficient and economical, there being no necessity for removing or replacing the deteriorated wooden ties. In addition, even when the inventive ties deteriorate, it isn't necessary to bodily remove them either, because the concrete mass readily may be crushed and reused as aggregate in the road bed.

While the invention has been described and illustrated herein by reference to specific preferred embodiments thereof, this is to be considered as illustrative of rather than as limiting the scope of the invention, which is to be determined by the appended claims.

What is claimed is:

1. An inflated concrete containing railroad tie which is inserted in a railroad track bed beneath the rails and between the existing ties, and inflated in situ, wherein the improvement comprises: an elongated inflated housing including a hollow tubular casing portion formed of porous woven fabric, a cap portion closing each end of said casing portion, and an inlet port in one of said cap and casing portions, and a hardened concrete mass filling said housing following injection of a concrete forming mixture through said inlet port into said housing.

2. The inflated tie of claim **1** wherein each of said cap portions is provided with means forming an opening, and including an elongated reinforcing rod embedded in said concrete mass following insertion thereof longitudinally through said casing portion and openings, and rod fastener means engaging said means and the outer ends of said rod, placing said rod in tension and said concrete mass in compression.

3. The inflated tie of claim **2** wherein said opening forming means is located in each of said cap portions below the central longitudinal axis of said casing portion, and said rod fastener means place the lower portion of said concrete mass in compression.

4. The inflated tie of claim **1** wherein said cap portions also are formed of porous woven fabric.

5. The inflated tie of claim **1** wherein said inlet port is in the form of a fill tube extending outwardly through and secured to the upper side of said one of said cap and casing portions.

6. The inflated tie of claim **1** wherein said housing is formed of porous woven fabric, with said casing portion being formed of burlap and said cap portions being formed of canvas and secured to said casing portion by stitching.

7. The inflated tie of claim **1** including a preinstalled elongated reinforcing rod embedded in said concrete mass following insertion thereof longitudinally through said casing portion and said cap portions, rod fastener means engaging said cap portions and the outer ends of said rod, placing said rod in tension and said concrete mass in compression, and anchor means in the form of preinstalled eyebolts embedded in said concrete mass following said insertion, surrounding said reinforcing rod and extending laterally therefrom and through said casing portion for attachment to said rails.

8. An installation of an inflated concrete containing railroad tie inserted in a railroad track bed beneath the rails and between the existing ties and inflated in situ, wherein the improvement comprises: an elongated inflatable housing inserted into said bed transversely between said rails and longitudinally between said existing ties and including a hollow tubular casing portion formed of porous woven fabric, a cap portion closing each end of said casing portion, and an inlet port in one of said casing and cap portions, and a hardened concrete mass filling and inflating said housing into load bearing relationship with said rails following injection of a concrete forming mixture through said inlet port into said housing.

9. The installation of claim **8** wherein said rails have lower flanges each of said cap portions is provided with means forming an opening, and including an elongated reinforcing rod embedded in said concrete mass following insertion thereof longitudinally through said casing portion and openings, rod fastener means engaging said means and the outer ends of said rod, placing said rod in tension and said concrete mass in compression, and anchor means extending laterally through said casing portion, embedded in said concrete mass and enaged over said lower rail flanges to secure said tie and rails together.

10. The installation of claim **9** wherein said opening forming means is located in each of said cap portions below the central longitudinal axis of said casing portion, and said rod fastener means place the lower portion of said concrete mass in compression.

11. The installation of claim **10** wherein said anchor means are in the form of spikes driven through said casing portion and into said concrete forming mixture prior to setting thereof.

12. The installation of claim **11** wherein said spikes are provided with curved lower ends hooked under said reinforcing rod.

13. The installation of claim **8** wherein said cap portions also are formed of porous woven fabric.

14. The installation of claim **8** wherein said inlet port is in the form of a fill tube extending outwardly through and secured to the upper side of said one of said casing and cap portions.

15. The installation of claim **8** wherein said housing is formed of porous woven fabric, with said casing portion being formed of burlap and said cap portions being formed of canvas and secured to said casing portion by stitching.

16. The installation of claim **8** including a preinstalled elongated reinforcing rod embedded in said concrete mass following insertion thereof longitudinally through said casing portion and cap portions, rod fastener means engaging said cap portions and the outer ends of said rods, placing said rod in tension and said concrete mass in compression, and anchor means including preinstalled eyebolts embedded in said concrete mass following said insertion, surrounding said

reinforcing rod and extending laterally therefrom and through said casing portion for attachment to said rails, and rail fastener means engaging said eyebolts and rails and placing said eyebolts in tension.

17. A method of installing an inflated concrete containing railroad tie in a railroad track bed beneath the rails and between the existing ties, wherein the improvement comprises: inserting an elongated inflatable housing into said bed transversely beneath the rails and longitudinally between the existing ties, said inflatable housing including a hollow tubular casing portion formed of porous woven fabric, a cap portion closing each end of said casing portion, and an inlet port in one of said casing and cap portions, and inflating said housing in situ by injecting a concrete forming mixture through said inlet port into said housing until filled and inflated into load bearing relationship with said rails upon setting of said mixture to form a hardened concrete mass.

18. The method of claim **17** wherein said rails have lower flanges, each of said cap portions is provided with means forming an opening, and including inserting an elongated reinforcing rod longitudinally through said casing portion and openings, applying rod fastener means engaging said cap portions and the outer ends of said rod, to embed said rod in said concrete mass upon hardening thereof following inflation of said housing, thereby placing said rod in tension and said concrete mass in compression, and applying anchor means extending laterally through said casing portion and engaging said anchor means over said lower rail flanges to embed said anchor means in said concrete mass upon hardening thereof following inflation of said housing.

19. The method of claim **18** wherein opening said forming means is located in each of said cap portions below the central longitudinal axis of said casing portion, and said applying of said rod fastener means places the lower portion of said concrete mass in compression.

20. The method of claim **19** wherein said anchor means are in the form of spikes, and said lower flanges are secured to said tie by driving said spikes laterally through said casing portion into said concrete forming mixture prior to setting thereof and by engaging said spikes over said lower flanges.

21. The method of claim **29** wherein said spikes are provided with curved lower ends which are hooked under said reinforcing rod upon so driving said spikes.

22. The method of claim **17** wherein said concrete forming mixture is injected as a premixed wet slurry, followed by air drying until said slurry sets to form said hardened concrete mass.

23. The method of claim **17** wherein said concrete forming mixture is injected in a dry state simultaneously with water injected separately and/or sprayed through said inflatable housing to form a wet slurry in situ, followed by air drying until said slurry sets to form said hardened concrete mass.

24. The method of claim **17** including preinstalling an elongated reinforcing rod by inserting the same longitudinally through said casing portion and cap portions, applying rod fastener means engaging said cap portions and the outer ends of said rod, to embed said rod in said concrete mass upon hardening thereof following inflation of said housing, thereby placing said rod in tension and said concrete mass in compression and applying anchor means by preinstalling eyebolts surrounding said reinforcing rod and extending laterally therefrom and through said casing portion for attachment to said rails, to embed said eyebolts in said concrete mass upon hardening thereof following inflation of said housing, and applying rail fastener means engaging said eyebolts and said rails following said inflation to secure said tie and rails together, thereby placing said eyebolts in tension.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,907,201

DATED : September 23, 1975

INVENTOR(S) : Leonard T. Dlugosz

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 29, before "pads" insert --,--.

Column 7, line 14, change "R'" to --T'--.

Column 8, line 25, before "each" insert --,--.

Column 9, line 34, change "opening said" to --said opening--.

Column 10, line 8, change "29" to --19--.

Signed and Sealed this

sixteenth Day of *December 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks