July 10, 1956

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2,754,065

RAILROAD RAIL JOINT CONSTRUCTION

Filed April 25, 1952

FIG. 1.

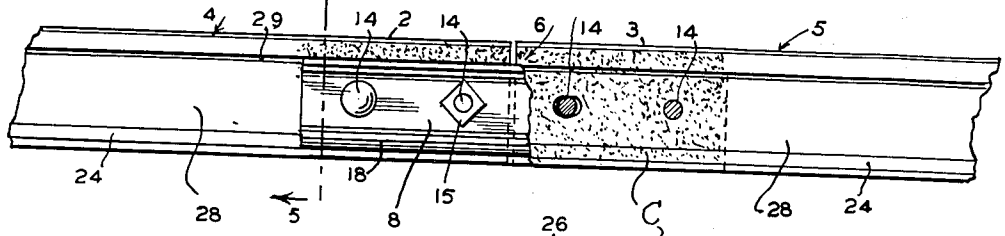
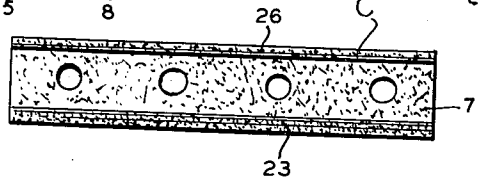


FIG. 2.



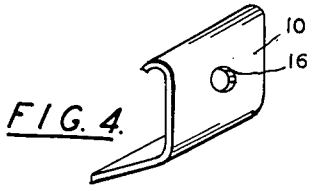


FIG. 4.

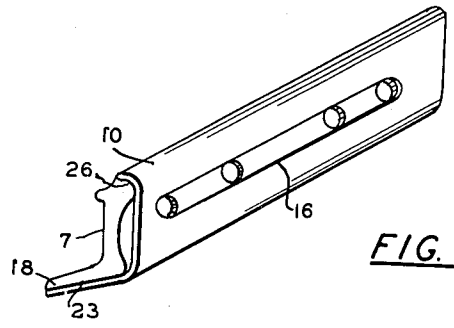


FIG. 3.

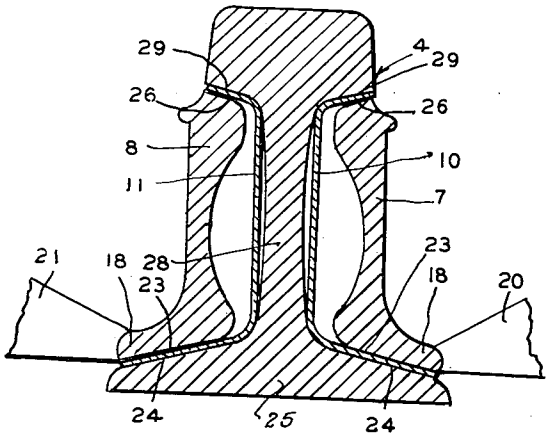


FIG. 5.

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United States Patent Office 2,754,065 Patented July 10, 1956

2,754,065

RAILROAD RAIL JOINT CONSTRUCTION

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Application April 25, 1952, Serial No. 284,260

3 Claims. (Cl. 238—244)

This invention concerns improved rail joint construction.

It has long been known that the cost of maintaining rail joints comprises a very high proportion of the total cost of maintenance of way. Since railroading began it has been thought necessary that rail joints should allow the rail ends to move relative to each other and to be free to expand and contract within the joint structure. Expansion and contraction is usually due to changes in temperature. However, longitudinal tensions are set up in the track due to the effects of traffic. This adds to the stresses caused by changes in temperature. Later experiments with continuous rail sections produced by solid welded joints were conducted and from these experiments it was proved that it is not necessary for the rails to slide relative to each other in every rail joint. By welding the rails and forming continuous lengths of rail it was found that the steel had enough elasticity to absorb and accommodate longitudinal expansion and contraction due to ordinary weather and traffic conditions. For example, rails were welded together to form a substantially continuous unit of more than one mile and it was found that this single rail unit had no more tendency to intermediate displacement or buckling than a series of rails of equal length fastened together in the usual manner with rail joints that were lubricated and set up according to standard practice. The cost of welding rail ends together, however, is so high that it is impractical at the present time to put the results of such experiments into general practice. Since rail joints as ordinarily constructed are subject to wear, failure, and require continuous servicing, it is apparent that a rail joint having no slippage and having otherwise the properties of a welded joint would be of great value.

In view of the foregoing, one of the objects of this invention is to provide a means for treating the end portions of rails and joint bars so that the rail joint formed with these parts will withstand more longitudinal and load stress than heretofore has been possible;

A second object is to provide a means of treatment for the end portions of rails and the rail joints so that they may be combined with shims and provide a rail joint having qualities similar to a continuous rail;

A third object is to provide a rail joint structure by which rails way be held together to withstand far more longitudinal and road stress than has heretofore been possible using standard rail shapes and standard joint bars;

A fourth object is to provide a method for the treatment of rail end portions and joint bars whereby the contacting surfaces between these parts will increase the area of frictional contact and will minimize the effects of mill inaccuracies, so that the holding quality of the joints is increased;

A fifth object is to provide a method which may be applied to rail joints, as herein concerned, which will increase the longitudinal quality of the rail joint without the necessity of increasing transverse bolt pressure of the

several joint bolts beyond the normal tension at which standard bolts are now set;

A sixth object is to provide a rail joint which has all the desirable qualities of a continuous rail but which may be secured at a minimum of expense and by the use principally of standard joint bars, rail shapes and joint bar bolts.

Another object is to provide a rail joint constructed as above stated in which the joint bars are so securely attached to the rail end portions that there is no wear between the joint bars and the rails due to sliding contact or otherwise.

Other objects will appear hereinafter.

I attain the foregoing objects by means of the methods hereinafter explained and by the structure illustrated in the accompanying drawings in which—

Figure 1 is a side elevation of a typical rail joint with portions of the near joint bar broken away to show the structure therebeneath;

Figure 2 is an elevation of a joint bar showing the inner face thereof;

Figure 3 is a perspective view of a joint bar and a shim such as is used here;

Figure 4 is a similar view of a single bolt shim; and

Figure 5 is a vertical section of a portion of the rail joint taken substantially on line 5—5 of Figure 1.

Similar numerals refer to similar parts in the several views.

In the drawings numerals **2** and **3** indicate rail end portions of two abutting rails **4** and **5**, while numeral **6** indicates the rail joint, generally, between these rails. Joint bar **7** is on the opposite side of the rail joint **6**, as viewed in Figure 1, and joint bar **8** is on the near side of these rails. It is to be understood that joint bar **8** is on the outside of the rails so far as the track structure is concerned. Shims **10** and **11** are made of dead soft steel and are clamped between each side of the rail end portions **2** and **3** and each of the joint bars **7** and **8**. The joint bars are held in place by bolts **14** drawn tight by nuts **15**. It is to be understood that the rails, rail end portions, and joint bars used in forming joint **6** are basically of conventional structure, and of standard size.

To attain the objects above stated the rail end portions **2** and **3** are thoroughly cleaned by subjecting them to an abrasive air blast using steel particles or similar materials. The inner faces of joint bars **7** and **8** are similarly cleaned. This air blast is continued until all oxide, rust, and scale is removed from the parts mentioned and the bare metal is exposed. This treatment leaves the metal in a roughened condition. There are numerous small and microscopic protrusions left on all treated surfaces and since metal in this condition is subject to rapid oxidation, the joint is immediately set up as hereinafter described. Shims **10** and **11** are preformed, as shown in Figures 3 and 4, to conform generally to the shape they will take when included in the joint between the rail and the joint bars. These shims are made of dead soft steel and are each provided with a slot **16** to accommodate the bolts **14**. With the shims included between the joint bars and the rail, as shown in Figure 5, the bolts are inserted and nuts set up to the usual tension which is approximately normal 20,000 pounds longitudinal stress per bolt. Pressure is then brought to bear on the lower flange portion **18** of each joint bar. This pressure is directed inwardly relative to the rail and may be applied so far as the present invention is concerned by the jaws **20** and **21** of a press (not shown). The pressure so applied is approximately 160,000 pounds and may be applied intermittently as by striking. Mechanically applied pressure of this order is preferred to hydraulically applied pressure. The effect of this pressure is to force the lower faces **23** of the joint bars toward the upper faces **24** of the rail base **25** so that the

latter act as an inclined plane transmitting any inward motion of the joint bars upward so that the upper faces **26** of the joint bars are forced toward the lower faces **29** of the rail head. The material of the shims is deformed by this action and caused to flow similar to the flow of metal in a coining press. It may be said that pressure is applied to the lower edges of the joint bars until the shims are effectively coined between the contacting areas of the joint bars and the rails. The results of this action are that the small protrusions left on the surfaces of the rails and joint bars are forced into the soft material of the shims. In the contact area between the upper edges of the joint bars and the lower edges of the rail heads these protrusions are forced directly into the surfaces of the shims, forming a myriad of small keys. In the contact area between the lower edges of the joint bars and the upper surfaces of the rail base keys are formed as the myriad of slots or interlocking grooves and lands. These form slots because of the inward movement of the lower edges of the joint bars as these bars are imbedded in the shims. This action not only forms interlocking keys between joint bars and the contacting surfaces of the rails, but increases the actual contacting area between the joint bars and the rails throughout the effective contacting area of these parts with the shims.

It is also evident that in order to displace the joint it is necessary that the keys above mentioned be sheared. Shearing of the numerous small keys existing between the shims and the rails and the joint bars requires a great deal of force and it is this resistance to shearing that helps maintain the joints in a fixed condition.

In practice rails are formed by rolling and are then tempered to a standard hardness. Similarly joint bars are rolled and heat treated. While these parts are manufactured with the closest tolerance obtainable for this type of manufacture, variations are nevertheless inevitable. In usual practice it is found that the actual total frictional area of contact between the joint bars and the rail ends of a 90-pound rail in a standard 4-bolt joint is as small as 1.5 square inches. After setting up the joint bars against the shims, as above explained, it is found that this area of frictional contact is increased to as much as the total theoretical available area. Since the holding power of a joint is in direct proportion to the amount of frictional surface area, it will be apparent that the holding quality of this joint is greatly increased. However, the total effective holding power is greatly increased due to the fact that the shims are coined into the surfaces of the rails and joint bars throughout all the contacting area. To pull the joint apart the resistance to sliding of the contacting surfaces must be overcome.

After pressure has been applied as above stated to produce the coining action desired, the nuts **15** on bolts **14** are again set up to normal tension. It has been found that after pressure has been applied as above stated, that the bolts are always loosened. This fact indicates that the metal of the shims has been deformed and caused to flow as the surfaces of the shims conform to the surfaces of the rails and joint bars. Using 90-lb. rails and 4-bolt joints, it has been found that joints constructed in this manner will resist a longitudinal pull of 180,000 pounds. The strength of the joint so far as load carrying is concerned is increased similarly. Whereas the normal joint will resist a longitudinal pull of approximately 20,000 pounds, it will be seen that the above treatment, process and structure will increase the strength of the joint approximately 9 times. It is thought that this resistance to longitudinal stress is obtained not only by the coining action of the joint surfaces on the soft shim material, but also on the increased frictional contact area which compensates for tolerances of manufacture. It is further thought that a cold welding process takes place between the contacting surfaces. It has been noticed that after a joint has been set up in the manner above described, the joint bars are firmly locked into the rails. This locking

is of such a nature that it is thought that the metal has actually joined in and along the points of contact. This condition is sometimes known as cold welding. It is also noted that after the joint is so formed no excessive bolt tension is required such as would either injure the web **28** of the rails or cause a longitudinal deformation of the bolts.

Since the position of the rails to each other is maintained fixed by this joint the rail ends do not spread and this condition is effective in preventing batter of the rail ends as the vehicle wheels go from rail to rail.

It is, of course, understood that rail joints do not depend for their strength upon any resistance to shear of the joint bolts. The strength of any ordinary joint must depend entirely upon friction. In this joint the strength depends not only upon friction between the contacting surfaces, but also upon the interlocking keys formed in surfaces of the shims. It is acknowledged that joints have heretofore been made between rails which would withstand a longitudinal pull of approximately 180,000 pounds, as above stated, but this condition was obtained by an excessive bolt tension. In obtaining these results bolts were set up to such a tension that the webs were put under a severe strain. When the rail web is put under a strain in excess of that produced by a normal bolt tension of 20,000 pounds per bolt, web failure not only is a probability but practically a certainty. The stressed webs usually fail by the formation of a fissure extending from some point of weakness in the cut end of the web, inward toward the bolt hole. When this happens the whole joint immediately fails and the rail must be replaced. This emphasizes the value of the construction above stated because in carrying out this invention bolt tensions exceeding normal are not used.

In view of the foregoing I have produced a rail joint which uses standard rail shapes, standard joint bars, and standard bolts set up to normal or standard tension, which is approximately 20,000 pounds total longitudinal or axial stress. No special shaping, grinding or treatment is necessary to alter these parts except the air blasting above mentioned. The air blasted area is indicated by stippeling C, Figure 1 on the end portions of the rails. It is to be understood that both sides of the end portions of both rails are similarly treated. Likewise, the inner faces of both joint bars are cleaned by abrasive air blast, particularly the upper top faces **26**, and the lower faces **23** of their lower or base flanges **18**. While I have previously mentioned that I have used an abrasive air blast, such as a steel blast or sand blast, for cleaning the contacting surfaces, it is to be understood that any equivalent means of cleaning may be used, such, for example, as a mechanically driven blast of abrasive particles. The above description concerns a standard shape 90-pound rail. The method and structure are obviously adaptable to rails of other weights and with a greater number of joint bolts. Preferably the pressure applied to form the interlocking keys between the rails, joint bars and shim is applied as indicated. It is to be acknowledged, however, that an improvement of holding qualities may be attained even if the pressure is applied evenly on all parts of the joint bar; the direction of pressure being directly toward the vertical center line of the rail. Pressure may be applied hydraulically instead of by mechanical means if desired. However, if the joint is to be constructed according to the practices disclosed, a light portable pressure producing apparatus must be considered and hydraulic devices are as a rule bulky and heavy.

I claim:

1. A railroad rail joint having no relative longitudinal slippage and possessing the qualities of a solid welded joint to provide a continuous rail; said joint being composed of end to end standard rail end portions having the upper surfaces of their rail bases and the lower surfaces of their rail heads cleaned and roughened; joint bars spanning the rail end portions and having surfaces,

which normally contact the surfaces of the bases and the heads of the rail end portions, cleaned and roughened; shims of soft steel interposed and compressed between the normally contacting surfaces of the rail end portions and the joint bars and cold coined into the surfaces of the rail bases and the heads and opposing normally contacting surfaces of the joint bars and providing a myriad of interlocking keys and lands between the contacting surfaces of the rail end portions and the shims and the contacting surfaces of the joint bars and shims and rail joint bolts tightly clamping the joint bars and rail end portions together in coined contact with the shims.

2. A railroad rail joint having no relative longitudinal slippage and possessing the qualities of a solid welded joint to provide a continuous rail; said joint being composed of standard end to end rails having end portions provided with transverse holes to receive rail joint bolts, rail joint bars longitudinally spanning the end portions and having bolt receiving holes registering with the holes in the rail end portions; the adjacent juxtaposed surfaces between said rail end portions and the joint bars being cleaned and abraded; shims of soft steel compressed between and cold coined into said juxtaposed surfaces of the rail end portions and the joint bars; and rail joint bolts extending through the shims and the holes in the rail end portions and the rail joint bars and maintaining the joint bars and rail end portions in coined compressive relation with the shims.

3. The method of forming a cold coined railroad rail joint by means of joint bars, joint bolts and cleaned soft metal shims between standard end to end rail end portions so that the rail end portions are secured against relative longitudinal slippage and the joint possesses the qualities of a solid welded joint to provide a continuous rail; said method comprising the steps of cleaning the

normally contacting bases and heads of the rail end portions and the bases and heads of the joint bars; positioning the joint bars to span the rail end portions with the shims positioned therebetween and having flanges interposed between the bases and heads of the rail end portions and the joint bars; setting up the joint bolts to normal pressure; applying inwardly directed pressure of approximately 160,000 pounds directly to the lower edges of the bases of the joint bars to embed the irregularities of the contacting surfaces of the rail end portions and the joint bars into the flanges only of the shims and then setting up the joint bolts to a normal tension of approximately 20,000 pounds longitudinal stress, whereby the strength of the joint is increased about 9 times the usual strength so that it resists a longitudinal pull of 180,000 pounds.

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