United States Patent

[11] 3,544,006

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[73] Assignee **Koppers Company, Inc.**
a corporation of Delaware

[54] **NONMETALLIC TIE PLATE**
4 Claims, 4 Drawing Figs.

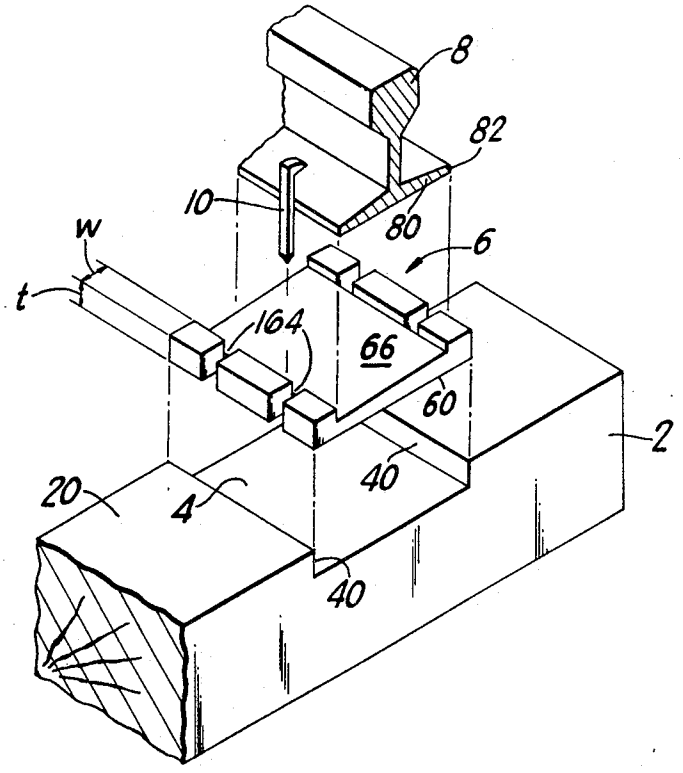
[52] **U.S. Cl.** **238/283,** 238/287
[51] **Int. Cl.** **E01b 9/40**
[50] **Field of Search** ..... 238/1, 10, 10(D), 29, 83, 84, 107, 151, 152, 264, 283, 287, 310, 315, 382

[56] **References Cited**
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3,358,925	12/1967	Pennino	238/287
3,369,753	2/1968	Olson	238/283

Primary Examiner—Arthur L. La Point
Assistant Examiner—Richard A. Bertsch
Attorney—Oscar B. Brumback and Olin E. Williams

ABSTRACT: A nonmetallic tie plate is provided which is disposable on a railroad tie for carrying a rail and which is usable with railroad spikes for securing the tie, the tie plate, and the rail together as a unit. The tie plate comprises a high density polyethylene which is capable of absorbing impact stresses and of distributing conventional compressive stresses that are caused by a train passing over the rail.



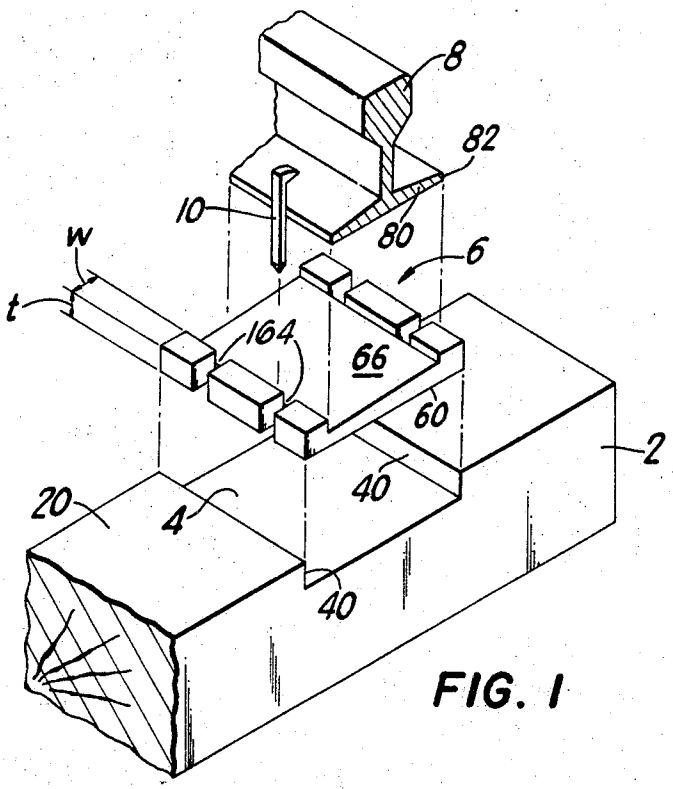


FIG. 1

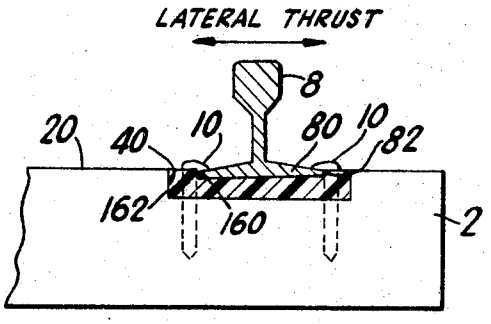


FIG. 2

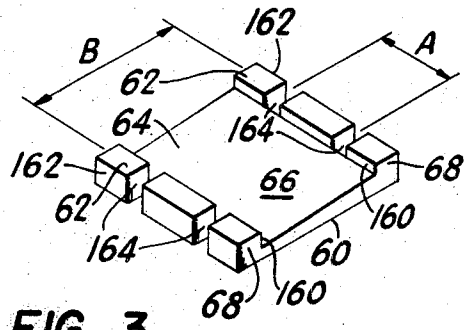


FIG. 3

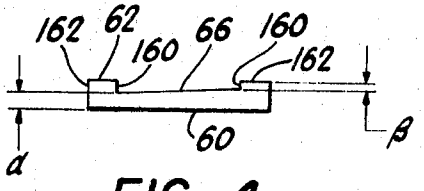


FIG. 4

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NONMETALLIC TIE PLATE

BACKGROUND OF THE INVENTION

This invention relates to a railroad tie plate and more particularly to a nonmetallic tie plate.

In the conventional construction of railroads, a metallic tie plate carrying a rail is disposed upon a surface of a wooden tie to spread and distribute the load or weight transmitted to the tie from the rail supporting a passing train. Conventionally, the tie plate and the rail are secured to the wooden tie by spikes driven through holes disposed near the lateral edges of the tie plate. These spikes secure the rail to the tie plate and likewise secure the tie plate to the wooden tie to restrict horizontal and vertical movements of the rail as the train passes over these rails.

Metal tie plates have been used for many years, although they have not been completely satisfactory. For example, the wooden tie is subject to "plate cutting" by the metal tie plate; that is, the cutting or wearing of the wooden tie by the tie plate. To reduce plate cutting, the metal tie plates have been made wider in order to more uniformly distribute the load from the rail to the tie. In some instances, tie plates have dimensions up to 16 inches in width, and still the tie plate cuts the wooden tie.

In addition, metallic tie plates have a high modulus of elasticity with respect to the stiffness modulus of wood; consequently, the tie plates do not absorb the initial shock or impact stresses resulting from the passing train, nor absorb sound waves and noise.

I have found a tie plate which is composed of a material which resolves the conflicting extremes of adequately transmitting and spreading the load of the passing train yet protecting the spikes from the buffeting of a tie plate and still absorbing sound waves.

DESCRIPTION OF PRIOR ART

Several solutions have been proposed heretofore by those skilled in the art to solve the aforementioned problems. U.S. Pat. No. 3,206,123, R.S. Baker, disposes a resilient polyethylene pad between a rail and a concrete tie to protect the tie from shock. One disadvantage of Baker is that the pad does not protect the spikes from impact stresses. If Baker's teachings were employed with wooden ties another disadvantage would be that the pad, being composed of a flexible polyethylene, would not distribute the weight from the rail over the surface of the wooden tie.

U.S. Pat. No. 2,892,592, John H. Greene, places a flexible tie pad between a metal tie plate and a wooden tie. A disadvantage, however, is that the metal tie plate is still required in Greene and again the spikes are subject to loosening by the horizontal components of motion of the tie plate.

In my patent, U.S. Pat. No. 3,358,925, I provide a nonmetallic tie plate composed of polyurethane or epoxies. The advantages of my patented tie plate include the bonding of the tie plate to the wooden crosstie to additionally protect the tie from the entrapment of moisture and dirt particles between the tie plate and the wooden tie. As a result of this bonding, the use of spikes is eliminated. However, to some skilled in the art, the use of spikes as a means of holding the tie plate to the crosstie is still desirable, particularly where it is wished to be able to replace the tie plate on the wooden tie.

My invention comprises a nonmetallic tie plate which is useable with railroad spikes. In fact, the tie plate is not conveniently adhesively bonded to a tie. The tie plate of my invention is composed of a material which imparts unexpected characteristics to the plate; namely, the tie plate is resilient relative to metallic tie plates and is capable of absorbing shock and of abating noise and yet is not so resilient that the loads are not transmitted and dispersed over the wooden tie. Because of the lower stiffness modulus of my tie plate and due to the design of my invention, the railroad spikes are protected from the loosening action of the tie plate caused when a train passes over a rail; hence, the life of the spike holding a tie plate to the tie is extended and the resetting of railroad tie plates is unnecessary.

SUMMARY OF THE INVENTION

In accordance with my invention, the tie plate comprises a right-angled parallelepiped which has a flat bottom surface for resting upon a railroad cross tie and has an upper surface spaced apart from the bottom surface. A recessed upper surface carries a rail; the recess extends from one end to the opposite end of the tie plate and defines a planar surface that is canted from one side to the opposite side of the tie plate at a slope of approximately 1 unit of rise to 40 units of run with respect to the bottom surface. Shoulders are thereby provided at each side of the tie plate which shoulders provide an inner surface meeting the planar recess surface for restricting the lateral movement of the rail carried by the recess. Also provided by the shoulders is an outer surface meeting the flat bottom surface which, when the tie plate is disposed into a recess rabbetted on a tie, restricts the lateral movement of the tie plate with respect to the tie by the outer surface engaging the side walls of the recess in the tie. Slots in each shoulder are spaced at locations on each side of the tie plate, the slots on each side being diametrically opposed and each slot extending from the edge of the plate to the recessed surface of the tie plate for receiving a spike. The tie plate is composed of high density polyethylene.

GENERAL DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is an exploded perspective view of the nonmetallic tie plate and the components with which it cooperates;

FIG. **2** is a cross-sectional view of the nonmetallic tie plate in cooperation with a railroad crosstie;

FIG. **3** is a perspective view of the tie plate; and

FIG. **4** is a cross-sectional view of the tie plate.

DETAILED DESCRIPTION OF THE DRAWINGS

In FIG. **1**, a wooden crosstie is shown generally indicated at **2** to carry the nonmetallic tie plate **6**, and a conventional rail **8** which is supported by the tie plate **6** and securable by spikes **10** to the tie **2**. Generally two such rails are secured to each tie by a tie plate at spaced apart distances from one another to form the gage of the track.

Crosstie **2** has a rectangular recess indicated at **4** transversely cut into the upper surface **20** of the tie providing sidewalls **40** which extend to a depth of about seven-eighths inches. The depth will depend upon the thickness *t* of the tie plate **6** so that the tie plate **6** fits flush with the upper surface **20** of the tie as shown in FIG. **2**.

The nonmetallic tie plate **6**, molded as a separate member, is generally formed as a rectangular slab or a right angled parallelepiped to fit snugly in the recess **4** between the side walls **40**.

The plate has a generally flat bottom surface **60** in FIG. **3** for engagement with the tie **2** in groove **4**. The tie plate **6** has an upper surface, generally indicated at **62**, which is spaced apart from the bottom surface **60**. The upper surface **62** has a recess generally indicated at **64** in the upper surface **62** extending from one end of the tie plate to the opposite end which defines a plane surface **66**. This planar surface **66** is canted from one side to the opposite side of the tie plate **6** at the slope of approximately 1 unit of rise to 40 units of run with respect to the bottom surface **60**. The slope of the cant is in accordance with the standards specified by various railroad companies. The purpose of the cant is to dispose the rails **8** inwardly of the track so that when the wheels of a train pass over the rail **8**, the load is better sustained. The tie plate **6** has raised abutments or shoulders **68** at each side of the tie plate, providing an inside planar surface **160** which is contiguous with and meets the planar surface **66** of the tie plate **6**. This inside planar surface **160** restricts the lateral movement of the rail **8** when a train passes over the rail as best seen in FIG. **2**.

The shoulders **68** also have an outer side planar surface **162** which, when the tie plate **6** is disposed within the recess **4** of the tie **2**, engages the side walls **40** of the tie **2** to prevent and to restrict any lateral movement of the tie plate with respect to the tie **2**. Slots generally indicated at **164** are provided in the shoulder **68** at spaced locations on each side of the tie plate **6**. These slots **164** on each side are diametrically opposite one another and they extend from the edge of the tie plate **6** or the outer planar surface **162** to the recessed surface **66** of the tie plate or to the inside surface **160** of the plate.

The tie plate **6** is disposable within the recess **4** of the tie **2** as seen in FIGS. **1** and **2**. The outer planar surfaces **162** of the tie snugly engage the side walls **40** of the cross tie **2**. As shown in FIG. **2**, the tie plate **6** disposed in the recess **4** is flush with the surface **20** of the tie, so that there is a coextensive engagement of the outer surface **162** with the sidewalls **40** of the tie. This aspect of the invention is essential as will be described hereinafter in order to provide sufficient support as the tie plate is thrust against the sidewalls **40** of the tie. The inner wall **160** of the shoulders **68** are substantially coextensive with the sidewalls **82** of the base portion **80** of the rail **8** to provide support when the base portion **80** is thrust against the shoulder **68** by the passage of a train over the rail.

The spikes **10** are disposable through the slots **164** of the tie plate **6** to engage the base portion **80** of the rail **8** for holding the rail to the tie plate **6**. Conventionally the spikes hold the tie plate to restrain lateral movement of the tie plate with respect to the tie. But in accordance with my invention the shoulders **68** of the tie plate by engaging the sidewalls **40** of the recess **4** restrain lateral movement of the tie plate; hence the function of the spikes **10** in accordance with my invention is merely to hold the rail **8** in the recess **64** of the tie plate **6**.

The slots **164** are spaced at locations according to the specification provided by the railroad industry. These specifications depend on the type and size of rail, particularly the cross-sectional width of the base portion **80** of the rail.

The dimensions of a commercially feasible tie plate are as follows:

The first dimension is referred to in FIG. **3** as the A dimension which defines the distance on each side of the tie plate with which the slots are spaced apart, and the second dimension, B dimension, is the distance that the slots are oppositely spaced apart of one another. For instance, with a 132 lbs. rail (a term of the art) which has a 6-inch base width of the rail **80**, the B dimension is conveniently 6¾" from center to center of each slot. The A dimension is conveniently 3 ½" from center to center of each slot. As a further example with a 115 lbs. rail, having a base width of 5 ½", the B dimension is 6 ¼" and the A dimension is 4". The minimum width *w* of the shoulder **68** as shown in FIG. **1** will depend upon the maximum diameter of the spike **10** to be used to secure the tie plate **6** and the rail **8** to the tie **2** and also will be determined by the composition of the tie plate in order to provide a sufficient width for restraining lateral movement of the tie plate. Conventionally square spikes are used having side dimensions of ⅝"; the minimum width *w* of the shoulders **68** should, therefore, be approximately ⅞" from the inner planar surface **160** to the outer planar **162** of the tie plate **6**. This width is also sufficient to restrain lateral movement of the tie plate **6**. The minimum thickness (α) from the bottom surface **60** of the tie plate **6** to the surface of the recess **66** in FIG. **4** has been found to be ¼"; however, greater thicknesses will offer the greater protection of the wooden tie. The depth (β) or the distance from the surface of the recess **66** to the top surface **62** of the tie plate generally **62** will depend upon the thickness of the base portion **80** or the height of the sidewall **82** of the rail **8**, and equal thereto in order that there will be a flush fit between the base of the rail **80** and the upper surface **62** of the tie plate **6**, and also will depend on the slope or cant of the surface **66**.

The shoulders **68** of the tie plate **6** serve a plurality of functions. They restrict lateral movement of the rail **8** carried by the tie plate **6**; they restrict lateral movement of the tie plate **6** itself with respect to the tie; and they protect the spikes **10** from loosening due to the buffeting of the tie plate **6** against the spikes **10** that is caused by a passing train. Hence the width *w* of the shoulders absorbs the shock of a sudden load causing a lateral thrust of the tie plate against the side walls **40** of the tie as illustrated in FIG. **2**. Movement of the tie plate is restrained by the engagement of the outer wall **162** against the sidewall **40**. In addition, the tie plate **6** at the edge of the slots **164** facing the sidewall **40** may however engage the spikes **10**. Because the tie plate **6** is composed of a nonmetallic material, the plate absorbs the shock of this engagement which reduces the probability of loosening the spikes **10**.

It is believed that a tie is normally subjected to two kinds of stresses: impact stresses and conventional compressive stresses transferred from the rail to the tie plate to the tie. The most damaging stresses are those of impact in that they represent a higher concentration of energy, causing more severe damage to a railroad tie by the cutting of a tie plate than conventional compressive stresses. Of course, compressive stresses may damage a railroad tie by the continuous exertion of a load on a tie plate g against the tie.

Conventionally the damage caused by compressive stresses on a tie may be substantially reduced by using wider metal tie plates which are capable of distributing the stresses over a greater surface of the tie. To some extent, wider tie plates also will distribute the impact stresses caused by the shock of the train passing over the rails. Conventional railroad tie plates are composed of a metal with a high modulus of elasticity rendering the tie plate capable of adequately distributing the compressive stresses; yet, the impact stresses are still transmitted through the tie plate to the tie surface causing severe damage.

I have found in accordance with this invention that by using a tie plate composed of a material which essentially absorbs impact stresses and yet is capable of distributing compressive stresses resolves the conflict of compressive and impact stresses. The material used in my invention absorbs impact stresses as well as distributes compressive stresses.

In accordance with my invention I have found that high density polyethylene not only is capable of absorbing the impact stresses but also is capable of distributing compressive stresses. I have also found polyurethanes and epoxy resins not to be suitable for my invention because they are essentially nonflowable materials and, when compared to the high density polyethylene used in my invention, are inelastic. Metallic tie plates are likewise not suitable with my invention because again they are, compared to the high density polyethylene used in my invention, also inelastic materials.

High density polyethylene is essentially a linear polyethylene as described in U.S. Pat. No. 2,816,883, Larchar and Pease. Conventionally high density polyethylene is produced at low pressures and low temperatures using a Ziegler catalyst. Typical properties of high density polyethylene include:

Tensile strength, (yield)—3000–4800 p.s.i.
Percent elongation at break—65–230 percent.
Stiffness modulus (1/16" specimen)—105,000–150,000 p.s.i.
Impact strength (Izod)—1.5–15.0 ft.-lbs. per inch.
Density—0.941–0.965 gms./cm.

Various fillers may be used with the high density polyethylene such as glass fibers, carbon black and the like to stabilize or improve the physical properties of the polyethylene.

Carbon black as a filler is highly desirable to stabilize the polyethylene from ultra-violet degradation and to preserve polyethlene from weathering. One source of high density polyethylene with a carbon black filler is Super Dylan 7000-N produced by Sinclair-Koppers Company having the following properties:

Tensile strength (yield)—3500 p.s.i.
Percent elongation at break—250 percent.
Stiffness modulus (1/16" specimen)—105,000 p.s.i.
Impact strength (Izod)—3.0 ft.-lbs. per inch.
Density—0.965 gms. per cc.
Abrasion—2.0 mg. per 1000 cycles.

This particular product has approximately 2½ percent by weight of carbon black filler.

The physical properties of the high density polyethylene are improved by reinforcing with glass fibers so the tie plate may better sustain its loads. By incorporating about 30 percent by weight of glass fibers into polyethylene the stiffness modulus may be increased to 366,000 p.s.i.

The tie plates may be conveniently manufactured by injected molding techniques or be conventional compressive molding and subsequently fitted into the recess 4 after molding.

As an example of the invention, a polyethylene tie plate having a carbon black filler was molded and positioned into the recess of the tie in similar fashion to FIGS. 1—3. The polyethylene used was Super Dylan Polyethylene 70 7000-N having the physical properties previously listed. This construction was then tested in a machine provided for such purposes by the American Railroad Association to artificially simulate the stresses and strains normally encountered in normal service. The tie and my nonmetallic tie plate secured thereto with spikes was then subjected to 2½ million cycles over a period of several weeks which represented a life-time wear of moderate railroad traffic. The rail was then removed from the tie and the surface of the tie was examined for wear. The wear on the polyethylene tie plate was very slight, and wear on the tie was also slight.

Thus my invention provides a nonmetallic tie plate composed of high density polyethylene which is capable of absorbing impact stresses yet it is capable of spreading and distributing the load of a passing train. Because the tie plate of my invention is disposed within a recess of a tie the spikes are relieved of the function of restricting lateral movement of my tie plate. The shoulders of my tie plate are engageable with the sidewalls of the recess to restrain lateral movement of the tie plate. My tie plate being composed of density polyethylene, absorbs sound waves thus providing noise abatement. Also my tie plate protects the spikes from loosening due to the buffeting of the tie plate against the spikes.

I claim:

1. A tie plate comprising:
a bottom planar surface for resting upon a tie;
a top planar surface spaced Apr. apart from the bottom surface for carrying a rail, extending from one end to the opposite end of the tie plate, and canted from one side to the other side of the tie plate at a slope of approximately 1 unit of rise to 40 units of run;
said top surface terminating at a raised abutment of each side of the top surface having an inner side planar surface meeting the top planar surface for restraining lateral movement of the rail;
said raised abutment having an outer side planar surface meeting the bottom surface for engaging a sidewall of a recess rabbetted in the tie to restrict lateral movement of the tie plate with respect to the tie;
said raised abutment having a top surface meeting the outer side planar surface and the inner side planar surface of the raised abutment of the tie plate;
said top surface of the raised abutment having two slots cut therein at spaced locations on each side extending from the top surface of the raised abutment to the bottom planar surface, the slots on each side being diametrically opposed and each slot extending from the outer side planar surface to the inner side planar surface of the raised abutment whereby spikes may be disposed in the slots, and driven into the tie to hold the rail, the tie plate, and the tie together as a unit; and
said tie plate being comprised of a high density polyethylene having approximately 2½ percent of a carbon black filler.

2. A tie plate comprising:
a right angled parallelepiped having a flat bottom surface for resting upon a tie and having an upper surface spaced apart from the bottom surface;
a recess in the upper surface for carrying a rail, extending from one end to the opposite end of the tie plate and defining a planar surface that is canted from one side to the opposite side at the slope of approximately 1 unit of rise to 40 units of run with respect to the bottom surface whereby shoulders are provided at each side of the right angled parallelepiped;
said shoulders providing an inner side surface contiguous with the planar surface of the recess for restricting the lateral movement of the rail and also providing an outer side surface contiguous with the flat bottom surface;
said tie plate being disposable into a recess rabbetted on the tie which recess has sidewalls engageable by the outer side surface of the shoulders for restricting lateral movement of the tie plate;
two slots cut in each shoulder at spaced locations on each side, the slots on each side being diametrically opposed and each slot extending from the edge of the plate to the recessed surface of the tie plate whereby spikes may be disposed in the slots and driven into the tie to hold the rail, the tie plate and the tie together a unit;
said tie plate being composed of a high density polyethylene being characterized by the following physical properties:

Tensile strength (yield)—3000–48000 p.s.i.
Percent elongation at break—65–230 percent.
Stiffness modulus (1/16" specimen)—105,000–150,000 p.s.i.
Impact strength (Izod)—1.5–15.0 ft.-lbs. per inch.
Density—0.941–0.965 gms./cm.

3. The tie plate of claim 1 wherein the high density polyethylene having approximately 2½ percent of a carbon black filler is characterized by the following physical properties:

Tensile strength (yield)—3500 p.s.i.
Percent elongation at break—250 percent.
Stiffness modulus (1/16" specimen)—105,000 p.s.i.
Impact strength (Izod)—3.0 ft.-lbs. per inch.
Density—0.965 gms. per cc.
Abrasion—2.0 mg. per 1000 cycles.

4. A tie plate comprising:
a right right angle parallelpiped having a flat bottom surface for resting upon a tie and having an upper surface spaced apart from the bottom surface;
a recess in the upper surface for carrying a base portion of a rail extending from one end to the opposite end of the tie plate and defining a planar surface that is spaced a minimum distance of one-fourth inch from the flat bottom surface and that is canted from one side to the opposite side at the slope of approximately one unit of rise to 40 units of run with respect to the bottom surface whereby shoulders are provided at each side of the right parallelepiped having a minimum width of seven-eighth inches;
said shoulders providing an inner side surface meeting the planar surface of the recess having a depth into the tie plate equal to the height of the base portion of the rail for restricting lateral movement of the rail and also providing an outer side surface of the shoulders for restricting lateral movement of the tie plate with respect to the tie;
two slots cut in each shoulder at spaced location of 3½ inches from the center to center of each slot, the slots on each side being diametrically opposed and spaced apart by 6¾ inches from center to center of each slot; each of said slots extending from the edge of the tie plate to the recessed surface of the tie by a distance of seven-eighth inches whereby spikes may be driven into the tie to hold the rail, the tie plate and the tie together as a unit; and
said tie plate being composed of a high density polyethylene having approximately 2 ½ percent by weight of carbon black filler which is characterized by the following physical properties:

Tensile strength (yield)—3500 p.s.i.
Percent elongation at break—250 percent.
Stiffness modulus (1/16" specimen)—105,000 p.s.i.
Impact strength (Izod)—3.0 ft.-lbs. per inch.
Density—0.965 gms. per cc.
Abrasion—2.0 mg. per 1000 cycles.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3544006 Dated December 1, 1970

Inventor(s) Charles J. Pennino

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

In Claim 2, line 21

"Tensile Strength (yield) - 3000-48000 psi"

should read

-- Tensile Strength (yield) - 3000-4800 psi --

SIGNED AND
SEALED
MAR 9 1971

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents