Dec. 6, 1966 E. L. GROFF 3,289,940

SYNTHETIC RAILWAY TIE

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FIG. 1.

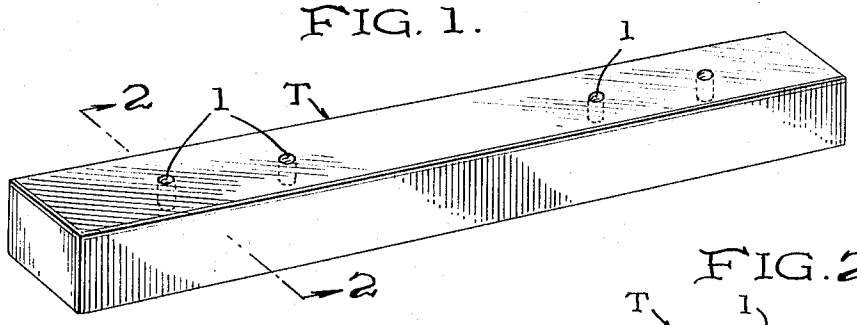


FIG. 2.

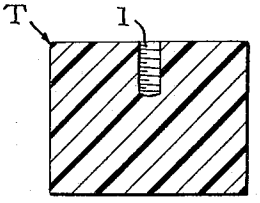


FIG. 2a.

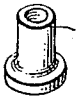


FIG. 3a.

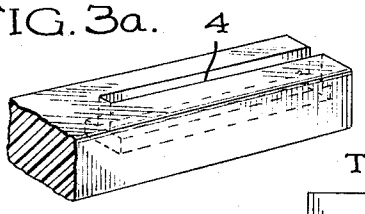
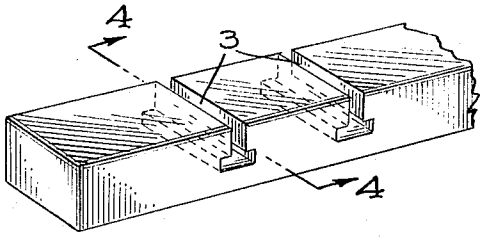


FIG. 3.



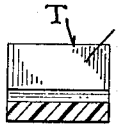


FIG. 4.

FIG. 5.

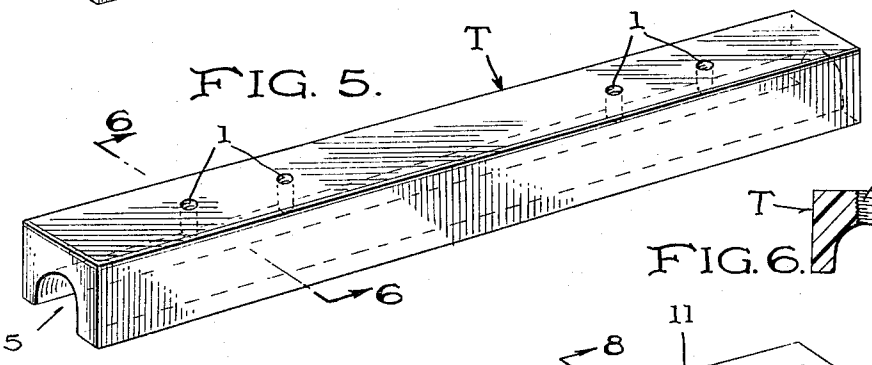
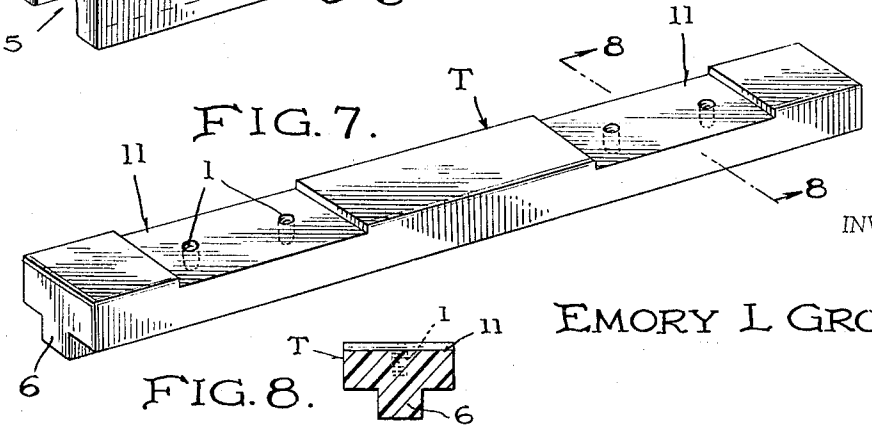


FIG. 6.

FIG. 7.



INVENTOR

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FIG. 8.

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FIG. 9.

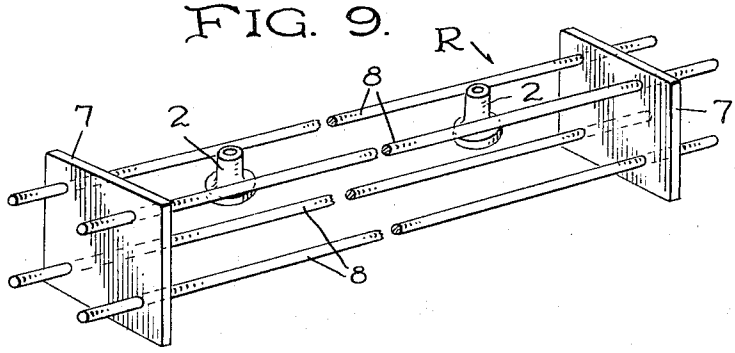


FIG. 10.

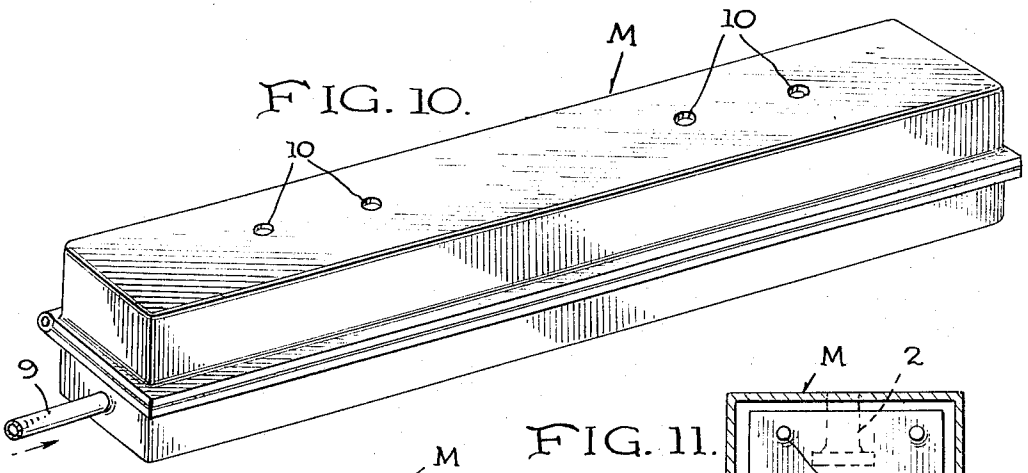


FIG. 11.

FIG. 12.

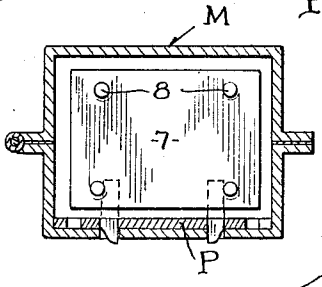


FIG. 14.

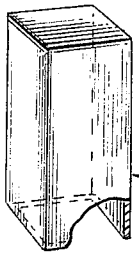
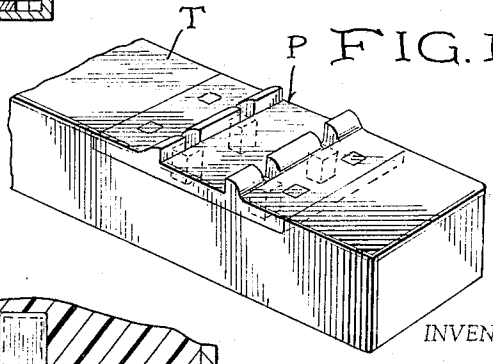


FIG. 15.



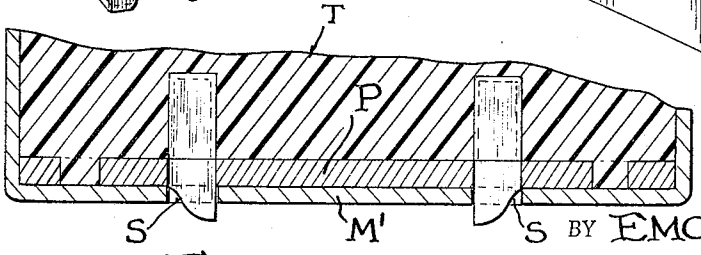


FIG. 13.

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United States Patent Office

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SYNTHETIC RAILWAY TIE

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Filed Sept. 10, 1965, Ser. No. 486,273
2 Claims. (Cl. 238—29)

This invention relates to railway ties.

For several generations railroads have used treated oak ties, but with the foreseeable scarcity of good wood of any sort, many railroads are turning to concrete cross-ties. Ties of this type have been used many years abroad, but are currently being used in greater quantity in the United States. In order to provide greater strength, durability, and better anchorage in the ballast, ties are now being made of pre-stressed concrete.

While concrete ties are being used in transition from wood ties to substitutes, nevertheless, the pre-stressing, casting, and waterproofing operations involve prolonged time intervals, the use of much equipment as well as man-power labor costs which show little prospect of declining in future operations, even with the aid of the possible location of manufacturing sites near the points of use.

Accordingly, one of the objects in the present invention is to provide a tie made of synthetic resinous material or a mixture of synthetic resinous materials, including reinforced synthetic resinous material or a reinforced mixture of synthetic resinous materials, which, more particularly from the standpoint of method, apparatus, and quantity production, greatly simplifies manufacturing procedures, and, to that extent, permits diversification of manufacture in locations of increasingly available plastic manufacturing facilities. In that connection, the present invention proposes to provide such synthetic resinous material type ties which may be produced by simple molding procedures and which may be readily reinforced, when required, by the use of non-metallic or metallic reinforcing elements.

At this point is may be noted that the individual weight of wood ties, depending on the type of wood, moisture content and preservative will weigh in the neighborhood of 325#–375#. This range is based on a tie which may be 6" x 6" to 7" x 9" in cross section and from 6' to 16' in length. A comparable concrete tie would weight approximately 650#–700#. A synthetic cross tie of the same general dimensions would weigh approximately 600#, although this figure would vary within reasonable limits according to the type or cross-sectional shape of the tie as well as the nature of the synthetic material and the chosen reinforcement, or filler when it is desirable to use one. Thus, is it apparent that so far as weight is concerned, synthetic ties are comparable but preferable to concrete, while having the further advantage of longer life than any other ties now generally in use, and lending themselves to more convenient and relatively inexpensive manufacturing procedures. Concrete, even when waterproofed, becomes relatively porous, and, with respect to its metal reinforcements, and the metal rail fastenings, is subject to deterioration at a greater rate than would be a comparable synthetic tie. Moreover, concrete ties are exposed to wide variations of temperature and moisture conditions which impose extraordinary limitations on the longevity of the metal fastenings used, particularly in rainy, damp or very humid locations, especially when the humid air includes salt as it does in all coastal areas and warm climates where land is surrounded by oceans or seas.

The use of concrete ties requires so-called rail clips which hold the rail flanges to the ties. This practice does not fully take into account the inevitable wave motion of the steel rails under rolling wheel loads, as is the case where it has been customary to use spikes to hold the tie plates to the tie, and let rail anchors accommodate wave motion while preventing creeping.

Line spikes merely hold the rails to gauge, and it is often the case that the heads of these spikes are lifted to greater degrees of space from the rail flanges while the tie plates are held to the ties by separate spikes.

Rail clips do have some small degree of resilience; nevertheless, experience have shown that spring clips hold the rail to the tie in a manner which causes vertical movement of the tie in the ballast known as "pumping." Records show that ballast is an important and expensive part of the railroad, not only from the standpoint of initial installation, but also maintenance. Roadbeds in which pumping occurs involve extraordinary maintenance and replacement expense which far outweighs the ultimate cost of the use of tie plates and fastenings which permit of accommodating wave motion with a minimum of damage to the ballast.

Another object of the invention is to provide a railway tie made from such synthetic resinous materials, including mixtures thereof, and such reinforced materials, as aforesaid, wherein, the tie plate may be secured to the tie at the time of manufacture, thus making a pre-plated tie as a single operation. Many attempts have been heretofore made to pre-plate ties by assembling them at track-side locations, or in a given maintenance area, and then adhesively or otherwise connecting the plates to the tie. This operation in itself is expensive from the standpoint of time and labor involved and distribution problems, but it can be entirely eliminated by the present invention.

Referring to the drawings,

FIG. 1 is a perspective view of a synthetic tie in which the threads for rail fastenings are molded directly in the material of the tie at the time of manufacture.

FIG. 2 is an enlarged cross-sectonal view taken on the line 2—2 of FIG. 1.

FIG. 2*a* is a perspective view of a fastening receiving anchor to be molded in the body of the tie.

FIGS. 3 and 3*a* are partial perspective views of portions of a tie of a synthetic resinous material, or mixtures thereof, as aforesaid, according to the present invention, respectively having special pre-formed transverse or longitudinal slots for receiving rail fastenings.

FIG. 4 is a cross-sectional view taken on the line 4—4 of FIG. 3.

FIG. 5 is a perspective view of a modified form of tie whose ballast engaging face is longitudinally arched.

FIG. 6 is a cross-section taken on the line 6—6 of FIG. 5 and shows the fastening receiving openings leading into the arched portion to effect drainage.

FIG. 7 is a perspective view of a tie of this invention having a longitudinally depending ballast embedding rib on its underside.

FIG. 8 is a transverse cross-sectional view of the tie shown in FIG. 7.

FIG. 9 is a perspective view of one example of reinforcing frame prior to placing the same in a tie mold box or equivalent enclosure.

FIG. 10 is a perspective view illustrating a typical more or less diagrammatic form of mold.

FIG. 11 is a vertical cross-sectional view of the mold shown in FIG. 10.

FIG. 12 is a vertical cross-sectional view of a modified form of mold on the order of FIG. 11 wherein the bottom wall of the mold is provided with slots to receive the shoulders of an inverted tie plate to enable the latter to be embodied in and surrounded by the synthetic material of which the tie is made.

FIG. 13 is an enlarged detail cross-sectional view showing the inverted tie plate on the bottom wall of the mold.

FIG. 14 is a detail perspective view of a hollow inverted thimble whose open end is placed in the line fas-

tening openings of the tie plate at the time of molding the tie to prevent plastic material flowing through said openings, and, at the same time, providing fastening receiving pockets.

FIG. 15 is a detail perspective view of one end of a plastic tie having a tie plate molded therein.

The materials of construction of the tie of this invention include, as hereinbefore set forth, synthetic resinous materials, a mixture of synthetic resinous materials, reinforced synthetic resinous materials, and reinforced mixtures of synthetic resinous materials. The ties of this invention are such as are made of such materials which are subjected to, as hereinbefore set forth, the inevitable wave motion of the steel rails under rolling wheel loads such as are encountered in railroad track. Therefore, the ties of this invention are made of said aforedescribed synthetic resinous material or compositions, as aforesaid, as have good static and dynamic load resisting qualities, good abrasion resisting qualities, adequate resistance to impact and shock, immunity to temperatures and temperature changes from —75° F. to +275° F. or more, good resistance to electrical environment, that is, good electrical insulation properties, ability to withstand acids of the type encountered in railway practice, ability to resist the damaging effect of oxygen, ozone and salt water, ability to resist fungi, ability to resist bacteria, and ability to resist rodent and animal attack. By way of example, and not limiting in nature, and because of their durability, availability and established handling procedures, the thermosetting synthetic resinous material, or materials, including epoxy resins, phenolic or phenol-aldehyde resins, melamine-aldehyde resins, cellulose-filled urea-aldehyde resins, alkyd resins such as diallyl phthalate molding resins, including glass-filled or polyacrylonitrile-filled DAP or diallyl phthalate resins, polyacrylonitrile also being known by the trademark Orlon, glass-filled phenolic resins, glass-filled urea-aldehyde resins, glass-filled melamine-aldehyde resins, glass-filled and other mineral-filled silicone resins, polyamide-filled phenolic resins, epoxy-phenolic resinous materials, epoxy-polyamide resinous materials, said polyamides being known as nylon, epoxy-polysulfide resinous materials, phenolic polyester resins, glass-filled silicone resins and other mineral-filled silicone resins, and the like are used. However, crystalline thermoplastic resins of good mechanical properties like polycarbonate resins are also proper materials to be used for the tie of this invention.

Use of the aforedescribed and aforementioned synthetic resinous materials will eliminate two steps in tie manufacture, namely, creosoting or other treatment of wood ties, and waterproofing of concrete ties.

Referring to the drawings, it will be seen that a railway tie of generally standard dimensions heretofore described is designated as T. This designation will be used throughout the specification to designate the tie formed of a material as hereinbefore set forth. Only modifications of the special structural features will be referred to by specific identifications.

As shown in FIG. 1, the upper face of the tie is provided with two pairs of spaced holes **1—1** in the rail gauge area of the tie. These holes may be formed internally by molding or mechanical means with threads to receive the threaded shank of a fastening, such, for example, as may be used with tie clips. In the latter connection, reference can also be made to FIG. 2 and to FIG. 2*a* which show a separate socket member **2** which may be set up in the mold prior to inserting the resinous moldable material into the mold. As shown, the socket member **2** is made of metal or even a non-metallic material, and is provided with an offset portion preferably in the form of an anchoring flange.

As illustrated by FIG. 3, the tie may be provided with a pair of inverted T-shaped slots **3** opening from the opposite sides of the tie. These slots may receive headed fastenings from the sides of the tie and provide for ready

transverse adjustments of the fastenings before final setting.

FIG. 3*a* shows slots **4** of the same type as shown in FIG. 3 but disposed longitudinally of the tie so that headed fastenings may be inserted from the end of the tie instead of the sides. This feature renders the ties useful with both standard and narrow gauge track.

FIG. 5 illustrates a tie whose bottom portion is provided with a longitudinally extending channel **5**. As will be observed from FIG. 5, the top surface of the tie may be provided with fastening receiving openings **1** which extend from the upper exposed face of the tie into the channel **5** for purposes of drainage. The radius of the arc of the arch will vary to suit desired specifications.

FIG. 7 shows a tie having the fastening receiving openings **1** at its upper side with its bottom portion formed with a rib **6** which is preferably integral and co-extensive with the length of the tie. As shown in FIG. 7, the gauge area of the tie may be transversely recessed as at **11** to receive the bottom flanges of a so-called continuous joint which has its inturned bottom flanges disposed beneath the rail, and, in some cases it is used without a tie plate. It will of course be understood that all tie described herein may have such recesses, to accommodate the joint bars or tie plates.

Referring to FIG. 9, it will be observed that it shows a form of reinforcing frame which may include opposite end plates **7** and longitudinally disposed rods **8** which may be readily inserted into the mold M of FIG. 10. The reinforcing material may be of a filler or reinforcing material for the resinous material being used, for example, metal or glass rods preferably composed of strands coated with resinous material during the course of manufacture, as set forth for example in U.S. Patent No. 3,193,201, dated July 6, 1965.

The mold M may be of any conventional type to provide the desired elongated rectangular shape of a tie. Instead of the preformed hollow mating sections shown in FIG. 10, the sides may be hinged to adjacent walls in the conventional way to facilitate removal of the tie. One of the mold sections may be conveniently provided with a resinous material inlet connection **9**, and the top wall of the mold may be provided with the openings **10** to receive a form for providing the threaded sockets **1**, or in fact, an internally threaded tubular member.

As previously indicated, concrete ties have generally used tie clips for securing the rails to the ties. While in some cases these clips have been described as spring clips, nevertheless to be of the desired strength, great sacrifice must be made in the degree of yieldability. In other words, although most clips are stamped or punched from so-called spring metal, they are so stiff that rapidly passing wheel loads, well known to be of considerable magnitude, have a tendency to lift the tie in the ballast under the wave motion generated by rolling loads. It is for this reason that the acceptance of concrete ties and tie clips has long been delayed, and it has been necessary for railroads to decide whether they want cheap rail clips, which are about half the price of rail anchors, as a temporary solution to their economical problems, or the more laborious and far more expensive job of track bed maintenance, with the consequent delays in schedules.

Therefore, one of the advantages of the present invention is that it lends itself to molding a metal tie plate directly to the tie during the course of manufacture of the latter, thereby providing a minimum of time and labor to obtain a readily handled unit.

Heretofore, it has been known to pre-plate railroad ties by securing the plates to the ties with adhesives, or even using metal fastenings at a location adjacent the installation site. This practice entails much labor of first placing the plates on the ties, and then transporting them to the installation site. All of these procedures are laborious and expensive. But by the present invention, the tie plates may be secured to the ties at the time they are

made, thus completely eliminating all pre-plating procedures and providing in a single step a combined tie and tie plate which can be used with rail anchors if desired. In this case, the rail anchors abut the ends of the tie plate which are exposed at opposite sides of the tie, as shown in FIG. 15.

When the tie plate P is to be used in the mold M, or equivalent form, the bottom wall M' is provided with transversely elongated slots S to permit the shoulders of the inverted tie plate to pass through the same, so that the service area of the tie plate rests substantially flush on the inner bottom face of the mold while resinous material is prevented from entering the line spike openings of the plate by suitable hollow thimble including side and bottom walls, shown for example in FIG. 14. The hollow open end of this thimble is inserted into the openings at the back of the tie plate so that its side walls and bottom end will keep the synthetic resinous material in its fluid or liquid state from entering the spike holes but permitting it to flow into and key with what would otherwise be spike holes in the tie plate so that when the tie is removed from the mold the plate is fixed to the tie. The thimbles B may be made of any form of commercial product now on the market such as glass cloth impregnated with resin, so as to keep their shape during handling and until applied and surrounded with tie forming plastic. Alternatively, the thimbles may be replaced for example, by a socket member such as shown in U.S. Patent No. 3,196,-583, dated July 27, 1965, which is embedded in the tie at the time it is made and left in place to receive a spike or similar fastening.

While the synthetic resinous material will be prevented from entering the rail seating portion of the tie plate because of its close fit with the adjacent face of the mold, nevertheless, it will be understood that any non-adhesive coatings known to the molding art may be applied to either the mold bottom or the face of the tie plate. Standard rolled and sheared tie plates having spaced parallel shoulders often have curved portions extending from the top outer edge of the ribs to a flat area in which the spike openings are formed. Thus, the bottom of the mold can be curved outwardly when the slots are made, or alternatively a suitable frangible ceramic material can be used to fill any space between the outer face of the tie plate and the related mold surface.

From the foregoing, it will now be seen that the present invention provides a moldable synthetic resinous material tie that requires a minimum of time and labor to produce, and which in use will have adequate impact, tensile compressive strength and flexual modulus, as well as a minimum of thermal expansion and contraction and resistance to moisture and acids likely to be encountered in railway track.

The terminology "synthetic resinous material" as used herein of course covers mixtures of synthetic resinous materials, reinforced synthetic resinous materials and reinforced mixtures of synthetic resinous materials.

I claim:

1. A pre-plated tie for embedment in the ballast of a track-bed for rails, comprising,

a homogeneous elongated monolithic body of synthetic resinous material capable of being molded and having an upper rail supporting face impervious to fluids and dust and adapted to support the base portions of railway rails weighing in the range of 75# to 165# per yard,

and a metal tie plate having vertically extending openings filled with the material of the tie during molding of the tie to secure the plate against movement in both horizontal and longitudinal directions in relation to the exposed surface of the tie.

2. A pre-plated tie for embedment in the ballast of a track-bed for rails, comprising,

a homogeneous elongated monolithic body of synthetic resinous material capable of being molded and having an upper rail supporting face impervious to fluids and dust and adapted to support the base portions of railway rails weighing in the range of 75# to 165# per yard,

and a metal tie plate having a pair of spaced shoulders defining a rail seating portion therebetween,

said shoulders provided with line fastening receiving openings and also provided outwardly of said shoulders with other openings for securing the plate to the tie,

said latter openings filled with the material of the tie during molding of the tie which serves to firmly secure the plate against movement in both horizontal and longitudinal directions in relation to the exposed surface of the tie.

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