Dec. 6, 1966 E. L. GROFF ET AL 3,290,419

METHOD OF MAKING RAIL ANCHOR

Original Filed Nov. 14, 1963

FIG. 1.

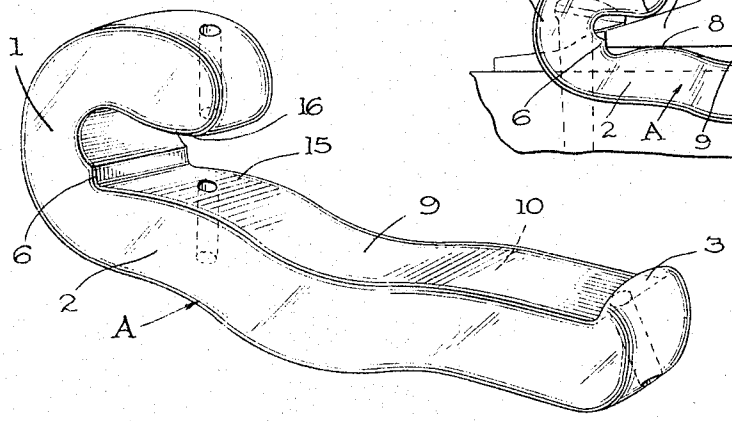


FIG. 2.

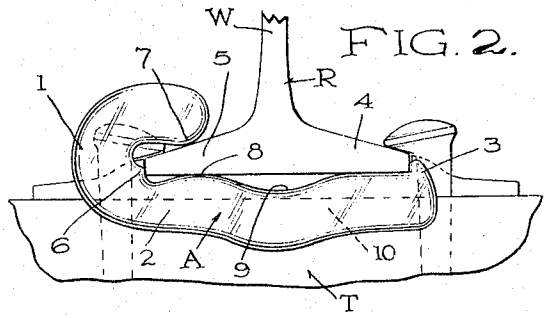


FIG. 3.

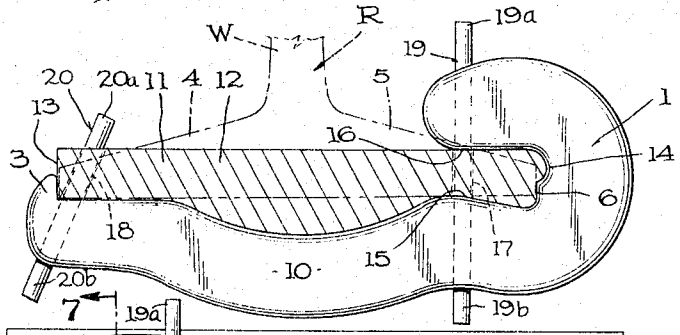


FIG. 7.

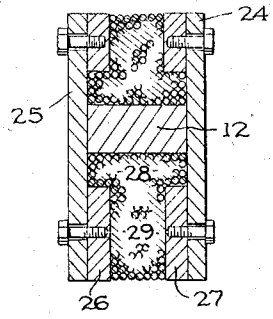
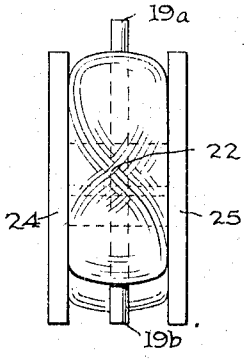


FIG. 6.



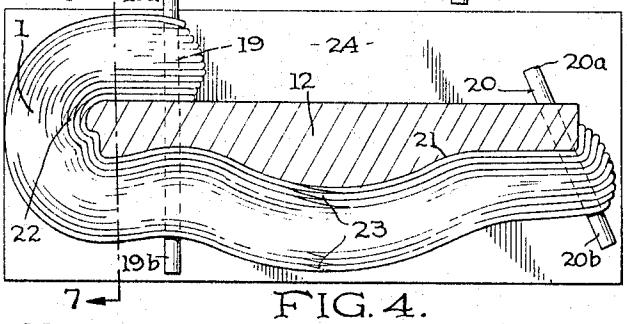


FIG. 4.

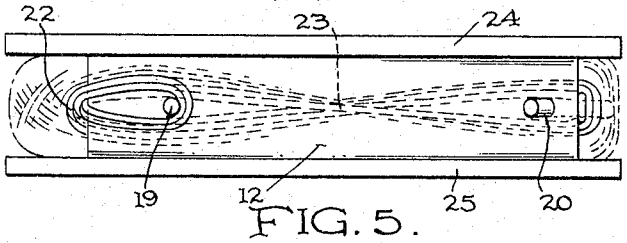


FIG. 5.

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METHOD OF MAKING RAIL ANCHOR

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Original application Nov. 14, 1963, Ser. No. 323,677. Divided and this application May 14, 1965, Ser. No. 455,864

2 Claims. (Cl. 264—103)

This is a division of application Serial No. 323,677 filed November 14, 1963, now Patent No. 3,193,201 dated July 6, 1965.

This invention relates to a one-piece rail anchor and more particularly to a rail anchor of plastic material and to the method of making same.

Rail anchors comprising a single steel element provided with an open hook or jaw portion adapted to grip the base flange of a railroad rail are well known, this form being the most common type of anchor used by railroads throughout the world.

Heretofore, all such rail anchors have been constructed of metal, usually a low or medium carbon mild steel, since this was the only known economical material which possessed the required strength to meet the demands imposed upon such devices, it being readily apparent that a steel anchor, properly fabricated, would inherently possess the tensile strength required in the area of the jaw to sufficiently grip the base flange of the rail to prevent creeping of the rail in a direction normal to the axis of the cross tie.

Significant advancements have been made in recent years in the formulation of synthetic plastic resin compounds possessing extremely high structural properties. Perhaps the most usual application involving these compounds is in the field of structural adhesives wherein countless plastic resins have been developed which may be used to join materials and provide a bond having even a greater resistance to specific stresses than the material itself.

Until now, no one has been able to develop a rail anchor of plastic composition since it has been impossible to achieve sufficient strength in the required areas by merely molding an anchor of plastic material alone, even in view of the newly developed high strength synthetic resins.

However, the present invention for the first time, so far as we are aware, provides for the formation of a plastic rail anchor having a reinforcing filler arranged in such a manner as to provide an article having a tensile strength in the required areas commensurate with that of the steel anchor. The advantages attendant to such an advancement in the art are numerous, the most important of which are the economical aspects. In the case of steel anchors, it is necessary to provide and maintain rolls, shears, ovens, dies and tools as well as other heavy equipment, all operated by high-wage personnel, while only a fraction of this effort is required for manufacturing the present plastic anchor. Steel anchors are usually produced in single units while the plastic anchor of the present invention may be manufactured on machines accommodating ten or more anchors at a time.

Moreover, the cost of storing and shipping is far less for the plastic anchor which weighs approximately one-

fourth the amount of the steel anchor. The shipping cost factor cannot be underestimated in this connection, because the manufacture of rail anchors is a relatively specialized field and a manufacturer usually maintains but a single plant from which the anchors are shipped to railroads all over the United States, as well as to railroads throughout the world.

An important use for a rail anchor of plastic would be in connection with the recently introduced electronically controlled rail system wherein a single operator sitting at a control panel automatically controls several unmanned trains operating over a single rail net, for example between two distant points in an iron ore mine complex. In such a system, electrical impulses are transmitted through the rails to control the different locomotive engines at several different speeds and to regulate the braking controls. The use of steel rail anchors would interfere with the maintenance of the critical electronic circuits being transmitted through the rails, contrary to the plastic anchor which is a non-conductive, non-magnetic, and non-corrosive element.

Accordingly, a primary object of this invention is to provide a rail anchor constructed of synthetic plastic resin.

Another object of the invention is to provide a reinforced plastic rail anchor having a filler material arranged to provide maximum tensile strength in specified areas.

Still another object of this invention is to provide a method for manufacturing rail anchors of plastic material.

A further object of this invention is the provision of a method for the manufacture of plastic rail anchors having a reinforcing filler material.

With these and other objects in view which will more readily appear as the nature of the invention is better understood, the invention consists in the novel construction, combination, and arrangement of parts, hereinafter more fully described, illustrated, and claimed.

A preferred and practical embodiment of the invention is shown in the accompanying drawing, in which:

FIG. 1 is a perspective view of one form of a plastic rail anchor of the tie bearing type produced according to the invention.

FIG. 2 is a side elevation showing the rail anchor of FIG. 1, as applied to a rail and in abutment with a cross tie.

FIG. 3 is a side elevation, partly in section, of the rail anchor of FIG. 1 and FIG. 2, as it is formed on a jig with a section of a rail base superimposed thereon to illustrate the corresponding points of contact.

FIG. 4 is a side elevation, partly in section, showing the jig with the rail anchor formed thereon, prior to curing of the anchor and diagrammatically illustrating the strands of the reinforcing filaments.

FIG. 5 is a top plan view of the assembly as shown in FIG. 4 and further illustrating the formation of the reinforcing filaments.

FIG. 6 is an end view of the structure shown in FIG. 4 pointing out the formation of the filaments in the area of the curvilinear jaw portion of the anchor.

FIG. 7 is a vertical sectional view taken on the line 7—7 in FIG. 4, and illustrates a different type of jig assembly for the production of a modified or T-shaped plastic rail anchor.

Similar reference characters designate corresponding parts throughout the several figures of the drawing.

Referring now to the drawings, it will be understood that the cross-sectional shape may be varied from rectangular, channel, or T-shape, but for purposes of illustration, FIGURES 1 and 2 disclose a rail anchor, generally designated A, of the tie-bearing type. The anchor of FIGURES 1 and 2 is provided with the usual curvilinear jaw or hook **1** attached at its lower portion to a base **2** which terminates at its free end with a locking lug **3**.

FIGURE 2 shows the rail anchor as applied to a rail R having a pair of base flanges **4** and **5**. As is conventional, such anchors which previously have been constructed of steel, may be applied to the rail base by striking the outer periphery of the curvilinear resilient jaw gripping portion **1** with a tool such as a maul or the like. Also, the anchor may be applied by machines available on the market and which either strike the anchor as indicated above, or are pressed on by a fluid ram.

In the present instance, the anchor is provided with a transverse over-drive preventing abutment shoulder **6** so that when applying the anchor, said shoulder will strike the outside of the rail flange **5** at the same time that the lug portion **3** snaps up over the outside of the opposite rail flange **4**. The springing of the lug portion **3** about the edge of the flange **4** is due to the inherent resiliency created by the tensile strength incorporated in the jaw or hook of the anchor and carried through to the base **2**. This same tensile strength provides gripping power of adequate magnitude between the nose portion **7** in the upper end of the jaw and the base contact point **8** oppositely disposed from the nose portion **7** on the base **2** of the anchor. The intermediate portion of the base **2** may be curved downwardly as at **9** at a point beneath the web W of the rail R in order to provide additional contact area between the side **10** of the anchor and the abutting cross-tie T.

The present rail anchor is constructed generally of a synthetic plastic resin. Synthetic resins fall into two basic classifications; namely, thermoplastic and thermosetting. A thermosetting resin is the desirable type of material for the present device in preference to the use of thermoplastic resins, since the latter are long chain compounds which soften upon the application of heat.

As thermoplastic compounds undergo no chemical changes and can be heated and cooled any number of times without change, they find little use in many structural applications, since they have limited resistance to heat and are subject to cold flow under load.

Accordingly, thermosetting resins are the most desirable compounds. The basic property of thermosetting resins is to change under heat by polymerization to form infusable cross-linked compounds. Many of these compounds require heat to complete the reaction, but others, for example the epoxies, are exothermic reactions and the heat is purely an accelerator to increase the speed of the reaction and to increase the permissible operating temperature of the resultant anchor when put into service. In view of their properties, the thermosetting epoxy resins are the most preferred compounds for use in producing the present invention. Such compounds include the epoxy-phenolics, epoxy-polyamides, epoxy-polysulphides, etc.

Even though the above resins appear to be the most suitable, numerous phenolic polyester, polycarbonate, polytrifluoroethylene, silicone, and phenol silane compounds cannot be ignored; however, the present description will be confined to the discussion of a rail anchor constructed of the epoxy type of synthetic resins.

In order to produce a rail anchor of plastic possessing the required strength which is a most critically required property between the opposed nose portion **7** and base contact point **8** of the jaw, it has been found necessary to

provide suitable reinforcing means in combination with the plastic resin.

Applicants have found that the most desirable reinforcing can be provided by utilizing a structural filler in the nature of glass strands more commonly referred to as glass fibers or roving. Numerous glass fiber reinforced epoxy resin compounds are available from commercial chemical concerns which may be utilized in the present invention. These plastic impregnated fibers or roving, usually referred to as glass filled epoxies, are usually supplied on spools ready for use by the manufacturer. The most common use heretofore for this product has been for use in filament winding by the electrical industry and for pressure vessels, rocket cases, tubular and tank type structures. Any suitable type of glass reinforcing strands or roving may be used in combination with any of various compounds of epoxy resins. For maximum strength, a ratio by weight of approximately 70% glass roving to 30% epoxy resin is recommended.

A typical composition for the glass roving may be, for example: silicone dioxide, 26 percent; aluminum oxide, 64 percent; magnesium oxide 10 percent. Such a composition provides a low alkali magnesia alumina silicate glass of extremely high tensile strength. When combined with any selected epoxy resins, this glass filled epoxy has been tested to indicate a tensile strength on the order of 450,000 p.s.i. The above described glass filler is merely an example of one composition which may be employed in carrying out the present invention as numerous other rovings may also be used composed of high strength specialty glass, high modulus glass, or quartz fibers.

Mechanical damage is the sole factor having any significant effect on the strength of a glass fiber reinforced plastic rail anchor, while on the other hand a steel rail anchor is also affected by time, static load, cold flow, exposure to the elements, annealing, stress corrosion and cracking, and crack propagation. In order to utilize to a maximum advantage the inherent strength of a glass fiber reinforced epoxy resin in connection with the formation of a rail anchor, applicants have devised a novel method whereby the epoxy resin impregnated roving is arranged in a particular manner prior to curing to produce the final rail anchor.

Reference may be made to FIGURES 3–7 in connection with the method for manufacturnig the subject anchor as shown in FIGURES 1 and 2 and for a more complete disclosure relating to the filler arrangement of the anchor per se.

FIGURE 3 shows in section, a jig generally designated **11**, and including a base **12**. As shown in this figure, the base **12** of the jig is shaped such that its perimeter corresponds generally to the desired inner perimeter of the rail anchor A.

As will be noted from this figure wherein the base of rail R is superimposed, one end **13** of the jig corresponds in position to the edge of the base flange **4**, while the opposite end **14** of the jig is shaped to conform to the inner surface of the rail anchor jaw and corresponds at one point to the end of the rail flange **5**. This corresponding point is the point at which the abutment shoulder **6** is designed to strike the edge of the base flange **5**. Similarly, the distance between the surface **15** on the bottom of the jig and opposed surface **16** on the top thereof is less than the corresponding distance between the similar points on the rail flange **5** as clearly shown in FIG. 3. This is to ensure that the space forming the resilient gripping jaw opening of a completed rail anchor will be slightly less than the corresponding thickness of the rail flange at this same point so that the jaw of the anchor will be slightly expanded or spread apart as the anchor is urged onto a rail base. This is a feature which would be obvious in order to produce the required gripping of the jaw upon the rail base to prevent displacement of the anchor when in position.

The jig **11** may be formed of any suitable material which is self-sustaining and not affected by the application of temperatures in the range of 300°–500° F. The jig is provided with two bores **17** and **18** passing from the top through the bottom thereof. Adapted to be removably disposed in the bores **17** and **18** are a pair of winding pins generally designated **19** and **20**, respectively, each pin projecting from both sides of the jig a substantial distance when inserted therethrough to provide upper sections **19***a*, **20***a* and lower sections **19***b*, **20***b*. The pin **19**, adjacent the jaw-forming end of the jig, is disposed substantially normal to the longitudinal axis of the jig while the pin **20** is angularly disposed through the jig, so that its lower section **20***b* projects downwardly and outwardly from the jig.

In the formation of a rail anchor according to the present invention, glass-filled epoxy resin strand material is wound around the pins **19** and **20** in such a manner that the individual strands **21**, or roving material, when assembled and cured, form a completed article having maximum tensile strength in the two most desired areas of the anchor, namely, at a point beneath the web W of the rail and most particularly, in the area of the jar or hook portion **1**. To obtain the particular ararngement of the wound strands **21**, any of suitable winding machines may be utilized. Such machines are well known for use in electrical filament winding, motor winding, and armature winding, and may be programmed by means of suitable cams, etc., so that an article such as the shape of the subject anchor may be formed by automatic means. Whatever means are used to wind the strands **21** upon the jig is immaterial so long as the proper pattern is achieved, as set forth hereinafter. Before winding the glass-filled epoxy resin strand on the jig **11**, the various exposed surfaces of the jig and pins **19** and **20** are coated with a suitable parting composition, such as any one of the well known silicone compounds so that the rail anchor, after it is formed and cured, may be readily removed from the jig after the pins **19** and **20** are withdrawn.

In forming the anchor upon the jig, the free end of the epoxy resin roving or strand **21** is suitably anchored to the jig, for example, by looping about the lower section **20***b* of the pin **20** adjacent the jig body. Thereafter, the continuous strand **21** of the material is wound in a figure **8** pattern starting at pin section **20***b*, crossing at a point on the bottom of the jig intermediate the pin sections **19***b* and **20***b*, passing around the lower section **19***b* of pin **19**, and again crossing at what will be the medial portion of the jaw **1** before passing around the upper section **19***a* of the pin **19**. During the return winding of the strand **21**, it will be seen that it will traverse a course opposite to that of the strand as it proceeded previously from pin **20** to pin **19**. In this manner, it will be seen that the strands cross one another during each passage of the strand from pin **19** to pin **20** at the point **22** in the medial portion of the jaw **1** and again at the point **23** substantially intermediate the pin sections **19***b* and **20***b*.

In order to contain the windings formed by the multiplicity of strands **21**, subsequently applied to the jig, suitable side plates **24** and **25** are attached to the sides of jig **11** by any suitable means providing for quick attachment and release therefrom. It will be understood that the side plates **24** and **25** extend vertically at least a distance as great as the vertical height of the rail anchor and likewise extend horizontally a distance corresponding to the overall length of the anchor. In this way, all of the strands **21** will be contained within the limits of the side plates **24** and **25** while the width of the jig **11** is obviously predetermined depending upon the desired width of the finished anchor A. One of the principal advantages afforded by the side plates **24** and **25** is that after curing, when the individual impregnated strands **21** will have consolidated, the finished anchor will have substantially vertical side walls, which feature is most desirable in the utilization of the anchor since the side walls form the bearing contact surface against the cross-tie T and any irregular curvature of an anchor side wall would not provide a positive abutment for anchoring of the rail to the tie through the anchor.

After a sufficient number of windings of the strand material have been made on the jig according to the desired size of anchor, the jig assembly is cured by heating. Many of the thermoplastic resins may be cured by means of a single heat, while others may require a post-cure in order to achieve maximum physical properties. An exemplary cure cycle which may be used in the formation of the present rail anchor when produced with epoxy resin designated EF 787, as produced by U.S. Polymeric Chemicals, Inc., is as follows:

Cure cycle: 1 hour at 180°–200° F.
Post cure: 1 hour at 250°–300° F.

After the appropriate curing has been achieved and the anchor removed from the jig, it is ready for immediate use, although some epoxy resins may increase in strength for about 21 days after curing and therefore should be stored for this period.

Referring now particularly to FIG. 7, it will be seen that the side plates **24** and **25** may be furnished with additional forming blocks **26** and **27**, respectively, which blocks are removably attached to the inner surface of the walls **24** and **25** for the purpose of defining a T-shaped area completely surrounding the jig in the area to be occupied by an anchor. In this manner, a plastic rail anchor may be produced of the tie plate and cross-tie bearing type generally corresponding in shape to a rail anchor such as that set forth in U.S. Patent No. 2,719,008 dated September 27, 1955, to Ruppert.

In forming a plastic rail anchor having a T-shaped cross section, a plurality of windings are made around the jig between the pins as previously described herein until the area **28** between the blocks **26** and **27** and the jig **11** is filled with the strand material. At this point the removable blocks **26** and **27** are added since it would have been most difficult to wind the strands in the area **28** if said blocks were permanently attached to the side plates **24** and **25**. After attaching the blocks **26** and **27**, the winding is continued until the area **29** between the blocks is filled to the proper dimension after which the woven strands are cured similarly to the manner described previously.

We claim:

1. A method of forming a rail anchor of plastic material including a longitudinal base, a nose disposed above said base and an upstanding hook portion; comprising the steps of: depositing strands of glass-filled plastic resin around a jig having top, bottom and two end surfaces providing an outer contour approximately the desired inner contour of the formed anchor, said strands deposited by winding from a point adjacent one end surface of said jig in a first direction across the bottom of said jig to form said rail anchor base, continuing the winding by looping said strands around the other of said jig end surfaces in an upward direction normal to said first direction and in a figure-8 pattern providing crossing of the strands to form said rail anchor hook portion, further continuing the winding of said strands over the top surface of said jig towards said first mentioned jig end surface to form said nose portion, curing the wound strands by the application of heat to consolidate the strands in conformity with the contour of said jig, and removing the cured anchor from the jig.

2. A method of forming a rail anchor of plastic material including a longitudinal base, a nose disposed above said base and an upstanding hook portion; comprising the steps of: providing a jig having an outer contour approximating the inner contour of the desired anchor, inserting a pair of pins through said jig adjacent the opposite end surfaces thereof, winding strands of glass-filled plastic

resin on said jig and around and between said pins with the strands extending across the jig bottom surface and looping upwardly around one of said jig end surfaces to overlie said jig top surface, said winding step including crossing of said strands in a figure-8 pattern adjacent one of said jig end surfaces, curing the wound strands by the application of heat to consolidate the strands in conformity with the contour of said jig, removing said pins from the assembled anchor and jig, and removing the cured anchor from the jig.

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