Sept. 8, 1942. R. C. RAASCH 2,294,934

RAIL BOND

Filed Aug. 15, 1939

Fig. 1.

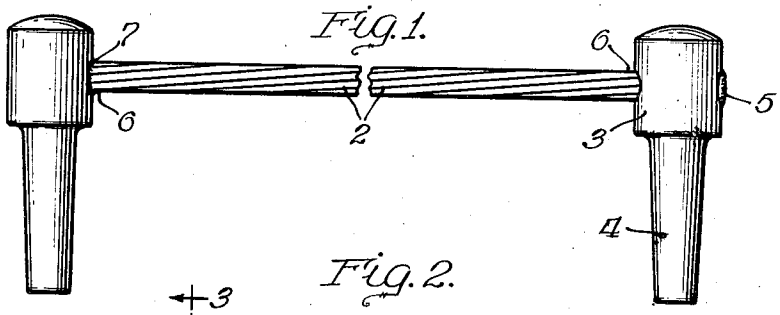


Fig. 2.

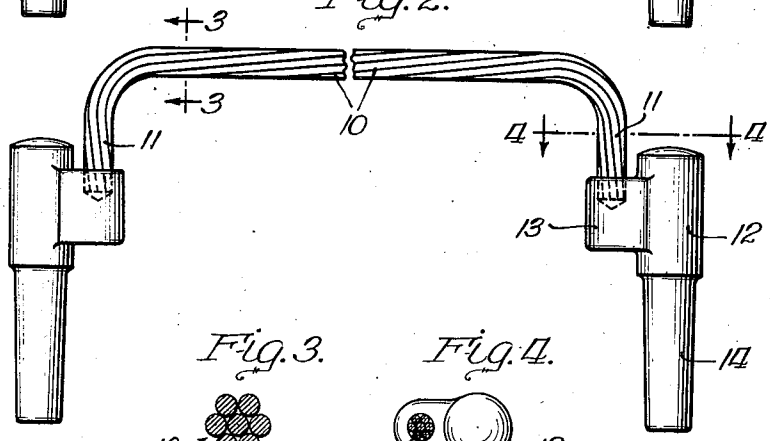
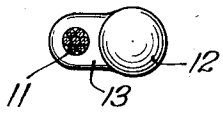


Fig. 3.

Fig. 4.



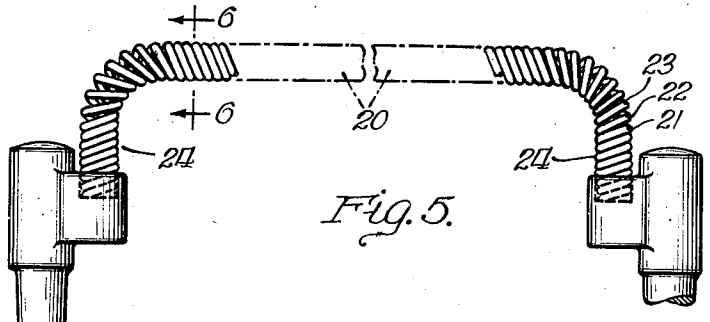


Fig. 5.

Fig. 7.

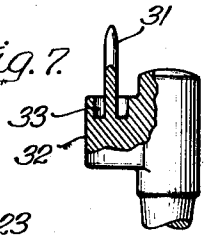


Fig. 8.

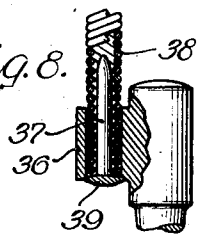
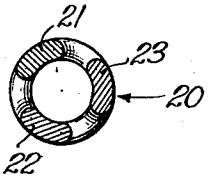


Fig. 6.



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RAIL BOND

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10 Claims. (Cl. 238—14.12)

The present invention relates in general to rail bonds, which are conductors adapted to be applied to rail junctions for the purpose of electrically connecting the adjacent rails. The object of the invention is to produce a new and improved rail bond which has a longer life than bonds previously used and which at the same time is readily installed and does not cost substantially more than bonds previously used.

The known type of rail bond generally consists of a heavy stranded conductor having a terminal at each end, and is installed by connecting the terminals in some suitable manner to the two rails at a rail junction. The conductor is thus connected in parallel with the tie plate and affords a low resistance path around the joint between the rails. Such bonds are essential whenever the rails are used in signalling circuits.

A great deal of trouble has been experienced in the past due to the breakage of rail bonds in service, which occurs much more frequently than would be expected. Efforts have been made in the past to increase the life of rail bonds, but without entire success. It is the theory of the present invention that previous failures along this line have been due to a lack of understanding of the nature of stresses set up in rail bonds and in a consequent failure to design the conductors so that the stresses can be endured without impairment of the bonds and premature fracture. The object of the present invention, more specifically, therefore, is to provide a rail bond which is especially designed with reference to the stresses and strains to which it is subjected in service, and which will therefore have a much longer life than bonds heretofore known and used.

The invention and the operation thereof will be described more in detail hereinafter, with reference to the accompanying drawing in which:

Fig. 1 shows a known type of rail bond in common use;

Fig. 2 shows a rail bond according to the invention;

Figs. 3 and 4 are sections on lines 3—3 and 4—4, respectively, Fig. 2;

Fig. 5 shows a modified form of the rail bond shown in Fig. 2, using a different form of conductor;

Fig. 6 is a section on the line 6—6, Fig. 5;

Fig. 7 shows a modified form of terminal which may be used in the bond shown in Fig. 5; and

Fig. 8 shows another form of terminal which may be used in the bond shown in Fig. 5.

Referring to Fig. 1, the rail bond therein depicted comprises a stranded conductor 2 and two terminals to which the opposite ends of the conductor are secured. Each terminal comprises a cylindrical head 3 and a tapered shank 4. The stranded conductor is attached to the head of the terminal in various ways. For example, the end of the conductor may be butt-welded to the head, as indicated at 7. According to another method which has been adopted, the conductor is passed through a transverse hole drilled in the head and the strands are welded together and to the head on the opposite side thereof from where the conductor enters, as indicated at 5 in the drawing.

A rail bond of this type is installed at a rail junction by drilling two holes, one in each rail, and just large enough in diameter to receive the tapered shanks of the bond terminals. These holes are drilled horizontally through the webs of the rails and are spaced apart a distance which is slightly less than the length of the bond conductor. After the holes have been drilled, the shanks of the terminals are inserted and the terminals are driven home with a hammer or sledge.

A bond of the foregoing description, when properly installed, affords a good low resistance conducting path around the rail junction and would be eminently satisfactory were it not for the breakages which occur. The passage of trains causes a relative vertical movement of the rail ends; that is, first one rail end and then the other is momentarily depressed, with the result that the bond terminals are displaced relative to one another, and bending stresses are set up in the conductor of the bond. These stresses appear to be concentrated in a very short section at each end of the conductor next to the terminal; at any rate, the fractures occur close to the terminals at the points indicated at 6.

In order to prevent premature fractures, various expedients have been tried. One method which has been suggested is to make the conductor more flexible by stranding each of the separate strands, but this method is not successful. The bending strains are not eliminated and the increased flexibility of the conductor does not distribute the bending strains, which remain concentrated as before. Breakages therefore occur adjacent to the terminals regardless of the flexibility of the conductor used. Another expedient that has been tried involves providing a support for the conductor at the point where it usually breaks, said support taking the form of a collar projecting from the side of the terminal and surrounding the conductor. This scheme is a failure because it merely transfers the concentrated bending strains to a point further out on the conductor, which breaks prematurely at the point where it enters the collar.

Reference may now be made to Fig. 2, which shows an improved rail bond designed to overcome the difficulties described in the foregoing. The bond shown in Fig. 2 comprises a stranded conductor 10, and two terminals as indicated, one attached to each end of the conductor. The conductor may have seven strands, as shown in

Fig. 3, although a greater or lesser number may be used. Each strand may also be made up of a plurality of smaller strands if desired. Each terminal comprises a cylindrical head 12, having an offset lug 13 formed integrally therewith, and a tapered shank 14. The construction will be clear from Fig. 2, and from Fig. 4, which shows an end view of the terminal.

The conductor may be attached to the terminals in any suitable manner as, for example, by one of the methods described in connection with Fig. 1. As illustrated in Fig. 2, however, a hole is drilled part way through the lug 13 and is partly filled with flux and molten solder, heat being applied to the lug. The end of the conductor, having been thoroughly tinned, is then inserted in the hole, and the terminal is allowed to cool. This method of attaching terminals to stranded conductors is well known and makes an excellent connection.

The rail bond shown in Fig. 2 is installed in the same manner as the bond shown in Fig. 1. The offset lugs to which the conductor is attached enable the terminals to be driven into the holes in the rails without any special difficulty, although if desired the sledge blows may be directed against an intervening piece of metal held against the head of the terminal in order to avoid any danger of damaging the conductor.

It will be seen that the bond shown in Fig. 2 differs from the one shown in Fig. 1 chiefly by the contour of the conductor between the terminals. In Fig. 1 the conductor comprises a single straight section, extending parallel to the rails when installed, whereas in Fig. 2 the conductor comprises a straight section extending parallel to the rails which is connected to the terminal at each end by a short section such as 11 which extends parallel to the axis of the terminal and perpendicular to the rails. As a result of this change in conductor design, the bending strains caused by independent up-and-down vibration of the rail ends at the joint are eliminated and are replaced by torsional strains in the conductor. These torsional strains are distributed over the short sections 11 at the ends of the conductor, with the result that fatigue of the metal at any one point is prevented or greatly delayed, and breakages are much less apt to occur.

The rail bond shown in Fig. 5 is similar to the one shown in Fig. 2, except that a different type of conductor is used. The two terminals to which the conductor is joined may be the same as the terminals described in connection with Fig. 2. The conductor 20 is hollow and is made up of a plurality of strands. The drawing shows three strands 21, 22, and 23, but a different number could be used. The conductor is made up by winding the strands in parallel on a mandrel, following generally the method employed in manufacturing a coil spring. The terminals may be attached to the conductors as described in connection with Fig. 2.

The bond is installed as previously described. When a train passes over the joint bridged by the bond, the relative up-and-down movement of the rail ends tends to produce torsional strains in the short sections 24 of the conductor, as in the case of the bond shown in Fig. 2. The conductor of Fig. 5 is able to accommodate itself to these strains more easily, however, because of the relatively short pitch of the coils in which the strands are wound, and there results a minute tightening and untightening of the coils in sections 24. The strains are thus well distributed along the individual coils; fatigue of the metal is prevented; and the life of the bond is greatly increased.

The rail bond shown in Fig. 5 can be further improved by providing each of the terminals with means for supporting a portion of the associated section 24 of the conductor. One way in which this may be accomplished is illustrated in Fig. 7, which shows a terminal suitable for the purpose, having a pin 31 projecting upward from the lug 32. The pin 31 may be formed integrally with the lug and the annular recess 33 surrounding the pin may be cut out by means of a hollow drill.

The conductor 20, Fig. 5, is soldered to the terminal as described in connection with Fig. 2. Section 24 of the conductor is threaded onto pin 31, and the conductor and terminal are pressed together until the end of section 24 fully enters the annular recess 33. Upon cooling of the solder, the conductor will be firmly attached to the terminal and will, moreover, be supported by the pin 31 for a short distance from the lug 32. The pin 31 should be of the proper size to make a close fit inside the coils of the conductor, while permitting a slight movement of the coils relative to the pin.

It will be seen that with a bond constructed as just described, the conductor is supported at each end for a short distance from the terminal, while at the same time the normal action of the conductor in response to the up-and-down vibration of the rail ends is not interfered with in the least. In other words, the pin supports the conductor as a whole, opposing transverse movement of section 24 thereof in any direction, but does not interfere with the slight winding and unwinding of the coils of the conductor under the torsional strains set up by movement of the rails.

Another method of constructing a bond having a central supporting pin at each end is illustrated in Fig. 8. The lug 36 of the terminal has a hole formed therein, as by drilling, which is large enough to receive the hollow conductor 38. In order to attach the terminal, the end of the conductor is passed through this hole, the pin 37 having first been inserted in the conductor, and then the strands of the conductor and the pin are welded together and to the lug. The pin is thus firmly secured to the lug and functions as described in connection with Fig. 7. An additional advantage over the Fig. 7 construction is obtained, however, due to the fact that the conductor is supported for a short distance on the outside as well as on the inside, it being understood that the coils of the conductor do not fit so tightly within the hole in lug 36 as to prevent a slight movement relative thereto.

The perforated lug and pin arrangement illustrated in Fig. 8 also lends itself to a different form of connection. The end of the conductor may be passed through the hole in the lug until it is flush with the lower edge, or extends slightly beyond it, and then the pin which in this case is made somewhat larger than before, is forcibly driven into the hollow conductor. This procedure expands the coils and compresses them tightly against the inside wall of the opening in the lug, affording a good connection between the conductor and terminal. If desired, the pin and the strands of the conductor may be welded to the lug as previously described. The conductor

to terminal connection made in this manner, with or without welding, is substantially the same as the one described in connection with Fig. 7, insofar as the freedom of movement of the conductor coils relative to the terminal is concerned.

The rail bonds constructed in accordance with the invention include intermediate sections, such as 10 or 20, which extend parallel to the rails in spaced relation to the webs of the rails. The sections 11 and 24 should be no longer than is necessary to accomplish their intended purpose and, generally speaking, may be short enough so that the intermediate section of the bond does not lie much if any outside the vertical plane defined by the inner edge of the rail head. Suitable guard means may be provided if desired to protect the bond conductor from injury or displacement.

The bond conductors and terminals may be of any suitable material. The terminals may be of steel or iron, preferably of non-rusting varieties, or of other material. The conductors are preferably of good conducting material, such as copper or bronze, but other material such as galvanized iron wire may be used. In any case, however, the process by which the wire for the strands is manufactured should be such as to give the wire the necessary resiliency.

The invention having been described, that which is believed to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

What I claim is:

1. A rail bond comprising two terminals each having a head and a tapered shank for driving into a hole drilled horizontally through the web of a rail, each terminal also including an offset lug rigidly secured to the head, and a lengthwise integrally formed conductor of uniform cross-section connecting said terminals, said conductor including a substantially straight intermediate section which extends parallel to the rails when the bond is installed, said conductor also including two relatively short and substantially straight end sections which extend toward the rails from the ends of said intermediate section to the lugs on said terminals, each of said end sections being disposed parallel to the axis of its associated terminal, whereby up and down vibration of the rails produces torsional strains in said end sections rather than bending strains at the junctions of the conductor and terminals.

2. A rail bond comprising two terminals adapted for connection to the two rails on the opposite sides of a rail joint, a conductor connecting said terminals, said conductor being formed throughout of strands wound with a minimum pitch in interspersed coils, said conductor comprising an intermediate section parallel to the rails and end sections adjacent the terminals which are perpendicular to the rails in which winding and unwinding of the coils is produced by the relative vertical movements of the rails due to passage of trains.

3. A rail bond comprising two terminals adapted for connection to the two rails on the opposite side of a rail junction, a hollow stranded conductor connecting said terminals, the strands of said conductor being wound from end to end in interspersed coils of minimum pitch, and the said conductor comprising an intermediate section parallel to the rails and end sections adjacent the terminals which lie in a horizontal plane and are perpendicular to the rails.

4. A rail bond for conductively bridging the joint between two rails of a railroad track, said bond comprising two terminals adapted to be driven horizontally into holes drilled in the webs of said two rails, respectively, each terminal having an offset lug with an opening therein, a hollow conductor formed of strands closely wound in interspersed coils, said conductor having end sections forming a right angle with the main part of the conductor and extending parallel to said terminals into said openings, and supporting means for each of said end sections comprising a pin rigidly secured to the associated terminal and to the coils which are inside the opening in the terminal and extending in loose supporting relation through a plurality of coils which are outside said opening.

5. A rail bond comprising two terminals adapted for attachment to the rails on the opposite sides of a rail joint, each of said terminals having an opening therein, a hollow conductor formed of strands closely wound in interspersed coils, said conductor comprising a substantially straight intermediate section and two end sections extending at right angles therewith into the openings in said terminals, and two pointed cylindrical pins driven into the ends of said end sections, respectively, to compress the coils of the conductor against the inner walls of the openings, each said pin being long enough to provide a supporting section passing loosely through a plurality of coils outside of the associated opening on which the coils can wind and unwind in response to vibration of the rails when the bond is installed.

6. A rail bond comprising two drive terminals each having an offset lug with an opening therein, a hollow conductor formed of strands wound in interspersed coils, the opposite ends of said conductor being passed through the openings in said lugs, respectively, and two pins located inside the two ends of said conductor, respectively, and welded to the coils thereof and to the associated lugs, each pin extending into the conductor beyond the associated lug to form a support for the coils.

7. A rail bond as claimed in claim 6, wherein the interior walls of the openings are in loose supporting contact with the coils of the conductor except at the point where the coils are welded to the lugs.

8. A rail bond comprising two terminals adapted for attachment to the rails on the opposite sides of a rail joint, a hollow stranded conductor closely wound in coils and having its opposite ends secured to said terminals, respectively, and two pins rigidly fixed to said terminals, respectively, and extending inside the conductor to support the same, each pin including a smooth cylindrical section which extends beyond the associated terminal and loosely through a plurality of the conductor coils, whereby said coils are movable relative to the said cylindrical section.

9. A rail bond as claimed in claim 8, wherein the pins are formed integrally with the terminals.

10. A rail bond as claimed in clam 8, wherein the conductor and pins are attached to the terminals by welding.

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