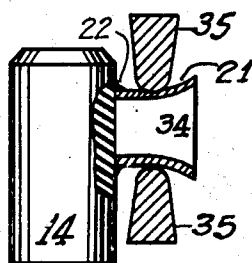
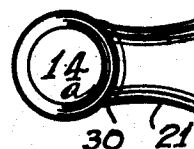
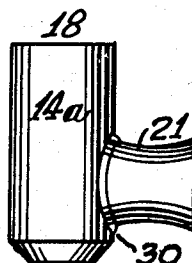
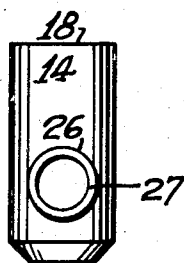
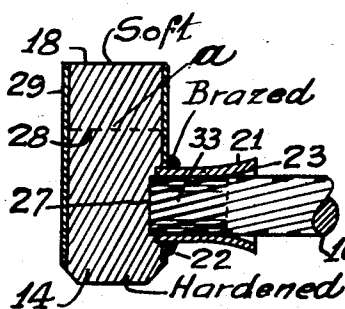
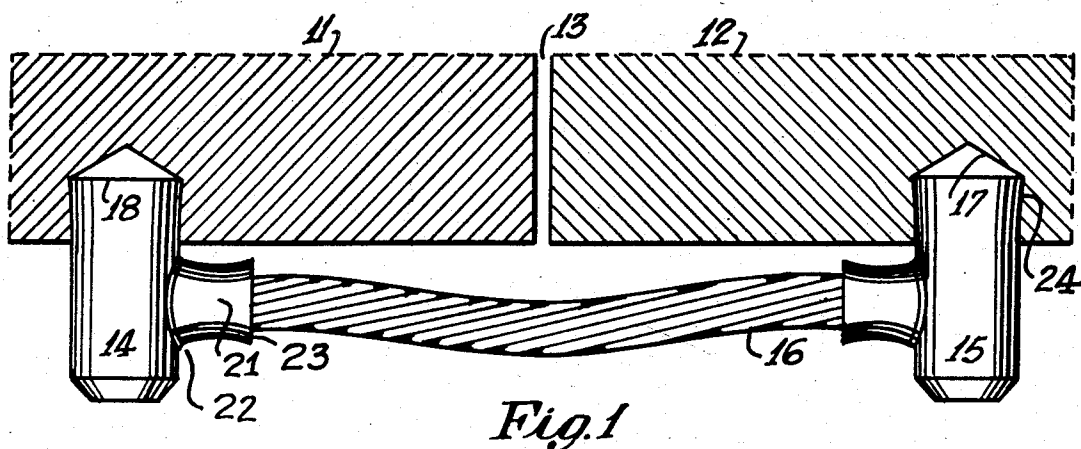


ATTACHMENT FOR SECURING A STRANDED CONDUCTOR TO A RAIL
Filed Aug. 2, 1937



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UNITED STATES PATENT OFFICE

2,222,609

ATTACHMENT FOR SECURING A STRANDED
CONDUCTOR TO A RAIL

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Application August 2, 1937, Serial No. 156,982

3 Claims. (Cl. 173—280)

This invention relates to bonds for rail joints such as are used to maintain the continuity of track circuits, and it has for an object to provide an attachment for an electric conductor to a railway rail which is easily applied to a hole in the rail and can readily be removed and replaced. A further object of the invention embodies means for attaching a flexible conductor to a terminal plug which is attached to the rail. Another object of the invention is to provide a flexible conductor with the members of the conductor brazed solid at the end and secured in an aperture of the plug; another object of the invention is to provide a plug for driving into a hole in the rail and formed with a socket at the opposite end for the flexible conductor.

Other objects of the invention reside in the method of manufacture and in the details of construction which are more fully described in the following specification, and illustrated in the accompanying drawing, in which:

Fig. 1 is a horizontal plan view of a rail bond applied to the head of the rail which is sectioned in the drawing and embodying my invention;

Fig. 2 is a side elevation of the rail bond shown in Fig. 1;

Fig. 3 is a cross section of one form of plug, made from copper coated steel showing the conductor attachment thereto, and Fig. 4 is a view of the plug shown in Fig. 3 taken at right angles to Fig. 3 and with the conductor removed;

Fig. 5 shows a plug with another form of attachment for the conductor thereto, and Fig. 6 is a top plan view corresponding to Fig. 5;

Fig. 7 is an elevation of a plug and conductor socket, partly sectioned, and Fig. 8 is a conductor prepared for attaching to the socket in Fig. 7 by a crimping process.

This invention relates to the plug type of rail bond shown in U. S. Patent 2,074,379 of March 23, 1937, filed November 7, 1932, U. S. Patent 2,112,694 and U. S. Patent 2,180,350. The rail bond in question is usually applied to the head or ball of the rail in which case it must be applied to a bottomed hole in the rail. It may also be applied to the flange of the rail where there is sufficient space for this purpose outside of the splice bar. The invention, however, is shown with the use of copper coated steel plugs and various methods of attaching the conductor to these plugs which is quite independent of the type of rail hole to which the plug is applied. The construction may be adapted for application

to the web of the rail in which case the hole is usually drilled completely through the rail.

In practice it is found that when a plug is provided with a conical end to correspond with the conical end of the bottomed rail hole that the plug will readily rebound after driving to a limited extent in the hole and once the plug rebounds its frictional grip on the rail is materially reduced. On the other hand, if the plug is provided with a flat nose to engage the conical end of the bottomed hole, it can be driven into the hole with an increased driving force without liability to rebound, and when so driven, the nose of the plug, where it engages the rail hole, spreads or mushrooms out and increases the grip in the hole. It has been found that the plugs must be specially constructed to stand the extra driving force without becoming deformed outside the hole and this condition is liable to occur where the conductor is attached to the plug, unless it is provided for, which is one of the objects of the present invention.

In the drawing, 11 is one rail and 12 is the adjoining rail which are separated by the varying joint 13 and which it is desired to bond for electric continuity between the rails. 14 is one plug and 15 is the other plug connected by the conductor 16, these plugs being inserted in bottomed holes in the rail as shown. These holes are drilled with a pointed drill making the conical ended hole as indicated at 17 and the plug is provided with a flat nose as indicated at 18, which causes the nose of the plug to spread in the hole as indicated at 24 when the plug is driven into the hole. The conductor 16 is attached to the plug by the ferrule 21 which is brazed or otherwise welded to the plug as indicated at 22 and is provided with a bell mouth at 23 where the conductor leads away from the fixed terminal.

The plug may be constructed as illustrated in Figs. 3 and 4, having the steel core 28 surrounded on the outside by the copper sleeve 29, made by what is known as a welded copper coating on the steel. The nose of the plug 18 is soft compared with the outer end which is hardened by a tempering process. This process may be carried on by covering the part of the plug that is to remain soft while the exposed part is heated and cooled for tempering purposes. The tempered part of the plug may extend to the line *a* which is within the rail hole as the plug is driven in place.

The plug is counterbored in the side as indicated at 26 to receive the sleeve 21 and at 27 to receive the end of the flexible conductor, which may previously be brazed at the end as

indicated at 33 to make a solid connection with the plug. It will be observed that the sleeve 21, which may be made of brass or non-ferrous metal, is directly brazed to the copper sleeve 28 of the plug at 22.

It will be observed that the larger part of the plug, Fig. 3, is steel, what is known as 30% copper coated steel has been successfully used for this purpose. This term implies that the copper coating has 30% of the electric conductivity of the plug. The recess in which the sleeve 21 and the conductor is seated removes a comparatively small portion of the metal so that the plug can be driven the same as if it were solid steel and the hardening of the outer end prevents bulging or swelling of the plug as it is driven in place.

In the construction in Figs. 5 and 6 the end of the sleeve 21, where it engages the plug 14 is curved to correspond with the surface of the plug and is brazed thereto as indicated at 30. The plug in this case is steel. In this construction it will be noted that the solid plug is maintained throughout and the construction is less expensive than that shown in Fig. 3.

The conductor 16 is shown as made from stranded cable which has been found highly practical for this purpose, but if a ribbon type of conductor is to be used, the sleeve 21 must be shaped to conform to the conductor. The conductor is usually made from strands of copper or copper alloy and it may, in some cases, be desirable to prevent excessive heat from reaching these strands, such, for instance, as would arise from brazing or welding the sleeve 21 at 22. In this case I prefer to assemble the sleeve 21 on the plug and afterwards attach the conductor, which attachment may be made mechanically in a cold state. In Fig. 7 the sleeve 21 is brazed or welded to the plug 14 and the end of the conductor 16 is brazed at 33 to hold the strands together, to hold them in cylindrical form and to make this portion of the conductor solid. It is then inserted in the orifice 34 of the sleeve 21 and the crimping tool 35 is applied to this sleeve to crimp it around the end 33 and to make a tight mechanical connection therewith, which also forms a satisfactory electrical connection. In this operation it will be noted that the conductor 33 is heated only to the extent necessary to braze its own strands.

The plug of the terminal which is driven into the rail hole is made from copper coated steel, which is a well known commercial product and is not to be confused with electroplating, or with a non-corrosive coating of zinc or tin. Coatings of this kind are usually applied to prevent rusting, but the copper coating of the copper weld does much more than this. It is found by experience and tests that a coating of zinc or of tin acts as a lubricant for the plug when driven in the rail hole and is a detriment to plugs that grip the rail hole by friction. Electroplating is usually applied so thin that it is partially worn off before the plug is applied to the rail and the shear from driving in the rail hole strips this coating entirely from the plug. It has long been recognized that tapered plugs, after the rail hole is filled cannot tighten in the hole, as the excess metal merely shears off and a coating of soft metal merely facilitates this condition.

In the copper coated construction the copper coating has substantial thickness, representing in one type, 30% of the conductivity of the iron of the plug. This coating is not merely a sleeve

or a loosely applied flux, instead it forms a weld with the iron making a solid, integral plug. This copper coating cannot be shorn away when the plug is driven in the rail hole, if a shaving is shorn off a substantial coat remains. The copper protects the plug against rusting and it provides a large copper surface for contact with the walls of the rail hole which cannot rust in service. A copper coated plug which expands in the rail hole has a yielding copper surface in contact with the walls of the hole which makes a closer and more perfect seal than could be obtained with the iron of the plug alone. Copper for this purpose is superior to tin or zinc, if these metals could be applied in the same way, as it is more rigid and holds its shape.

Rail plugs that are made of solid copper, or copper alloy, after a time, due to temperature changes, become loose in the rail hole and require to be tightened. This condition does not arise with the type of plug in this invention as the cross-section of the copper is much less than the cross-section of the steel and there is less opportunity for shrinkage due to the different metals.

Plugs of the type shown that are expanded in the rail hole are subject to very considerable pressure when driven in the hole, which pressure is exerted on the outer end of the plug and is transmitted through the cylindrical body of the plug. If the cross-section of the plug is materially reduced on one side, it has a tendency to bend under the driving force. The conductor is attached by a sleeve to the side of the plug which may be brazed to the plane surface of the plug, or the plug may be recessed to a limited extent to make a seat for the end of the conductor.

The stranded cable is twisted as shown and in a uniform lay there is usually a core in the cable which is not twisted, or twisted to a less extent than the outer strands. In a tensile pull the core does not yield to the same extent as the outer twisted strands with the result that it takes most of the load and slips out of place before the other strands take their portion of the load. It is necessary, therefore, to unite the strands at the end of the cable so that they will all take a proportional part of the load as is shown by the brazed end in Fig. 8, or in Fig. 3.

The plugs are usually made from bar stock and the cable attachment is made through a sleeve brazed against the side of the plug. This sleeve is made of brass and is readily brazed against the copper coating of the plug. It is crimped or spun around the end of the cable which has been made solid by brazing. This forces the sleeve into the spaces of the cable strands in a cold assembly and the sleeve has sufficient rigidity to secure the end of the cable and to provide a satisfactory contact between the cable and the plug. In this construction the terminal is comparatively small and does not form an objectionable obstruction on the rail head.

The various constructions used may be applied as shown or may be used in other combinations for the purposes specified without departing from the intent and purpose of the invention.

Having thus described my invention, I claim:
1. An attachment for making electrical connection to a rail, comprising a cylindrical plug of steel with a coating of copper for attaching to the rail, a brass sleeve having one end brazed to the copper cover of the plug, and a flexible conductor having its end inserted in said sleeve after

the sleeve is brazed to the plug, and crimped in said sleeve in a cold state.

2. An attachment for making electrical connection to a railway rail, comprising a cylindrical plug of copper coated steel, a sleeve having one end brazed to the side of said plug and a flexible conductor having its end brazed solid and inserted in said sleeve after the sleeve is brazed to the plug, said sleeve being crimped in a cold state on said conductor.

3. The method of securing a stranded conductor to a plug for attaching to a railway rail, comprising brazing one end of a sleeve to the side of the plug, brazing the strands at the end of the conductor to make a substantial solid end, inserting said end in the sleeve after the sleeve is brazed to the plug and crimping the sleeve around the brazed end of the conductor in a cold state.

EDWARD A. EVERETT. 10