

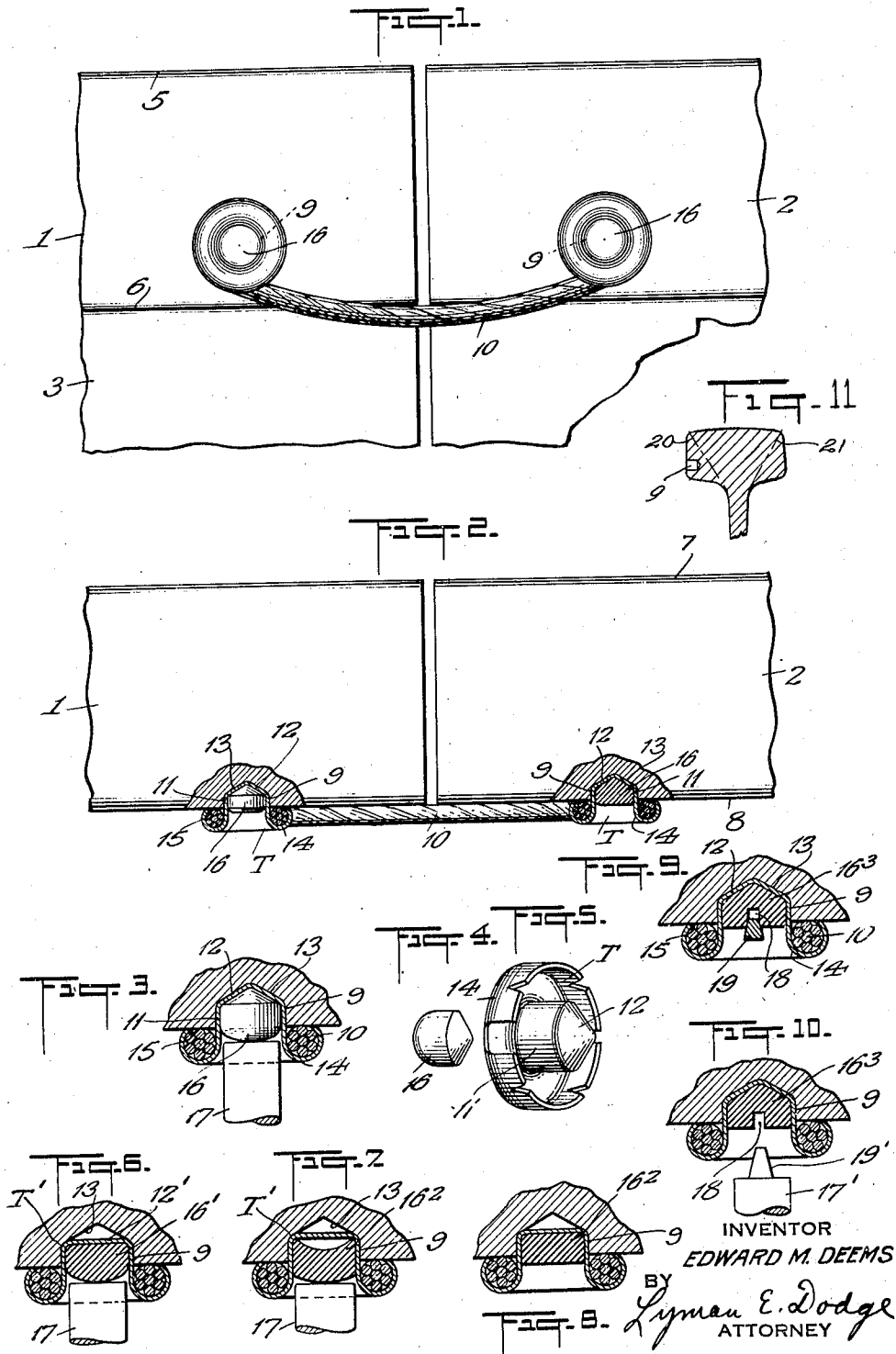
June 23, 1936.

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2,045,126

CONDUCTOR

Filed May 21, 1931



UNITED STATES PATENT OFFICE

2,045,126

CONDUCTOR

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Application May 21, 1931, Serial No. 538,943

12 Claims. (Cl. 173—280)

This invention relates to conductors, more especially to conductors for connecting the adjacent ends of railway rails, particularly those for use in connection with railway track circuits.

It is well understood by those skilled in the railway signalling art, that a track circuit includes an insulated section of the trackway formed by placing insulating joints in each of the lines of rails, and by connecting a battery across the rails at one end, and a relay across the rails at the other end.

It is also well understood that the ordinary rail connecting or fish plates connecting the adjacent ends of the ordinary thirty-six foot sections are not to be relied upon to furnish sufficient conductivity for the electrical energy which flows in the rails from the battery at one end of the section to the relay at the other end thereof. This fact has necessitated a special bonding of each of the adjacent abutting rail ends within the section.

Great difficulties have been encountered in successfully bonding the adjacent abutting rail ends in track circuit sections because provision has to be made for many adverse conditions. A common method is to bond, from one rail web to the adjacent rail web, by means of one or a plurality of conductors of a length somewhat greater than the length of the fish plates. This method of bonding exposes the bonding wires to mechanical injury, in that they may become entangled with dragging parts from the rolling stock, or may actually get onto the top of the rail, and so be severed by the passage thereover of the wheels of rolling stock. In addition, they are very likely to be damaged by trackmen when working along the track, particularly when working in and about the rail joint, and more especially when tightening the bolts thereof, or replacing the fish plates with new plates.

A very pronounced difficulty with the old type of bond is, that due to its length and in spite of its size as it may be commercially used, it does not offer a conductivity as great as is desired. The desired conductivity cannot be attained without enlarging the bond to a prohibitive extent.

Attempts have been made to increase the conductivity and decrease the mechanical disadvantages of bonds by applying a bond directly to the rail heads. Such a bond can be very short, as compared with the previously described bond, therefore, for a given diameter has an increased conductivity in that it has less resistance. Such bonds have, in general, been applied to the head of the rail by electrical or flame welding. Many

competent engineers are adverse to applying any considerable degree of heat to the side of the ball of a rail, especially adjacent the end thereof, and this reluctance, considered by many to be well founded, has militated against the use of such bonds.

A further difficulty which has been met with in the type of bond applied directly to the rail heads is that it is particularly exposed to injury by snow ploughs and ballast spreaders. Both of these devices, and especially the ballast spreader, have parts which extend below the top surface of the head of the rail on the outside thereof. These parts, due to the swaying of the vehicle, come in contact with the head of rail bonds and destroy them.

Attempts have been made to attach bonds to rail heads by drilling a cavity in the rail head and attaching the bond to a plug driven into the cavity. A difficulty with this type of bond arises from the fact that it is necessary to drill a relatively deep hole in the head of the rail. This hole penetrates what might be called the active cross-sectional area of the head and to that extent weakens the rail head.

A principal object of the present invention is the production of a bond which will obviate most of the defects of the type of bonds hereinbefore described which are connected from rail web to rail web, and which on the other hand will have the desirable virtues of a rail bond connected from rail head to rail head, and will be free from most of the undesirable characteristics of the electrical or flame welded bonds, and will also be free from the important undesirable characteristics of the mechanically attached rail head bond.

A further object of the invention is the production of a bond of the rail head connected type which has the advantages specified, and which will further be of such a construction that it may be applied to rails without the necessity for the cumbersome, expensive, and unusual apparatus, and tools commonly required for the affixing of an electrical or flame welded bond.

A further object of the invention is the production of a bond of the type described, which will be of a construction such that it will be of high conductivity, mechanically strong, and of small compass.

A further object of the invention is the production of a bond of the type described which will be of such construction that the likelihood of being caught and damaged by dragging parts of rolling stock will be greatly diminished.

A further object of the invention is the pro-

duction of a bond of the type described which will be of such construction that it will be substantially immune from injury by snow ploughs and especially ballast spreaders.

5 A further object of the invention is the production of a bond of the type described which will be of such construction that it will not be necessary to drill a hole in the rail head to a depth which will penetrate what might be called the active cross-section thereof.

10 Other objects and advantages will appear as the description of the particular embodiments selected to illustrate the invention progresses and the novel features of the invention will be particularly pointed out in the appended claims.

15 In describing the particular physical embodiments selected to illustrate the invention, reference will be had to the accompanying drawing, and the figures and characters of reference thereon, wherein similar characters of reference designate like parts throughout the several views, and in which:

Figure 1 is a side elevational view of two adjacent rail ends with the improved bond of the invention in place thereon; Fig. 2 is a top plan view of the arrangement as shown in Fig. 1, with some parts broken away and others in cross-section in order to more clearly show the construction; Fig. 3 is a fragmentary enlarged view showing the initial positioning of parts of the improved bond; Fig. 4 is a perspective view of one of the parts of my improved bond which is designated by me as a plug; Fig. 5 is a perspective view of one of the parts of my improved bond which has been designated by me as a terminal; Fig. 6 is a fragmentary enlarged view similar to Fig. 3 illustrating a modified form of terminal and plug; Fig. 7 is a fragmentary enlarged view similar to Fig. 3 showing another modified form of plug; Fig. 8 is a fragmentary enlarged view similar to Fig. 3 but showing the plug of Fig. 7 in its final condition; Fig. 9 is a fragmentary enlarged view similar to Fig. 3 but showing a modified form of plug; Fig. 10 is a fragmentary enlarged view similar to Fig. 3 showing a further modified form of plug; Fig. 11 is a diagrammatic view illustrating the active load bearing cross-section of a rail.

Two adjacent rails 1 and 2 are shown in Fig. 1. These rails are shown in elevation. The webs are 3 and 4, and the heads extend between the lines 5 and 6. As shown in Fig. 2, the flange side of the rail is 7 and the outside face is 8.

In order to electrically bond the rail 1 to the rail 2, using as short a conductor as possible, a cavity 9 is formed in each rail head. This cavity is formed an appropriate distance back from the end of the rail so that the conductor as 10 will not be too long. The cavity is also formed low down on the head of the rail, as most clearly shown in Fig. 1, and is extremely shallow. In practice, the cavity would be about three-eighths of an inch in diameter and the cylindrical portion about one-eighth of an inch in depth. Such a cavity could be formed in what is virtually inactive material of the rail, that is, the cavity would not be of such depth as to penetrate, what might be called, the active cross-section of the rail head, or the portion of the rail head which acts to sustain the load. A cavity so formed would have no effect in decreasing the strength of the rail and consequently would be entirely unobjectionable. Such a cavity differs from those previously formed in similar situations because the previous cavities have been of a very considerable depth, penetrating the active load bearing

cross-section of the rail and suitable for receiving the ordinary and well known tapered bond plug.

The relation of the cavity to the other portion of the rail head is most clearly shown in Fig. 11, in which 9 is the cavity, and the active load bearing cross-section of the rail is the area between the dotted lines 20 and 21.

In order to conductively connect the conductor as 10 at each end in the cavities in the rail heads, applicant makes use of a plug. This plug is not of the ordinary and usual form, that is, it does not correspond to the ordinary tapered plug used in rail head bonding and in rail web bonding because applicant's plug is not secured or fixed in position in the cavity by the binding action or friction between two surfaces one of which is not exactly parallel to the other, that is, one of which is tapered very slightly. Applicant's method of affixing a plug in a cavity is by expanding the plug, in the cavity, against the wall which is at right angles to the outside face of the rail. In none of the examples illustrated in the drawing is the plug held in the cavity by friction between two surfaces one of which is slightly tapered, but in all cases the plug is held in the cavity merely by reason of the degree of pressure by which it is pressed toward the surface of the cavity.

Applicant's plug, or disc, may be made in various forms and the means cooperating between the plug and the conductor at 10 may take various forms, in fact, applicant does not intend to exclude, by his particular showing, a construction in which the plug and the conductor 10 are integral, but in the preferred form as shown in the drawing the conductor is associated in all cases with what is known as a terminal which in turn cooperates with a plug.

In the particular preferred form of conductor terminal designated, as a whole, by T, and shown in Fig. 5, there is included substantially an annulus 11. This annulus 11 is of such an outside diameter that it substantially fits or contacts the cylindrical wall portion of cavity 9. It is preferred to form an end wall 12 on the annulus 11, and to have this end wall formed so as to substantially fit the end wall 13 of a cavity 9. It is further preferred to extend the annulus 11 such a distance that sufficient material will be provided by which a skirt 14 may be formed which may be curved tightly about the conductor 10 so as to make intimate, mechanical, and electrical contact therewith. This contact may be materially enhanced by electrically welding or soldering the conductor 10 to the skirt 14 as at 15.

In practice applicant prefers to associate the conductor 10 with the terminals T, one at each end of the conductor, at the factory.

Placing applicant's bond on rails consists in forming cavities as 9 in each of the adjacent rail heads, and, by cavity, applicant means a space having at least one end wall, as distinguished from a through hole. This would be done by drilling as is customary, with the ordinary twist drill, of usual construction. Such drilling would form a cavity 9 having a cylindrical portion and an end wall portion of conical form. The conductor 10, having a terminal T at each end thereof, would be positioned against the rails and a terminal placed in each of the cavities. It would then be necessary to place a plug within each of the annuli and properly expand it.

Various forms of plugs may be used by applicant but the preferred form is that shown in Figs. 2, 3, and 4, and designated 16. This plug in its original form is substantially a right cylinder

with one base formed substantially hemispherical and the other conical. The diameter of the cylindrical portion is preferably greater than the total length of the plug. In practice, the length of the cylindrical portion would be about one-eighth of an inch, for a plug three-eighths of an inch in diameter. The length of the conical portion would correspond to that necessary to substantially fit the end wall, and the length of the hemispherical portion could be adjusted so that after the plug is in position and driven home it will not extend substantially beyond the edge of the cavity.

Using a plug such as 16 it would be first placed in the annulus as shown in Fig. 3, and then a punch such as 17 forced against the plug 16 in any suitable manner, as by striking or screw pressure or leverage, sufficiently to force the plug into a condition substantially as shown by Fig. 2, that is, to exert a very considerable force against the outside end face of the plug so that while the plug is supported by the end wall of the cavity it is squeezed and expanded laterally so as to press firmly and fixedly against the inside wall of the annulus thus acting to force the outside wall of the annulus into close mechanical and electrical contact with the inside surface of the wall of the cavity 9.

Bonds constructed, arranged and affixed as hereinbefore described provide a suitable conductivity, are out of the way of dragging, rolling stock, flanges and snow ploughs, may be affixed without the use of large and cumbersome tools, unsuitable for handling by one man, and when affixed are permanent, and so closely connected mechanically with the inside surface of the cavity 9 that the bond must be practically destroyed in order to wrench it from its position.

In practice applicant prefers to make the conductor 10, the terminal T, and the plug 16 all of copper, but applicant does not intend to exclude by such specification the use of other and suitable material such, for instance, as mild steel for the plug, or brass or mild steel for the terminal T, or copper clad steel for the conductor 10.

A most distinctive characteristic of applicant's invention is the plug 16 and the method of affixing in position. No reliance for the maintenance of this plug in its fixed position is placed on contacts between tapered surfaces, but reliance is placed upon such a contact pressure between the outside surface of the plug and the inside surface of the annulus or the cavity as will be sufficient to properly retain the plug in place. It is to be further observed, that when the bond is placed in position with the terminal T in the cavity and the plug 16 within the terminal, that then no matter how much pressure is applied to the plug 16, there is substantially no relative movement between the body and the plug 16 and the annulus 11 so that there is no tendency to tear the annulus 11. The plug while being expanded laterally is supported by the end wall of the cavity and pressed upon by the end surface of the member 17.

Various other forms of terminals and plugs may be used in carrying out applicant's invention. In Fig. 6 a plug 16' is shown which corresponds with plug 16 except that one base instead of being conical is substantially flat. With this form of plug a terminal T' is used which has an end wall 12' which is flat and square across. With this form of plug and terminal, the first effect of the pressure from the punch 17 is to

force the central portion of the plug 16' to the end wall of the cavity 9 together with the end wall 12'. When these portions have become seated, further pressure merely results in lateral expansion of the plug 16'.

In Fig. 7 a plug 16² is shown. This plug is concavo-convex in form. Pressure on the punch 17 straightens out the plug 16² into the form as shown by Fig. 8. This straightening out causes a very decided lateral expansion. In this form of plug the thrust of the punch 17 is resisted by the end wall 13 of the cavity 9, because the plug 16² along its inside edge bears against the terminal T' which in turn is supported by the end wall.

In Fig. 9 a plug 16³ is shown. This plug has 15 a central cavity 18 formed therein. Plug 16³ is laterally expanded by using a tapered plug 19. This tapered plug 19 is driven into the cavity 18. The plug 16³ is prevented from moving endwise by reason of its support by the end wall 13 of the cavity 9 so that the whole effect of driving the tapered plug 19 into the cavity 18 is to laterally expand the plug 16³.

A plug 16³ as shown in Fig. 10 may also be expanded by a punch 17' which is withdrawn 25 after the plug 16³ has been suitably expanded. This punch 17' bears a reduced portion 19' which serves just as the tapered plug 19 does to enter the cavity 18 of the plug 16³ and expand the same, but after the expansion has been accomplished the punch 17' with the reduced member 19' thereon is withdrawn.

Although I have particularly described the principle, construction and mode of operation of particular physical embodiments of my invention, nevertheless, I desire to have it understood that the forms selected are merely illustrative but do not exhaust the possible physical embodiments of the idea of means underlying my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. The method of fixing a body having a substantially axial recess in a rail cavity of uniform bore which consists in supporting said body by an end wall of said cavity while forcing into the recess of said body an expander body of flowable metal, spreading the expander body laterally and shortening it longitudinally and thereby spreading the walls of said first-named body, and holding it under compression against the circumjacent walls of said cavity.

2. In a rail bond, in combination: a conductor having a terminal formed with a recess and means for conductively attaching the conductor to a rail head having a cavity of uniform bore formed with an end wall, said means including a body adapted to be expanded in said recess and thereby to expand said terminal in said cavity while supported by an end wall of the cavity against substantial displacement bodily.

3. In a railway bond, in combination: a conductor; terminals, one on each end of the conductor, each of said terminals including an annular portion adapted to fit into a cavity in a rail and lie against a cylindrical wall thereof; deformable plugs, one fitting within each annulus, and adapted to be supported by the end wall of the cavity in the rail whereby pressure exerted against the plug expands the plug laterally, binding the annulus mechanically and electrically to the rail.

4. In a rail bond, in combination: a conductor; annuli, one at each end of the conductor, adapted to be positioned in a cavity in a rail head, said annuli having one edge rolled over, substantially

embracing the conductor; two deformable members, one for each annulus, each member being of a diameter allowing the member to readily enter its respective annulus and each of said members being readily deformable and increased in diameter by pressure thereon.

5 5. The method of connecting a conductor to a rail which consists in first forming a cavity in the rail, then placing therein an annulus with its outer surface in contact with an inner surface of the cavity and having a conductor connected thereto, then inserting within the annulus a disc, and then spreading the disc so as to force the disc tightly against the inner surface of the annulus and the outer surface of the annulus against the inner surface of the cavity.

6. The method of attaching a conductor to a rail which consists in attaching a conductor conductively to a conducting member bearing against the inside surfaces of a rail cavity and then expanding a body of resistantly yielding flowable material against the said member so as to hold the member tightly in contact with the said surface while the member is supported by the end wall of the cavity.

7. In a rail bond, in combination: a conductor; hollow terminals, one at each end of the conductor; discs, one for each terminal, each disc being of a diameter allowing the disc to readily enter its respective hollow terminal and each of said discs being readily flattened and thereby increased in diameter so as to be thereby retained in a cavity in a rail while being supported by the end wall of the cavity.

8. The method of electrically bonding to a rail which comprises forming a cavity in the side of a rail head so far down thereon and of such shallowness as to be substantially without the active load bearing cross-section of the rail and affixing therein an electrical conductor.

9. The method of electrically bonding to a rail

which comprises forming a cavity in the side of a rail head so far down thereon and of such shallowness as to obviate substantial encroachment upon the active load bearing cross-section of the rail and affixing therein an electrical conductor.

10. In combination with a rail having a head and a supporting web, said head having in a lateral face at a region remote from the upper surface of the head a cavity extending to a depth at which it is free from substantial encroachment upon the active load bearing cross-section of the head, an electrical connector having a hollow terminal extending within said cavity, and a separately formed metal plug within said hollow terminal and expanded to hold the walls of said terminal under compression against the inner walls of said cavity.

11. In combination with a rail having a head and a supporting web, said head having in a lateral face at a region remote from the upper surface of the head a cavity extending to a depth at which it is free from substantial encroachment upon the active load bearing cross-section of the head, an electrical connector having a hollow terminal extending within said cavity, and a separately formed metal plug within said hollow terminal and expanded laterally to a dimension in excess of its axial extent, whereby it holds the walls of said terminal under compression against the inner walls of said cavity.

12. The combination with a rail bond provided with a terminal of mild steel having an annular part adapted to enter a bonding cavity in a rail, of an expansible plug of copper positioned axially of said annulus and expandible laterally to bind said terminal to the inner walls of said cavity, said plug being restrained from bodily longitudinal movement by the end wall of said cavity.

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