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2,690,879

METAL-TO-WOOD FASTENING FOR RAILWAY TIES

Filed May 25, 1948

2 Sheets-Sheet 1

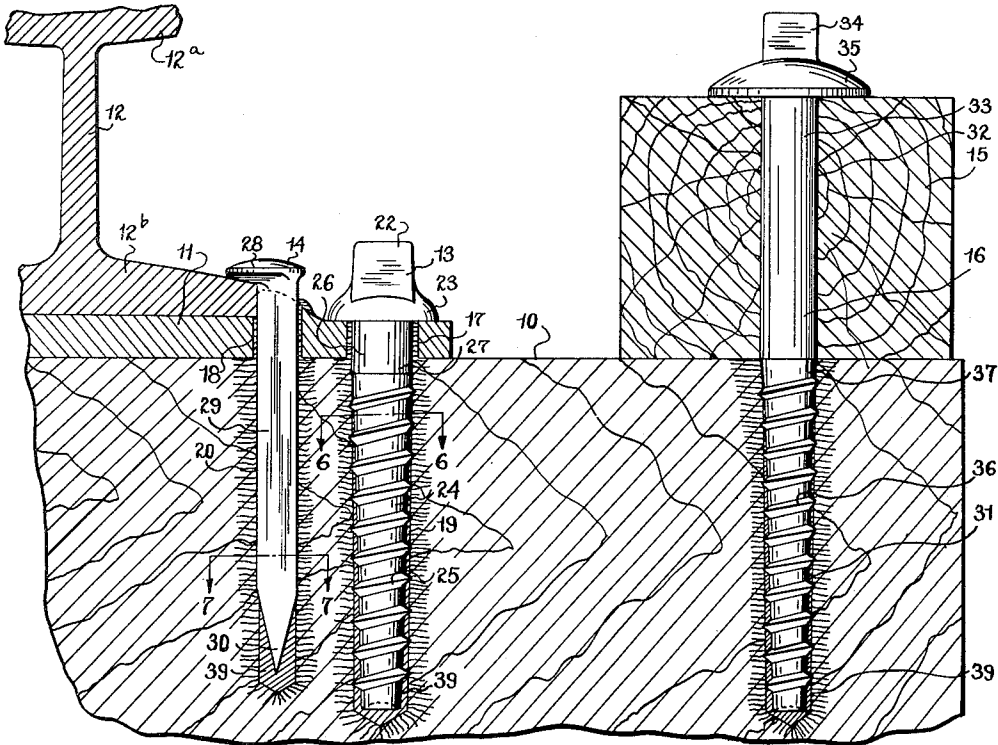


Fig. 1

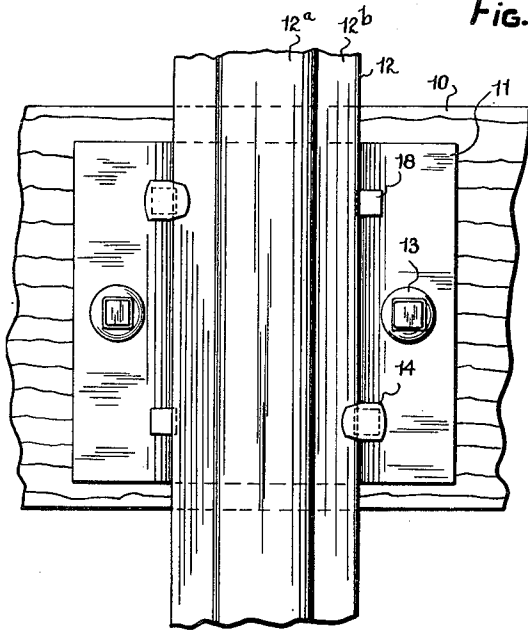


Fig. 2

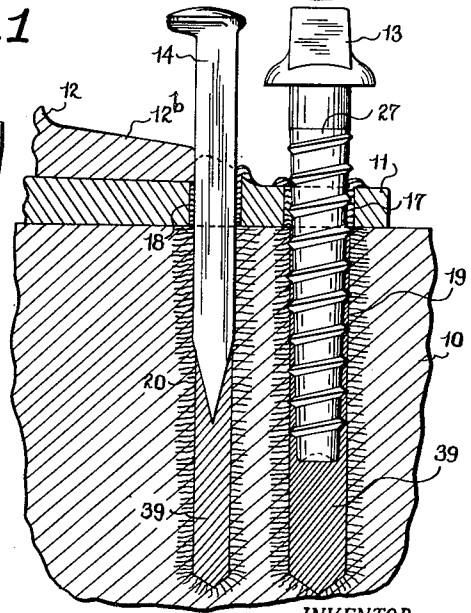


Fig. 3

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2 Sheets-Sheet 2

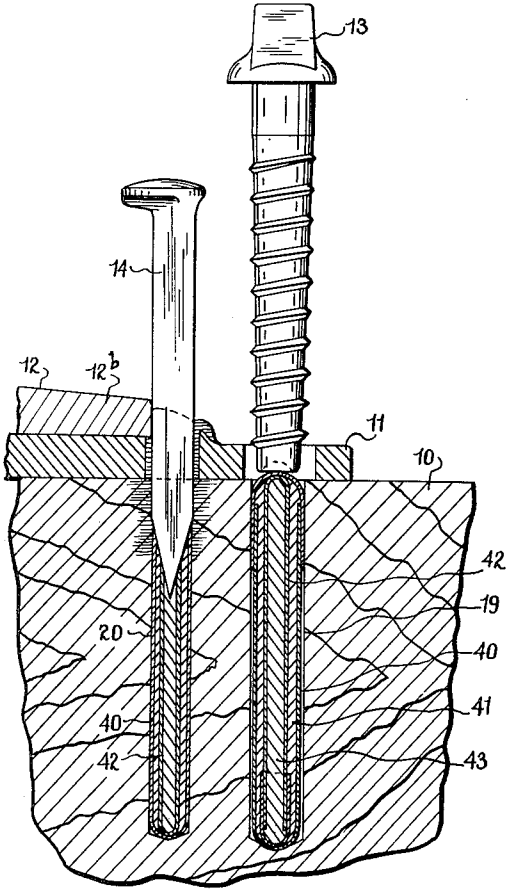


Fig. 4

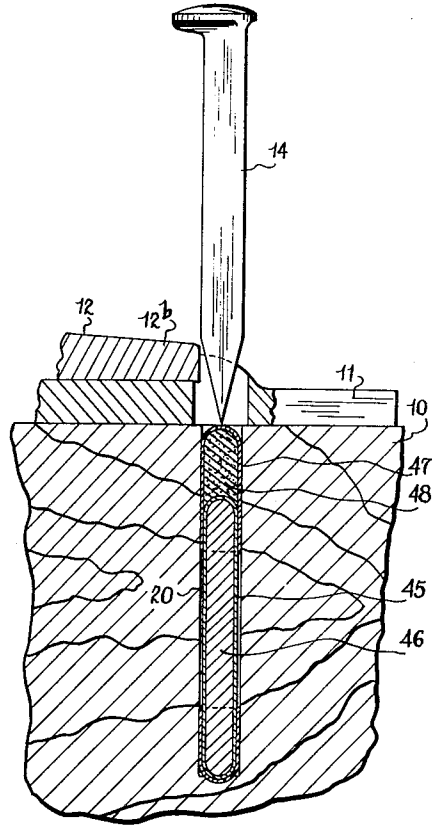


Fig. 5

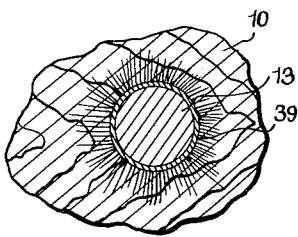


Fig. 6

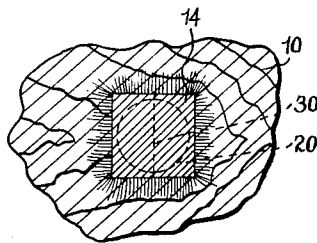


Fig. 7

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# UNITED STATES PATENT OFFICE

2,690,879

## METAL-TO-WOOD FASTENING FOR RAILWAY TIES

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Application May 25, 1948, Serial No. 29,132

22 Claims. (Cl. 238—371)

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This invention relates to metal-to-wood fastenings of the type in which a metal fastener such as a spike or lag screw is driven into a wood member and relates, more particularly, to an improved fastening of this kind in which a stronger and more durable connection is obtained between the metal fastener and the wood member.

Although the improved metal-to-wood fastening provided by the present invention can be applied to numerous different specific uses, it is particularly valuable in railroad construction and for that reason is hereinafter described as applied to that use. The disclosure of the improved fastening as applied to railroad construction represents one practical embodiment of the invention and is not made with any intent to limit the invention to that particular use.

Considerable difficulty has been encountered heretofore in railroad construction in that track fastenings are subject to rapid deterioration and loosening. Fastenings of this kind are subject to adverse service conditions by reason of the fact that they are constantly exposed to weather effects and to corrosive brine, and the like, which drips from railroad cars. These fastenings are also subject to constant jarring and vibration during the passage of trains on the track, as well as to lifting forces resulting from repeated deflection of the rails under the weight of passing railroad cars. Such jarring, vibration and lifting forces tend to loosen the spikes in the wood ties, which permits water and brine to enter the spike holes and further promote corrosion of the spikes and rotting of the ties. Moreover, when loosening of the spikes has occurred, it creates a hazardous condition which may result in a train wreck and also produces a condition which is very destructive to the ties because the loose fastenings permit increased flexing of the rail and this results in pounding and cutting of the ties by the tie plates. Still other factors which result in loose or weak fastenings are splitting of the ties and shearing of the wood in the spike holes when excessive torque is used in driving screw spikes.

One way of dealing with this problem is offered in my earlier Patent No. 2,389,464, granted November 20, 1945, in which the spike holes of wood ties are treated with a preservative material, such as asphalt or creosote, and although this treatment is highly beneficial it does not prevent the spikes from working loose. Another attempt to meet some of these disadvantages consists in the use of rustproofed spikes, such as galvanized spikes, and although the rustproof-

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ing decreases corrosion, it also gives the spikes a smoother surface characteristic which materially decreases their holding power in the wood ties.

The present invention satisfactorily overcomes all of the above-mentioned difficulties and it can accordingly be said that, as one of its objects, this invention provides an improved metal-to-wood fastening in which increased holding power and durability are obtained.

Another object is to provide an improved fastening of this character in which increased holding power and durability are obtained by reason of the fact that the wood member has been chemically treated and hardened.

A further object of this invention is to provide an improved fastening of the type comprising a metal fastener driven into a preformed bore of a wood member and in which a water-insoluble cold-setting glue increases the strength of the fastening by accomplishing the dual purpose of reinforcing the wood member and establishing an adhesive bond with the metal fastener.

Still another object is to provide an improved fastening of this kind having increased strength and durability by reason of the fact that the wood member has been impregnated with a wood-hardening and -preservative material, preferably a thermosetting material, although a thermoplastic material or a combination of thermosetting and thermoplastic materials can be used.

Yet another object is to provide an improved fastening of the character mentioned in which the wood-hardening and -preservative material is a resin type of glue which also establishes an adhesive bond between the metal fastener and the wood member.

As another of its objects, this invention provides an improved rail fastening in which a connection formed between a wood tie and a metal spike driven therinto has increased holding power and durability due to the impregnation of the tie, or the portion thereof immediately surrounding the spike, with a water-insoluble cold-setting glue which is also a wood-hardening and -preservative material, such material being preferably a thermosetting resin, although a thermoplastic material or a combination of thermoplastic and thermosetting materials can be used.

As a further object this invention provides a novel metal-to-wood fastening of this character in which the glue or wood-hardening and -preservative material comprises a mixture of a synthetic resin of the aldehyde or phenol aldehyde class and a vinyl resin and which mixture is

rendered thermosetting by the mixture of a hardener or catalyst therewith.

This invention also provides, as another of its objects, the novel use of capsule means by which the treating material or glue for the above-mentioned metal-to-wood fastenings can be introduced into a preformed bore of a wood member.

Other objects and advantages of this invention will be apparent in the following detailed description and in the accompanying sheets of drawings in which,

Fig. 1 is a partial vertical section taken through a railroad track construction embodying the present invention, the view being taken longitudinally through a wood tie and transversely of rail and stringer members connected to the tie;

Fig. 2 is a plan view of a portion of the track construction of Fig. 1 and showing the rail and tie plate supported on the wood tie;

Fig. 3 is a partial vertical section similar to Fig. 1, but showing the spikes only partially driven into the tie;

Fig. 4 is another partial vertical section showing the treating material contained in capsule means adapted to be broken during the driving of the spikes;

Fig. 5 is another such partial vertical section, but showing a different form of capsule means for the treating material, and

Figs. 6 and 7 are transverse sectional details taken respectively on section lines 6-6 and 7-7 of Fig. 1.

Proceeding now with a more detailed description of the invention, reference will first be made to Figs. 1 and 2 of the drawings which show a typical form of railroad track construction having the present invention embodied therein. The railroad track construction here illustrated includes a wood tie 10 having a conventional tie plate 11 mounted thereon and supporting a conventional rail 12 of the type having a head 12a and a base flange 12b. The tie plate 11 is secured to the tie 10 by means of conventional screw spikes 13 and the rail 12 is held against the tie plate 11 by means of conventional cut spikes 14. The railroad track construction here shown also includes a wood member or stringer 15 extending transversely of a number of the ties adjacent the end thereof and connected to the tie 10 by a screw spike 16 of the kind commonly referred to as a lag screw.

The tie 10 is a wood member such as a tie sawed or otherwise prepared from oak, pine or other kind of wood timber. The tie may have its outer surface creosoted as is conventional practice in present day railroad construction. The tie plate 11 has spaced openings 17 and 18 therein which accommodate the spikes 13 and 14, and the tie 10 has preformed openings or bores 19 and 20 located so as to register with the openings of the tie plate and into which the spikes 13 and 14 are driven, respectively.

The spike 13 is a conventional screw spike having a square head 22 carrying a shoulder 23 and also having a tapered stem 24 carrying a helical screw thread 25. The stem portion 26 immediately adjacent the head 22 can be cylindrical in shape, but for a purpose to be explained hereinafter, the stem portion 27 located immediately below the cylindrical portion 26 is a tapered portion. The preformed bore 19 into which the screw spike 13 is driven is of a diameter slightly larger than the root diameter of the screw spike but smaller in diameter

than the diameter of the screw spike measured across the tops of the thread convolutions.

The spike 14 is a cut spike of conventional form having a head 28 which includes an offset portion overlying the rail flange 12b, and also having a stem 29 of a substantially square cross-section which is provided at its lower end with a chisel point 30. The preformed bore 20 into which the spike 14 is driven is of a smaller diameter than the minimum transverse dimension of the spike, as illustrated in Fig. 7.

As shown in Fig. 1, the tie 10 is also provided with a preformed bore 31 into which the lag screw 16 is driven and the stringer 15 is provided with an opening 32 which is aligned with the bore of the tie and accommodates the cylindrical upper portion 33 of the stem of the lag screw. The lag screw 16 is provided at its upper end with a square head 34 carrying a shoulder 35 and the lower portion of the lag screw carries a helical thread 36. The intermediate portion 37 which connects the threaded lower stem portion of the lag screw with its cylindrical upper stem portion 33 is tapered for the same purpose as the taper 27 provided on the screw spike 13.

An important feature of the present invention resides in the fact that the tie 10, or the portions thereof immediately surrounding the bores 19, 20 and 31, is impregnated with a wood-hardening and -preservative material which increases the strength and durability of the connections formed between the metal fastenings 13, 14, 16 and the wood tie. In some cases the entire tie 10, or a substantial portion thereof, will be impregnated with the wood-hardening and -preservative material and such complete or partial impregnation can be prior to or after the formation of the bored holes in the tie. This complete or partial impregnation of the tie can be accomplished by forcing the treating material into the tie in accordance with the method and apparatus disclosed in co-pending application, Serial No. 29,133, filed May 25, 1948, now abandoned. In other cases only the portions of the tie immediately surrounding the preformed bores 19, 20 and 31 are impregnated with the treating material and this is accomplished by a pressurizing of the material in the bores by the fasteners during the driving of the latter, as is explained hereinafter. When the fasteners 13, 14 and 16 are to be driven into bores formed in a wood tie which has been previously treated with the wood-hardening and -preservative material, a small additional amount of this material is introduced into the bores at the time of the driving of the fasteners thereinto for establishing an adhesive bond between the fasteners and the treated tie.

Fig. 1 of the drawings illustrates the case in which the treating material has been placed in the bores 19, 20 and 31 and is subjected to pressure during the driving of the fasteners 13, 14 and 16 for causing such material to impregnate the portions of the tie immediately surrounding the bores. The treating material has been designated in the bores 19, 20 and 31 by the reference character 39 and although portions of this material are shown remaining in the bores, it will be understood that other portions of this material form a coating on the fasteners and still other portions have been forced laterally into the pores of the wood tie 10. When the treating material 39 is placed in the bores 19, 20 and 31, it is in a plastic or liquid state and dur-

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ing the driving of the fasteners, this material is trapped in the bores and is subjected to pressure. In the case of the threaded fasteners 19 and 31, the trapping and pressurization of the treating material is accomplished by the engagement of the tapered portions 27 and 37 in the bores 19 and 31. In the case of the cut spike 14, the treating material is trapped in the bore 20 by the engagement of the square cross-section of the spike in the smaller diameter bore 20.

After the fasteners have been driven into the tie 10, the treating material 39 assumes a set or hardened condition in which it bonds with the wood and reinforces those portions of the tie immediately surrounding the fasteners and also forms an adhesive bond between the tie and the fasteners. The hardening of the wood around the bores into which the fasteners are driven renders the wood substantially non-absorbent and highly resistant to subsequent rotting or splitting. The setting of the material in these portions of the tie also greatly increases the holding power of the fasteners in the tie by preventing shearing or stripping of those portions of the tie in which the screw threads engage. The adhesive bond which the treating material forms between the tie and the threaded fasteners also holds the fasteners against turning movement and thus prevents loosening of the fasteners. In the case of the cut spike 14, the adhesive bond formed by the treating material holds the spike against upward movement in the bore 20 and the hardening of the wood surrounding this bore increases the resistance which the tie is able to offer to lateral shifting of the cut spike.

Various chemical materials can be used as the treating material 39, but in general the material employed for this purpose should be initially fluid or plastic and should have setting characteristics such that in its set condition it will be water-insoluble and substantially non-absorbent and will harden or reinforce the wood and render the same resistant to fraying, shearing or rotting. As this treating material, any one of various synthetic resins can be used, such as resins of the aldehyde or phenol aldehyde class, for example, phenol formaldehyde, urea formaldehyde, melamine formaldehyde or resorcinol formaldehyde. These materials are potentially thermosetting in character and are rendered actually thermosetting by the mixing of a hardener or so-called catalyst therewith, such as formaldehyde, and the mixture formed by the resin and the catalyst constitutes the treating material 39. The catalyst can be in either powdered or liquid form and is added to the resin in suitable amounts such as 5 per cent to 50 per cent by weight to 95 to 50 per cent by weight of the resin but the amount of the catalyst to be used will depend upon the setting characteristics desired for the treating material. Ordinarily an amount of the catalyst is employed which will produce setting of the resin in a period of from one to four hours at normal temperature, that is to say, a temperature ranging from 65 degrees to 90 degrees Fahrenheit.

An important feature of the present invention is that the treating material 39 also establishes an adhesive bond between the wood and the metal fasteners driven thereinto. It is also important to prevent the treating material 39 from assuming a brittle state in which cracking or crazing might result in the material after it has set. Both of these characteristics are obtained

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by incorporating a plasticizing agent, such as a suitable thermoplastic material, in the aldehyde resin prior to the mixing of the catalyst therewith. As this plasticizing agent a vinyl resin can be used such as vinyl acetate or vinyl butyral. The preferred plasticizing agent can be designated as a partially hydrolyzed polyvinyl acetate. Suitable amounts of the plasticizer can be used depending upon the setting characteristics desired for the resin and when the above-mentioned polyvinyl acetate is used as the plasticizer, 2 per cent to 20 per cent by weight is added to the resin. The treating material or glue then comprises, by weight, 93 to 30 per cent of the aldehyde resin, 2 to 20 per cent of vinyl resin and 5 to 50 per cent of the catalyst.

To illustrate the effectiveness of the treating material 39 in increasing the strength of the connection formed between the tie 10 and the metal fasteners driven thereinto, the following tabulations are given showing the results of actual tests which have been carried out.

(A) Torque tests on metal-to-wood fastenings

| Test | Metal Fastener      | Wood Tie | Bore             | Torque Resistance in Ft. Lbs. |              |
|------|---------------------|----------|------------------|-------------------------------|--------------|
|      |                     |          |                  | With Glue                     | Without Glue |
| 1    | 1 3/16" Screw Spike | Red Oak  | 1 1/16" x 5 1/2" | 252                           | 125          |
| 2    | 7/8" Screw Spike    | do       | 1 1/16" x 5 1/2" | 256                           | 125          |
| 3    | do                  | Pine     | 1 1/16" x 5 1/2" | 184                           | 64           |
| 4    | 1 3/16" Screw Spike | Red Oak  | 1 1/16" x 5 1/2" | 296                           | 120          |
| 5    | 7/8" Screw Spike    | do       | 1 1/16" x 5 1/2" | 240                           | 115          |
| 6    | 7/8" Lag Screw      | Pine     | 1 1/16" x 5 1/2" | 216                           | 120          |

(B) Pull tests on metal-to-wood fastenings

| Test | Metal Fastener      | Wood Tie | Bore             | Pull resistance in Lbs. |              |
|------|---------------------|----------|------------------|-------------------------|--------------|
|      |                     |          |                  | With Glue               | Without Glue |
| 1    | 1 3/16" Screw Spike | Red Oak  | 1 1/16" x 5 1/2" | 17,850                  | 13,700       |
| 2    | 7/8" Screw Spike    | do       | 1 1/16" x 5 1/2" | 20,500                  | 13,800       |
| 3    | 3/4" Cut Spike      | Pine     | 1 1/16" x 5 1/2" | 3,400                   | 2,200        |
| 4    | do                  | Red Oak  | 1 1/16" x 5 1/2" | 5,375                   | 3,000        |
| 5    | do                  | do       | 1 1/16" x 5 1/2" | 6,900                   | 3,125        |
| 6    | do                  | do       | 1 1/16" x 5 1/2" | 9,290                   | 3,050        |

In the tests of the above tabulations the wood ties used were creosoted new wood ties having the bores formed therein after the ties had been creosoted. The glue as used in these tests consisted of a mixture of a potentially thermosetting resin and formaldehyde as a hardener or catalyst. Torque tests Nos. 1 to 6 inclusive of tabulation (A) and pull tests Nos. 1 to 4 inclusive of tabulation (B) were performed on metal-to-wood fastenings which had been formed by the use of a glue comprising a mixture of 100 parts by weight of a liquid potentially thermosetting resin, namely resorcinol formaldehyde, and 30 parts by weight of powdered formaldehyde as a hardener or catalyst. Pull tests Nos. 5 and 6 of tabulation (B) were performed on metal-to-wood fastenings which had been formed by the use of a glue comprising 100 parts by weight of a liquid potentially thermosetting resin, namely resorcinol formaldehyde, 15 parts by weight of liquid formaldehyde as a hardener or catalyst, and vinyl acetate in the amount of 10 parts by weight for test No. 5 and 15 parts by weight for test No. 6. In all of the tests of tabulations (A) and (B) the glue was introduced

into the bores and was pressurized into the wood by the driving of the spikes thereinto and the glue was permitted to assume a set condition before the test forces were applied to the fasteners.

Fig. 3 of the drawings shows the improved fastening being formed by the driving of the spikes 13 and 14 into the bores 19 and 20 in which quantities of the treating material 39 in bulk form have been placed. During the driving of the spikes the treating material is subjected to pressure, as explained above, and is forced into the pores of the wood tie 10.

Fig. 4 shows the treating material contained in capsule means so as to render this material convenient to handle for introducing the same into the bores 19 and 20. The capsule means here shown comprises an outer capsule 40 containing a quantity of the treating material 41, that is to say, a quantity of a potentially thermosetting resin as mentioned above, or a mixture of such resin and a plasticizer as mentioned above. The capsule means also includes an inner capsule 42 containing the catalyst material 43 and maintaining the catalyst segregated from the resin. The capsules 40 and 42 can be made of any suitable material, such as a molded plastic capable of resisting any chemical action thereon by the materials contained therein. Fig. 4 shows the screw spike 13 about to be started into the bore 19 and which inward movement of the screw spike causes rupturing of the capsules and a mixing of the catalyst with the resin to render the resin thermosetting. Fig. 4 also shows the cut spike 14 partially driven into the bore 20 and as having already ruptured the capsules 40 and 42 contained therein.

Fig. 5 of the drawings illustrates another form of capsule means in which a main capsule 45 contains the potentially thermosetting resin 46, or a mixture of such resin and plasticizer, and a supplemental capsule 47 contains a quantity of the catalyst 48 in powdered form. The capsule member 47 is here shown in the form of a cap which is telescopingly mounted on one end of the main capsule 45. Fig. 5 shows the cut spike 14 about to be driven into the bore 20 in which the capsule has been inserted. The movement of the pointed lower end of the spike into the bore will rupture the capsule and cause mixing of catalyst powder 48 with the fluid resin 46 and will render the latter thermosetting.

In the tabulations given above the values representing the increased holding power of the metal fasteners in the tie 10 resulting from the use of the treating material 39 are the values obtained when the fasteners were subjected to torque tests and pull tests for the initial removal of the fasteners from the connection. It has been found, however, that when the fasteners are removed from the tie, as for the purpose of replacing the rail 12 and are again driven into the same bores of the tie, the fasteners will still have a substantially increased holding power in the tie. When the fasteners are thus re-driven into the same bores of the tie, additional amounts of the treating material 39 can be used and holding values for the fasteners comparable with, or greater than, those expressed in the above tabulations will again be obtained.

From the foregoing description and the accompanying drawings, it will now be readily understood that this invention provides an improved metal-to-wood connection by which the holding power and durability for fastenings formed be-

tween a wood member and a metal fastener driven thereinto will be greatly increased. It will now also be understood that the increased holding power and durability for the fasteners is derived, in part, from a hardening and strengthening of the wood member and, in part, from an adhesive bond established between the metal fasteners and the wood member. Additionally, it will be seen that the improved fastening provided by this invention is especially valuable in railroad track construction and will contribute materially to the longer life of wood ties.

Although the improved fastening provided by this invention has been illustrated and described herein to a detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope, but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. A fastening of the character described comprising, a wood member having a preformed bore therein, a metal fastener engaging in said bore with a relatively close fit such that portions of said fastener are in direct contact with the side wall of said bore, and an initially fluid thermosetting resin in a set condition forming an adhesive bond between said fastener and said wood member internally of the latter.

2. A fastening of the character described comprising, a wood member having a preformed bore therein, and a metal fastener engaging in said bore with a relatively close fit such that portions of said fastener are in direct contact with the side wall of said bore, the portion of said wood member immediately surrounding said bore being impregnated with an initially fluid wood-hardening and -preservative thermosetting resin material which in its set condition hardens the impregnated portion of said wood member and renders the same stronger and more durable, said fastener having increased resistance to lateral shifting and axial loosening movements in said bore by reason of its tight fitting direct engagement with said impregnated and hardened portion of said wood member.

3. A fastening of the character described comprising, a wood railway tie having a preformed bore therein, and a metal fastener of the rail fastening spike type engaging in said bore with a relatively close fit such that portions of said fastener are in direct contact with the side wall of said bore, the portion of said wood member immediately surrounding said bore and substantially coextensive therewith being impregnated with a thermosetting resin which is initially fluid and in its set condition hardens the impregnated portion and increases the strength and durability of the connection between said fastener and said wood member.

4. A fastening of the character described comprising, a wood member having a preformed bore therein, and a metal fastener engaging in said bore with a relatively close fit such that portions of said fastener are in direct contact with the side wall of said bore, the portion of said wood member immediately surrounding said bore being impregnated with a thermosetting resin which is initially fluid and in its set condition in the impregnated portion hardens the same for increasing the strength and durability of the connection between said fastener and said wood member, the set resin also forming an adhesive bond between said fastener and said wood member internally of the latter.

5. In a fastening of the character described, a wood member having a preformed bore therein, and a metal fastener of the cut spike type driven into said bore and having a relatively tight-fitting metal-to-wood engagement with the portion of said wood member immediately surrounding said bore, such surrounding portion being impregnated with an initially fluid but settable water-insoluble wood-hardening and -preservative synthetic resin material which in its set condition hardens and preserves the impregnated portion and also forms an adhesive bond between said spike and wood member, said material being initially contained in said bore and the bore being of a smaller diameter than the minimum transverse dimension of said spike such that during the driving of said spike said material will be trapped and pressurized thereby in said bore and forced into the portion of the wood member immediately surrounding said bore.

6. In a rail fastening, a wood tie having a preformed bore therein, a tie plate on said tie and having an opening aligned with said bore, a rail on said tie plate, and a screw spike extending through the opening of said tie plate and driven into said bore and having a relatively tight-fitting metal-to-wood engagement with the portion of said tie immediately surrounding said bore and substantially coextensive therewith, such surrounding portion being impregnated with and having distributed therein a thermosetting resin in a set condition, said resin being initially fluid in said bore and being forced into said surrounding portion of said tie by the driving of said spike into said bore.

7. In a rail fastening, a wood tie having a preformed bore therein, a tie plate on said tie and having an opening aligned with said bore, a rail on said tie plate, and a screw spike extending through the opening of said tie plate and engaging in said bore with a relatively close fit such that portions of said screw spike are in direct contact with the side wall of said bore, the portion of said tie immediately surrounding said bore being impregnated with an initially fluid thermosetting wood-hardening and -preservative synthetic resin material, said material in its set condition rendering the impregnated portion harder and more durable and also forming an adhesive bond between said screw spike and said tie.

8. In a rail fastening, a wood tie having a preformed bore therein, a tie plate on said tie and having an opening aligned with said bore, a rail on said tie plate, and a cut spike extending through the opening of said tie plate and engaging in said bore with a relatively close fit such that portions of said cut spike are in direct contact with the portion of said tie immediately surrounding said bore, such surrounding portion being impregnated with an initially fluid thermosetting wood-hardening and -preservative synthetic resin material which in its set condition renders the impregnated portion harder and more durable and also forms an adhesive bond between said spike and tie.

9. In a fastening of the character described, a wood member having a preformed bore therein and the portion of said wood member immediately surrounding said bore being impregnated with a thermosetting wood-hardening and -preservative chemical, and a metal fastener driven into said bore and forming with the impregnated portion of said wood member a connection of increased strength and durability, said chemical

comprising a potentially thermosetting resin material and a catalyst material and being initially contained in a capsule means of a size to be received in said bore, said capsule means having separate compartments adapted to contain the resin and catalyst materials in segregated relation but being adapted to be broken by the driving of said spike to permit mixing of said resin and catalyst materials.

10. In a fastening of the character described, a wood member having a preformed bore therein and the portion of said wood member immediately surrounding said bore being impregnated with a thermosetting wood-hardening and -preservative chemical, and a metal fastener driven into said bore and forming with the impregnated portion of said wood member a connection of increased strength and durability, said chemical comprising a potentially thermosetting resin material and a catalyst material, one of which materials is contained in a capsule of a size to be received in said bore and the other of said materials being contained in a second capsule located inside the first-mentioned capsule, said capsules being adapted to be broken by the driving of said spike to permit mixing of said resin and catalyst materials.

11. A fastening of the character described comprising, a wood member having a preformed bore therein, a metal fastener engaging in said bore with a relatively close fit such that portions of said fastener are in direct contact with the side wall of said bore, the portion of the wood member immediately surrounding said bore being impregnated with an initially fluid water-insoluble cold-setting synthetic resin glue which in its set condition hardens and reinforces said impregnated portion of the wood member and establishes an adhesive bond between the impregnated portion and said metal fastener.

12. A fastening of the character described comprising, a wood member having a preformed bore therein, a metal fastener engaging in said bore with a relatively close fit such that portions of said fastener are in direct contact with the side wall of said bore, the portion of the wood member immediately surrounding said bore being impregnated with an initially fluid water-insoluble cold-setting synthetic resin glue which in its set condition reinforces said portion of the wood member and establishes an adhesive bond with said metal fastener, said glue comprising a mixture of a synthetic resin of the aldehyde class and a vinyl resin and said mixture being rendered thermosetting by the addition of a hardener catalyst thereto.

13. The method of making metal-to-wood fastenings of the kind in which a metal fastener engages in a wood member, which comprises the steps of forming in the wood member a bore of a smaller diameter than the transverse size of a given metal fastener to be driven thereinto, introducing into said bore a quantity of settable wood-hardening and -preservative material in fluid form, driving said given fastener into said bore and thereby pressurizing the fluid material therein and causing said material to impregnate portions of said wood member surrounding said bore, and permitting said material to assume a set condition in which it hardens and preserves the impregnated portions of said wood member and increases the holding power of said fastener therein.

14. The method of making metal-to-wood fastenings of the kind in which a metal fastener en-

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gages in a wood member, which comprises the steps of forming in the wood member a bore of a smaller diameter than the transverse size of a given metal fastener to be driven thereinto, introducing into said bore a quantity of settable wood-hardening and -preservative glue in fluid form, driving said given fastener into said bore and thereby pressurizing said glue therein and causing said glut to impregnate portions of said wood member surrounding said bore and substantially coextensive therewith, and permitting said material to assume a substantially water-insoluble set condition in which it hardens and preserves the impregnated portions of said wood member and also forms an adhesive bond between the fastener and said wood member.

15. In a method of making metal-to-wood fastenings of the kind in which a metal fastener engages in a wood member, the steps of forming in the wood member a bore of a smaller diameter than the transverse size of a given metal fastener to be driven thereinto, introducing into said bore a quantity of thermosetting resin in fluid form, and driving said given fastener into said bore and thereby pressurizing the fluid resin therein and causing said resin to impregnate portions of said wood member surrounding said bore.

16. The method of making fastenings as defined in claim 15 in which said thermosetting resin comprises a synthetic resin of the aldehyde class.

17. The method of making fastenings as defined in claim 15 in which said thermosetting resin comprises a mixture of synthetic resin of the aldehyde class and a catalyst for causing the resin to set.

18. The method of making fastenings as defined in claim 15 in which said thermosetting resin comprises a mixture of synthetic resin of the aldehyde class, a plasticizer and a catalyst for causing the resin to set.

19. The method of making metal-to-wood fastenings of the kind in which a metal fastener engages in a wood member, which comprises the steps of forming in the wood member a bore extending cross-wise of the grain of the wood and of a smaller diameter than the transverse size of a given metal fastener to be driven thereinto, introducing into said bore a quantity of thermosetting resin in fluid form, driving said given fastener into said bore and thereby pressurizing the fluid resin therein and causing said resin to impregnate portions of said wood member surrounding said bore, and permitting said resin to assume a set condition.

20. The method of making fastenings of the character described which comprises the steps of, forming in a wood member a bore which extends thereinto cross-wise of the grain and is closed at its inner end, introducing into said bore a quantity of thermosetting resin in fluid form, driving a metal fastener into said bore in tight fitting engagement with the side walls thereof and substantially trapping the fluid resin in said

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bore and forcing a substantial portion of the fluid resin into the portion of the wood member surrounding said bore and substantially coextensive therewith, and permitting the resin to assume its set condition in which it hardens and preserves the impregnated portion and forms an adhesive bond between the fastener and said wood member.

21. The method of making metal-to-wood fastenings of the kind in which a metal fastener engages in a wood member, which comprises the steps of forming in the wood member a bore of a smaller diameter than the transverse size of a given metal fastener to be driven thereinto, providing a capsule means containing a thermosetting resin in fluid form, introducing said capsule means into said bore, driving said given metal fastener into said bore and rupturing said capsule means and pressurizing the fluid resin in the bore and causing the resin to impregnate portions of said wood member surrounding said bore, and permitting the resin to assume a set condition.

22. The method of making fastenings of the character described which comprises the steps of, forming in a wood member a bore which extends thereinto cross-wise of the grain and is closed at its inner end, providing a capsule means having one compartment containing a potentially thermosetting resin in fluid form and a second compartment containing a catalyst for causing the resin to set when mixed therewith, introducing said capsule means into said bore, driving a metal fastener into said bore in tight fitting engagement with the side walls thereof and rupturing said capsule means to liberate and cause mixing of said fluid resin and said catalyst, the driving of said fastener also causing pressurization of the mixture of fluid resin and catalyst in the bore and impregnation of the portion of said wood member surrounding said bore with said mixture, and permitting said resin and catalyst mixture to assume a set condition in which it hardens and preserves the impregnated portion of the wood member and forms an adhesive bond between the fastener and said wood member.

## References Cited in the file of this patent

## UNITED STATES PATENTS

| Number    | Name                   | Date          |
|-----------|------------------------|---------------|
| 406,566   | Dudley -----           | July 9, 1889  |
| 1,276,725 | Cretsinger et al. ---- | Aug. 27, 1918 |
| 2,114,784 | Maisch -----           | Apr. 19, 1938 |
| 2,158,771 | Beckwith -----         | May 16, 1939  |
| 2,162,604 | Clow -----             | June 13, 1939 |
| 2,299,693 | Green -----            | Oct. 20, 1942 |
| 2,334,600 | Boysen -----           | Nov. 16, 1943 |
| 2,376,200 | Smidh -----            | May 15, 1945  |
| 2,389,464 | Snyder -----           | Nov. 20, 1945 |

## FOREIGN PATENTS

| Number  | Country             | Date          |
|---------|---------------------|---------------|
| 500,109 | Great Britain ----- | Jan. 30, 1939 |