United States Patent

Hanig

[15] **3,656,690**

[45] **Apr. 18, 1972**

[54] RAILBED

[72] Inventor: **Siegfried Hanig**, Peine, Germany

[73] Assignee: **Ilseder Hutte**, Peine am Hannover, Germany

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[21] Appl. No.: **21,953**

[30] **Foreign Application Priority Data**

Mar. 22, 1969 Germany ..... P 19 14 712.7

[52] **U.S. Cl.** **238/2**, 94/22, 104/11

[51] **Int. Cl.** **E01b 1/00**

[58] **Field of Search** 104/11-14; 238/2, 238/3, 7, 283; 94/7, 22

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Primary Examiner—Arthur L. La Point
Assistant Examiner—Richard A. Bertsch
Attorney—Karl F. Ross

[57] **ABSTRACT**

A railbed for high-speed railways in which a plurality of elongated concrete slabs are longitudinally prestressed in groups with cast synthetic-resin sealing strips between the adjoining ends of the concrete slabs. The slabs are laid over a hollow bed and are cushioned below with a hard-foam synthetic resin including expanded mineral filters, the foamable synthetic resin being injected through perforated ducts. The downward force is supported by a pair of longitudinally extending sills flanking the hollow and carrying the concrete-slab platform via sealing strips. The sills may be formed in situ by grouting mounds of loose stone or may be cast monolithically with the remainder of the bed.

5 Claims, 6 Drawing Figures

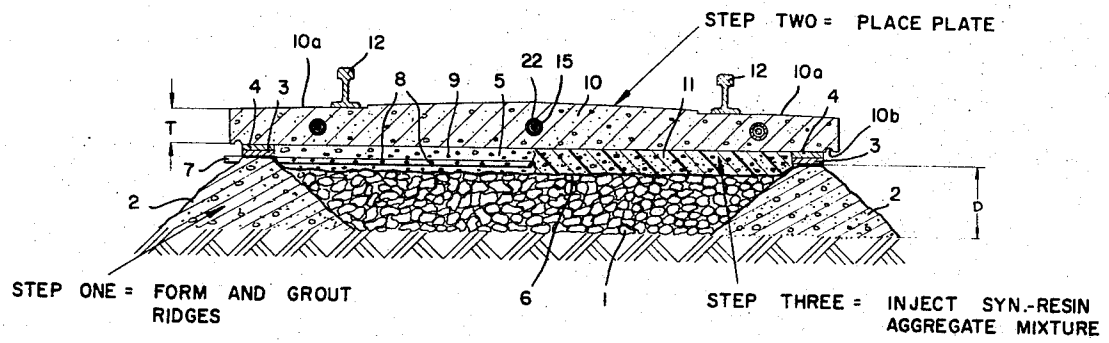
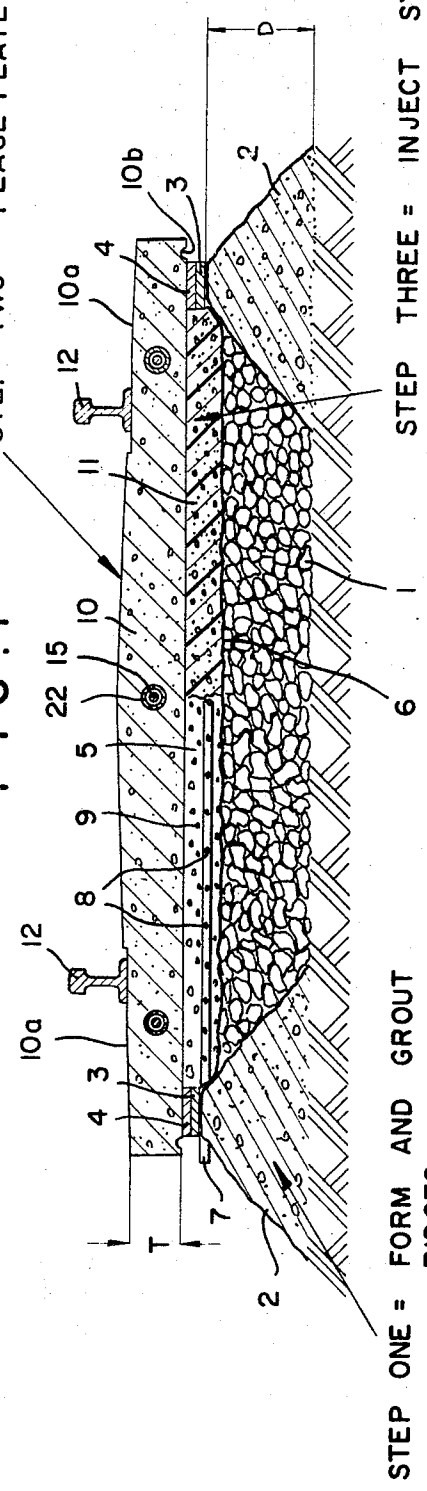


FIG. 1



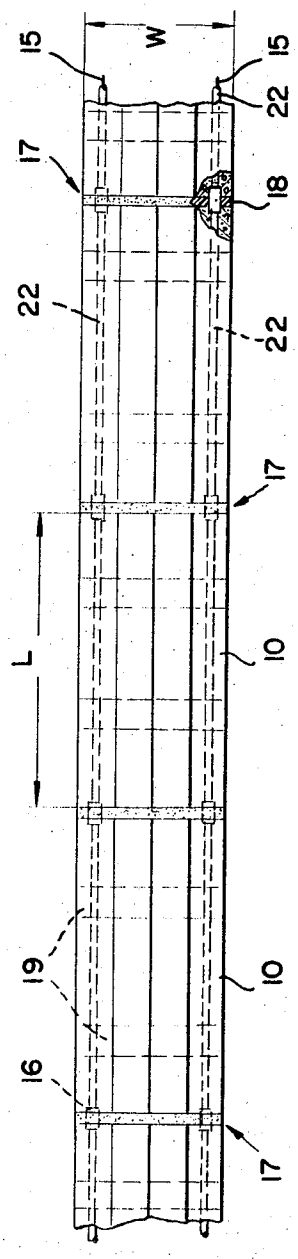


FIG. 5

INVENTOR.
SIEGFRIED HÄNIG
BY
Karl F. Ross
ATTORNEY

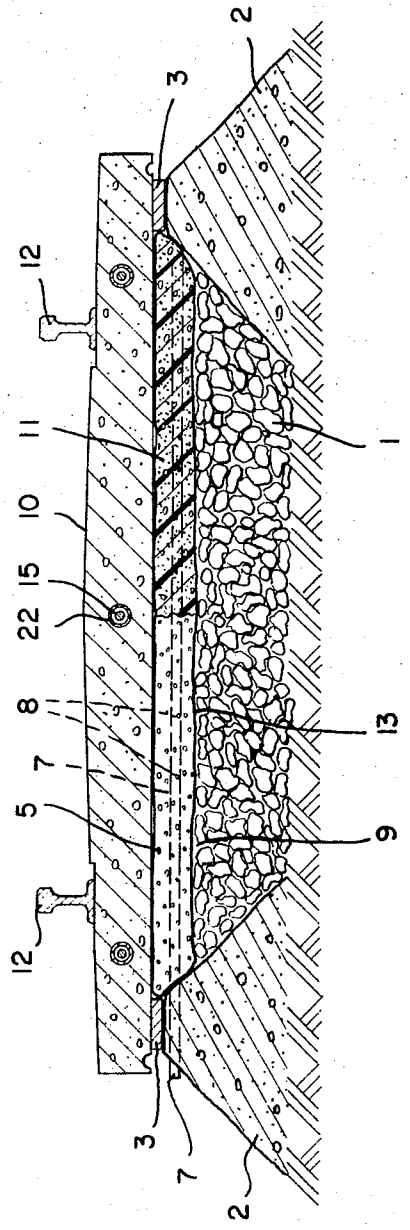
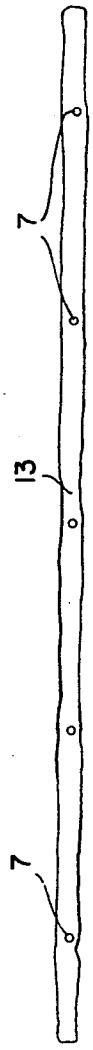


FIG. 2

INVENTOR.
SIEGFRIED HÄNIG
BY
Karl F. Ross
ATTORNEY

FIG. 3A



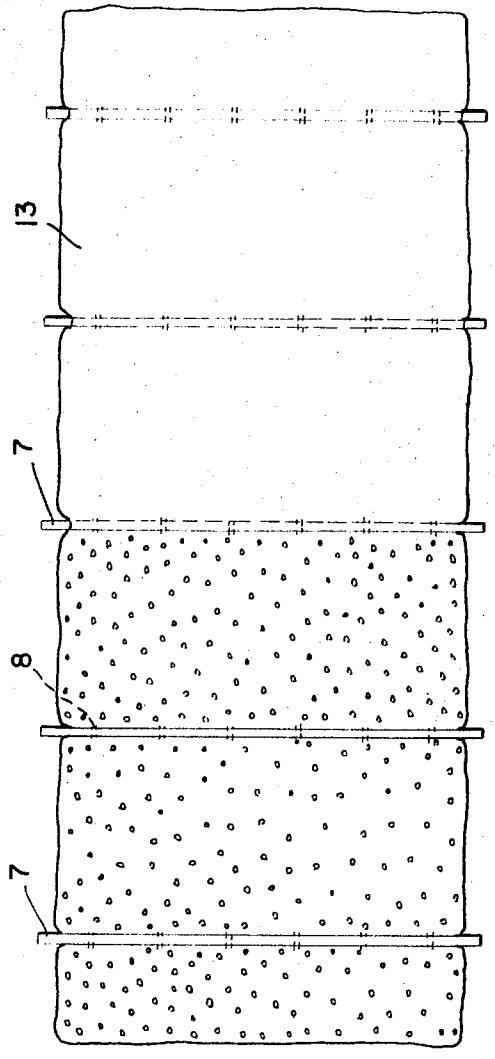


FIG. 3B

INVENTOR.
SIEGFRIED HÄNIG
BY
Neil F. Ross
ATTORNEY

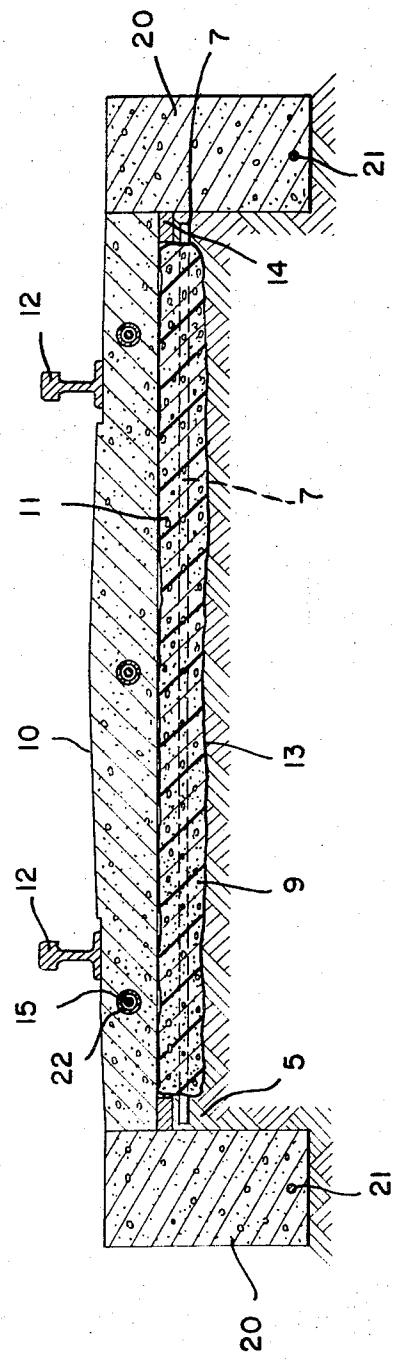


FIG. 4

INVENTOR.
SIEGFRIED HÄNIG
BY
Karl F. Ross
ATTORNEY

RAILBED

FIELD OF THE INVENTION

The present invention relates to a railbed or track assembly.

BACKGROUND OF THE INVENTION

A railbed for a railroad train usually consists of an elongated mount of ballast on which is laid a multiplicity of substantially parallel ties extending transversely to the mount; one or more pairs of parallel rails can be attached to these ties and extending longitudinally along the mount or ridge of ballast. The train rides these rails.

Such railbeds have proven increasingly unsatisfactory for today's high-speed and extremely heavy trains. Rails weighing upwards of 155 lbs/yard are used, and concrete ties with heavy-duty rail clips serve to anchor and space these rails. Nonetheless, with such arrangements the rail-bed underneath the tracks and ties deteriorates, needing frequent maintenance.

Another problem with conventional railbeds is that frequent thawing and freezing loosens and unpacks the ballast. This ballast must be periodically replenished and reconsolidated or tamped. Such maintenance is expensive and time-consuming

OBJECTS OF THE INVENTION

It is, therefore, an object of the present invention to provide an improved railbed.

Another object is to provide such a railbed which can be used by trains at speeds of upwards of 200 km/hour and which requires very little maintenance.

SUMMARY OF THE INVENTION

The above objects are obtained with a railbed comprising a trough formed by two ridges flanking an elongated hollow region, with a plurality of track-carrying members covering the region and bridging the ridges. The space (hollow) beneath the members and between the ridges is completely filled with a mass of cushioning and insulating material consisting at least partially of a settable synthetic resin, preferably a hardenable cellular or foam of the closed-pore type.

According to a feature of this invention the ridges consist of hydraulic-cement-grouted piles of ballast, and the hollow region is covered with a fluid-tight layer such as bitumen-impregnated paper or polyethylene film, so that the synthetic-resin mass cannot penetrate too far into the ballast.

In accordance with other features of the present invention the settable synthetic resin is injected into an effectively closed bag which is laid in the hollow region beneath the track-carrying members, while expanded slag is used as an aggregate with the synthetic-resin foam as binder.

Thus the method of the invention makes use of prefabricated, superficially crowned, stressable concrete slabs of generally rectangular configuration which are disposed substantially in end-to-end contiguity to form a more or less continuous platform for the track, any gaps between the slabs being filled with a weather resistant hardenable synthetic-resin sealant which is cast in place. The longitudinally interconnected reinforcement rods of the connected group of slabs are stressed against the ends of the group by conventional prestressing means to apply longitudinal compression loading of a magnitude sufficient to overcome the tensional stress applied by the train.

This substantially continuous, fluid-impermeable unit is provided, according to a most important feature of the invention, over a continuous ribbon of nonweathering hard cellular synthetic resin of a width equal at least to a major part of the width of the slabs and possibly over this entire width; the continuous fluid-impermeable ribbon is expanded in place to an expanded volume in excess of the space within which it is confined, thereby applying upward force to cushion the continuous concrete platform. The cushion may contain a large proportion (e.g. 50% by volume) of expanded mineral to increase

the compressive strength of this layer as well as its resilience and resistance to vibration fatigue.

Preferably this cushion or ribbon is received between a pair of load-supporting ridges extending continuously over the length of the right-of-way and sealingly engaging the lateral edges of the multislab concrete rail platform, the ridges and slabs having mutually confronting parallel planar horizontal surfaces to facilitate sealing of the space between the ridges. A continuous yieldable but weather-resistant strip of a sealant of high compressive strength is received between the pairs of surfaces along these lateral edges.

DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become apparent from the following description, reference being made to the following drawing, in which:

FIG. 1 is a cross section of a first embodiment of the present invention;

FIG. 2 is a similar section of a second embodiment of this invention;

FIG. 3A is a side view of a detail of FIG. 2;

FIG. 3B is a top view of the detail shown in FIG. 3A;

FIG. 4 is a cross section of a fourth embodiment of the present invention; and

FIG. 5 is a top view of the first embodiment of the invention in greatly reduced scale.

SPECIFIC DESCRIPTION

The embodiment shown in FIGS. 1 and 5 applies the present invention to the conversion of an existing old-style railbed to one according to this invention. The old ties and rails are removed, then the existing ballast 1 is cleaned and put back in place in the form of a shallow trough of a depth D of at most 30 cm. Edge portions 2 are grouted with a quick-setting hydraulic (Portland) cement mixture, and a very accurate sill 3 of the same quick-setting mixture is formed on the top of each edge ridge 2 with particular care being taken to maintain these sills 4 parallel and with regular flat upper surfaces. Atop each sill 3 is placed a strip 4 of a sealing material having a high compressive strength and resilience, such as Heraklite. Excellent results have been obtained with sealing strips laminated from paper and phenol-formaldehyde resins or with wood-fiber compositions saturated with such resins.

The hollow center region 5 between the ridges 2 is covered with a watertight material, here tar paper (i.e. bitumen-impregnated paper) 6 is used. This paper 6, for which an impermeable foil may be substituted covers the entire hollow region, and can even extend up over the sills 3 and under the strips 4 to completely seal the region 5. Extending through one of the ridges 2 is a plurality of pipes 7 which may span across the hollow region 5 and are formed with laterally opening holes 8. A settable synthetic-resin hard foam 9 (e.g. a stiff polyurethane or cellular and preferably expandable epoxy or polyester) is injected into the hollow region 5 under a concrete plate 10 laid over the two strips 4 to completely fill the empty space between the watertight covering 6 and the plate 10. The foamable material 9 is solvent thinned. This plate 10 is made of prestressed concrete and has on its upper surface two downwardly sloping flanks 10*a* and a pair of grooves 10*b* on its lower surface near the longitudinal edges. These grooves 10*b* prevent water from running back under the plate 10, while the flanks 10*a* prevent rainwater or the like from accumulating on the upper surface. Rails 12 are fixed to the top of the plates 10 with conventional rail clips.

There is shown at 11 pieces of an aggregate or filler which can be mixed with the synthetic-resin foam 9. Expanded slag or other material is advantageously used as aggregate or filler. This combination serves both to support and cushion the plates 10 and to insulate the ballast 1 so that no hard freezing thereof can take place. At the same time, water can in no way get into the railbed, so that the spring maintenance work can be virtually eliminated. The customary railway drainage

ditches will receive the water draining off the plate **10** and down the cement-stabilized ridges **2**.

Each plate **10** has a thickness T from 16 to 18 cm, a length L (see FIG. **5**) of 6 meters, and a width W of 3 meters. The plates **10** are provided with internal prestressing elements **15** and **19** which are stressed just sufficiently to prevent the plates **10** breaking during transport. The ends of the longitudinal prestressing bars **15**, which are slidably received in flexible, thin-walled tubes **22**, are threaded and are attached together in spaces **17** between adjoining plates **10** by sleeves **16**. This gap **17** is then filled with an epoxy cement **18** and finally the plates over a stretch of around 100 meters are all longitudinally stressed together. The epoxy **18** preveals relative slippage. The transverse bars may be used to apply full prestress of the casting site.

FIGS. **2**, **3A**, and **3B** show an arrangement similar to that of FIG. **1**, except that the aggregate **11** is contained in a synthetic-resin bag **13** fitted with the pipes **7**, which, as shown in FIG. **3B**, extend out on both sides. Once the plates **10** are placed one directly next to the other, the liquid foam binder is injected in through the pipes **7**, whence it moves out from the pipes in all directions and completely fills the bag **13**, forcing it against the plates **10** and against the ballast **1**. This bag can be rolled out in the trough formed in the ballast. These figures also show that the strip **4** can be dispensed with if necessary.

In FIG. **4** there is shown a railbed which is, unlike the embodiments of FIGS. **1** – **3B**, intended for a very hard surface needing no ballast. The trough is formed with two sills or ridges made of small sill plates **14** (designed to allow the concrete slabs to be sealed cleanly) which are carefully laid and spaced in continuous parallel rows to each side of the excavated trough **5**. The bag **13** full of aggregate **11** is placed and filled as above for FIGS. **2**, **3A**, and **3B**. Thereafter, large concrete blocks **20** with reinforcing rods **21** are placed to each side of the roadbed to prevent erosion.

I claim:

1. A railbed comprising:

a pair of substantially parallel grouted-ballast ridges flanking a hollow region and forming therewith a trough, said ridges having flat upper surfaces;

a plurality of elongated and substantially longitudinally contiguous concrete slabs bridging said ridges and covering said regions;

respective sealing strips between each of said ridges and said slabs;

means for sealing longitudinally adjoining edges of the slabs;

a bed of ungrouted ballast between said ridges and spaced below said slabs in said region; and

a mass of cushioning and insulating material at least partially consisting of hardened foamed synthetic resin entirely filling the space within said hollow region beneath said slabs and above said ballast.

2. The railbed defined in claim **1** wherein said mass further includes an aggregate.

3. The railbed defined in claim **2** wherein said aggregate is expanded slag.

4. The railbed defined in claim **1**, further comprising a fluid-tight covering between said trough and said mass.

5. The railbed defined in claim **1**, further comprising a flexible sleeve containing said mass.

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