A. LUKASZEWSKE.

METAL JOINT.

APPLICATION FILED JUNE 15, 1906.

1,007,005.

Patented Oct. 24, 1911.

2 SHEETS—SHEET 1.

Fig. 1

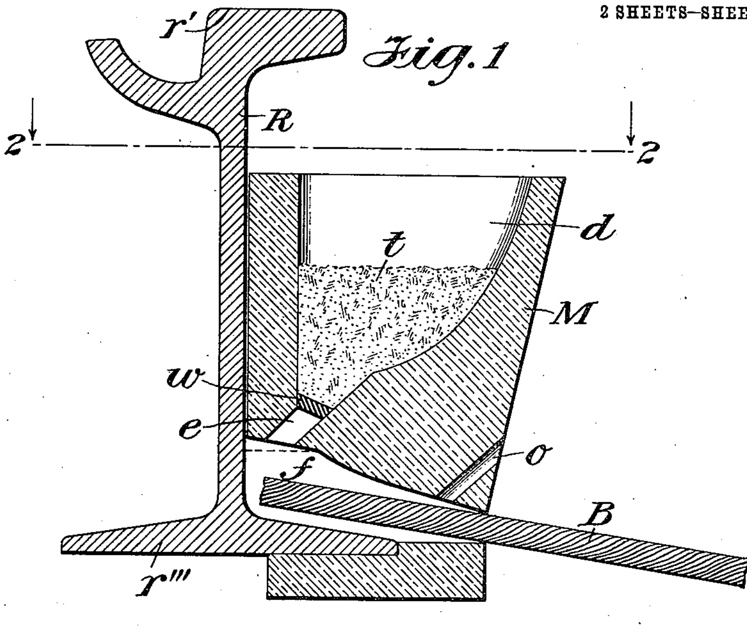

Fig. 2

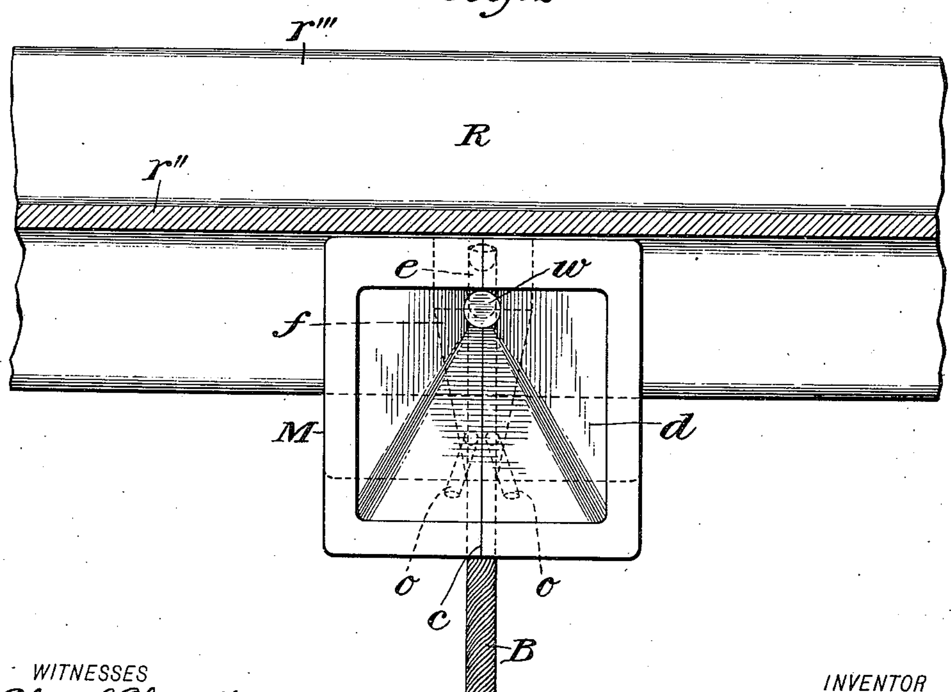

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Fig. 3

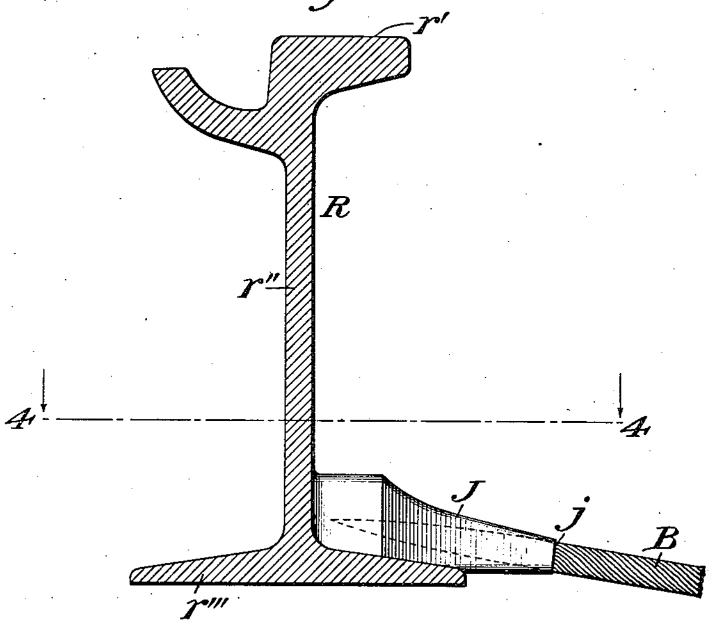
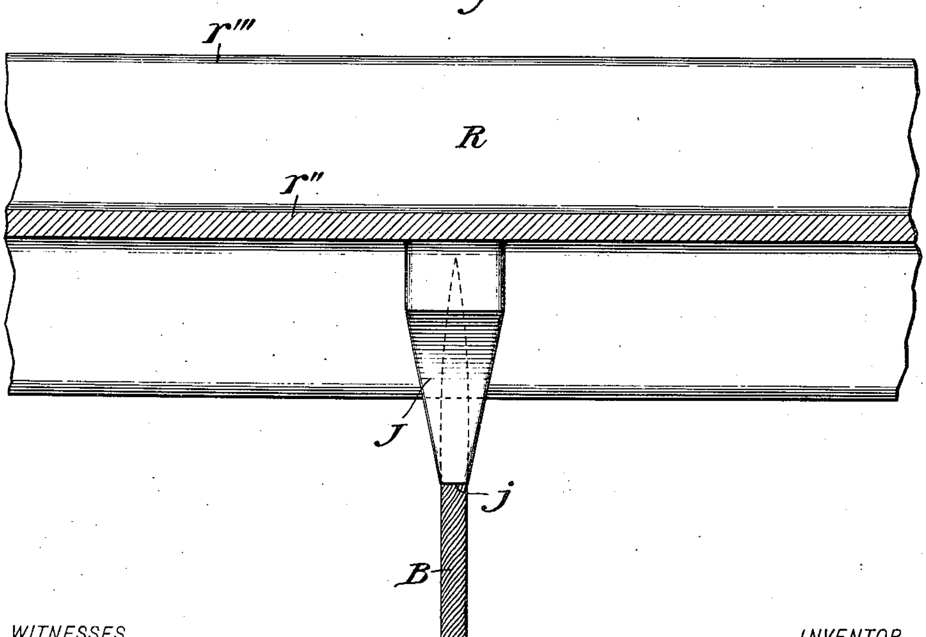


Fig. 4



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METAL JOINT.

1,007,005. Specification of Letters Patent. Patented Oct. 24, 1911.

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To all whom it may concern:

Be it known that I, Anton Lukaszewske, a subject of the Emperor of Germany, and resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Metal Joints, of which the following is a specification.

This invention relates to a metal joint, and its main object is to permit the forming of a perfect joint between two different metals, as for example, in forming a union between copper rail-bonds and the rails of a railway system.

More particularly, the invention relates to an improvement on the processes of joining metals disclosed in the prior patents granted to Hans Goldschmidt Nos. 735,244, granted August 4, 1903; 729,573, granted June 2, 1903, and 717,840, granted January 6, 1903, in which are set forth various methods of joining metals by the reduction of a metal from its compound by the ignition of a mixture of such compound with aluminum. In all of said patents the highly heated molten metal resulting from such reaction is joined to a solid piece of metal in such a manner as to form a welded joint between the solid metal and the molten metal added to it. In the present case, broadly speaking, the same general result is secured, but instead of joining two similar metals, two different metals are united in such a manner as to form a joint, the two metals united being preferably in a solid state and being joined by the addition thereto of highly heated molten metal resulting from the reaction of an oxidizing metallic compound in the presence of aluminum. When two such solid pieces of metal of different kinds are united in this manner the molten metal will unite with the solid metal of each in such a manner as to form a union in which the nature of the junction varies, one metal gradually merging into another and forming a metal of different composition at different points in the joint. Thus where steel rails are bonded by means of copper bonds the molten metal which is employed to form the union between the bond and the rail will fuse both the steel of the rail and the copper of the bond and will unite therewith to form a joint in which the percentage of iron or steel in the junction is greatest at the point where the molten metal is united with the rail, and in which the percentage of copper in the junction is greatest at the point where the copper bond is united with the molten metal, while between these points the composition of the joint will vary gradually until at the points of the junction most remote from the rail and from the bond the metal is substantially of the same nature as the molten metal used to effect the junction, while from such point toward the bond and the rail respectively the composition of the joint varies from a metal possessing on the one side little or much copper to almost pure copper, and on the other side little or much steel to almost pure steel of the kind constituting the rail. In these respects the present invention is in the nature of an extension of the principles disclosed in the Goldschmidt patents to the union of metals of different kinds in such a way as to obtain a union in which the metal connecting the two dissimilar metallic parts is a metal of variable composition at different points according as such points are near to or relatively far from one or the other of the metal parts so connected.

In the drawings accompanying this specification and forming part of the present application, Figure 1 is a vertical transverse section of a rail, a rail-bond and a mold in operative relation with one another. Fig. 2 is a horizontal sectional plan of the same, the section being taken in the line 2—2, Fig. 1. Fig. 3 is a vertical transverse section of a rail and a rail-bond united in accordance with the present invention. Fig. 4 is a horizontal sectional plan of the same, the section being taken in the line 4—4, Fig. 3.

Similar characters designate like parts in all the figures of the drawings.

While the present process may be applied to the joining of various parts composed of various kinds of metals, for the sake of showing one of the most important applications of the invention I have deemed it advisable to describe and illustrate the manner in which a steel or iron railroad rail and a copper bond may be united.

R designates in a general way such a rail, and B a copper bond of the usual type to be joined to such rail. r' indicates the tread of the rail, r'' the web of the rail, and r''' the base of the rail. In operative relation with the rail and the bond when the latter is disposed in the proper position with respect to the rail, as shown for example in Fig. 1, is placed a mold, which is designated generally by M and is substantially of the type shown in the prior patents to Goldschmidt hereinbefore mentioned. This mold is preferably divided substantially centrally along the line *c* to form a two-part mold which can be readily drawn away from the bond and the junction after the union of the parts has been completed. As here illustrated it has a large opening at the top, which opening gradually tapers to an outlet *e* which opens into another relatively large space *f* constituting the mold space proper. This mold space may be of any suitable size and shape, and preferably tapers toward the point at which the mold closes around the bond B, in order that the metal of the union may merge gradually to the cross-sectional dimensions of the bond. The space *d* of the mold M constitutes a crucible in which a mixture of aluminum and the metallic compound to be reduced may be placed. The aluminum is preferably in the usual finely-divided state, as is also the metallic compound, which is in this case ferric oxid, with which is mixed free carbon, in order that when the reaction takes place molten steel may be reduced. Between the mixture *t* and the outlet *e* from the crucible is preferably placed a thin disk *w* of iron which closes communication between the crucible and the mold space *f* until the reaction in the mass *t* is complete and all of the molten metal reduced therefrom.

At *o* one or more outlets may be provided for the escape of gases from the mold when the molten metal flows into the space *f*.

When the rail, the bond and the mold are in the positions just described and as illustrated particularly in Fig. 1, the mass *t* may be ignited in the usual manner, or in any suitable way, and reduction of the iron from its oxid will gradually take place throughout the mass from the top to the bottom thereof. When all of the iron is thus reduced the highly heated molten iron or steel resulting from the reaction will settle at the bottom of the crucible opening *d*, in contact with the disk *w* and will melt the same. During the reaction the aluminum unites with the oxygen of the ferric oxid to form alumina slag, which being lighter than the molten iron rises to the top of the crucible and thus separates from the pure molten iron or steel which is to constitute the joint between the rail and the bond. As soon as the disk *w* melts, the molten iron or steel, which is in a superheated condition and which I term superheated molten metal to distinguish it from molten iron or steel formed by melting in the ordinary ways, enters the mold-space *f* and fills the same, the gases, etc., escaping through the outlets *o*, and the overflow of metal from the mold-space filling such outlets after the mold-space *f* is completely filled. On the cooling of the compound the mold may be removed, the metal in the outlets *o* and *e* broken off, and the alumina slag removed from the upper part or crucible space of the mold.

The appearance of the union formed in this manner is clearly illustrated in Figs. 3 and 4, from which it will be seen that the rail and the bond are connected by a mass of metal integral therewith and gradually increasing in size from the bond toward the rail. At the joint *j* where the compound is connected with the bond, and for a considerable distance from such point measured in the direction of the rail, the mass of metal forming the junction or union J contains but little iron or steel, while as the distance from this point increases the amount of iron or steel in the joint gradually increases, until at points near the rail the junction is nearly all iron or steel. At points near the rail, where the metal of the joint is nearly all iron or steel this metal possesses more of the characteristics of the steel constituting the rail than of the iron or steel of the molten metal run into the mold, and at points most remote from both the rail and the bond the metal possesses substantially the characteristics of the molten metal run into the mold. Thus, the composition of the junction or union varies both with respect to the characteristics of the different metals composing it but also with respect to the different characteristics of the similar metals entering into its composition, to wit, the steel of the rail and the steel resulting from the reaction.

By means of this process metals of different kinds may be permanently connected by a joint possessing substantially the same strength as the metals connected, and such joint possesses all of the advantages enumerated in the Goldschmidt patents before specified, in addition to those advantages which it is obvious result from the connection of metals of different kinds by welded compounds. The bonding of rails in the manner described is more perfectly effected than by any other method known to applicant.

I claim:

1. An integral rail and rail bond of dissimilar metals united by a joint composed of a combination of the metals of the rail and the bond, the metal of said joint varying in composition progressively from the rail to the bond.

2. An integral article consisting of two parts composed of metals of different kinds united by means of a combination of such metals and a metal having characteristics distinct from those of either of the others.

3. An integral article consisting of two parts composed of metals of distinctly different types, united by means of a combination of such metals and another metal of the same type as one of the parts, but differing therefrom slightly in its characteristics.

4. An integral rail and rail bond united by a joint composed of a combination of the metals of the rail and the bond, said joint increasing gradually in diameter from the bond toward the rail.

5. An integral rail and rail bond united by a combination of the metal of the bond, the steel of the rail, and steel of slightly different characteristics.

Signed at New York, in the county of New York, and State of New York, this 14th day of June, 1906.

ANTON LUKASZEWSKE.

Witnesses:

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ROBERT F. GREACEN.