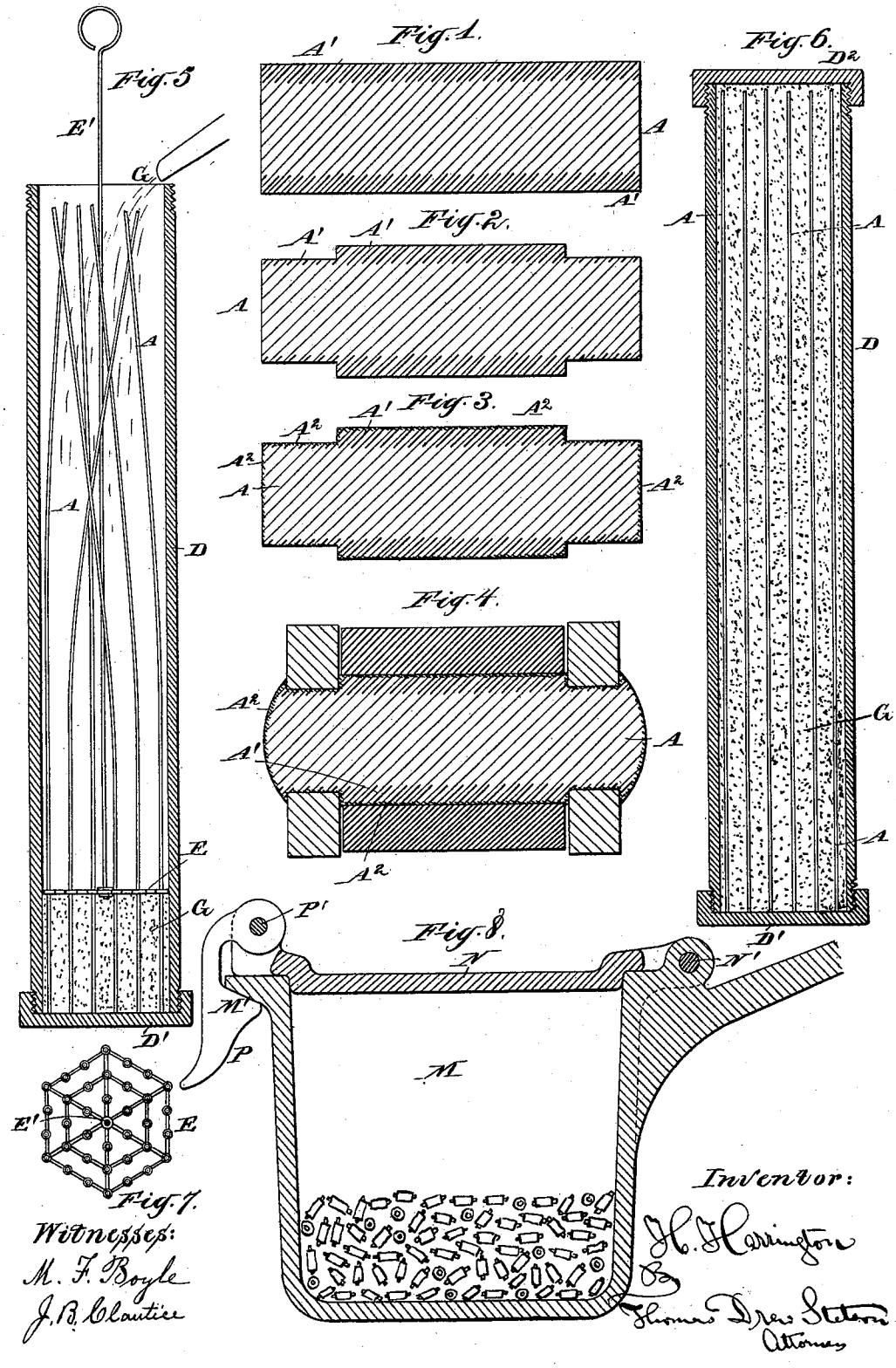
(No Model.)

H. HARRINGTON.

BICYCLE CHAIN.

No. 594,010. Patented Nov. 23, 1897.



Witnesses:
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UNITED STATES PATENT OFFICE.

HUMPHREY HARRINGTON, OF INDIANAPOLIS, INDIANA, ASSIGNOR TO THE INDIANAPOLIS CHAIN AND STAMPING COMPANY, OF SAME PLACE.

BICYCLE-CHAIN.

SPECIFICATION forming part of Letters Patent No. 594,010, dated November 23, 1897.

Application filed March 8, 1897. Serial No. 626,433. (No model.)

To all whom it may concern:

Be it known that I, HUMPHREY HARRINGTON, a citizen of the United States, residing at Indianapolis, Marion county, in the State of Indiana, have invented a certain new and useful Improvement in and Relating to the Manufacture of Bicycle-Chains, of which the following is a specification.

The invention relates to the rivets.

The wire from which I manufacture the rivets or studs is of soft or low steel. I treat it in a carbon bath composed, preferably, of broken bone for such period as will induce a moderately high steel over the entire surface. This produces a peculiar condition, having an interior of low steel or soft iron and a considerable thickness at the surface of sufficiently high steel, which latter will assume a tolerably-hardened condition when heated and suddenly cooled. I then treat such wire by machining, in the same manner as soft iron wire is machined, to reduce the portions which are to serve as the necks and to cut off the rivets to the proper lengths. The machining removes the whole or the main portion of the steelified surface on the parts which become the necks. I afterward treat the entire surfaces of such nearly-completed rivets by heating with a highly-carbonizing chemical, as cyanid of potassium or prussiate of potash, which has the effect of making an intensely-carbonized but thin coating over the whole surface. Then while fresh from the cyanid bath and at a red heat the rivets are suddenly cooled by dropping in water or oil. On the main body, where this second carbonizing is applied, and additional to the deeper but more moderately-carbonized coating, the surface is especially hard and able to resist abrasion for a long period of use. Thus the double carbonized surface is only on the main body, where the wear has to be endured.

My rivets are of the ordinary form and appearance when completed and may be worked in all respects in the ordinary way except that the operation of riveting or heading the ends after the parts of the chain have been assembled requires to be conducted with more vigor in consequence of the hardness of a thin coating on the surface of the necks and ends. The chain when completed appears in all respects like the ordinary chain.

It will be seen that my rivets are treated according to the earliest and last steps of the process set forth in the patent to William S. Wilson, dated July 3, 1894, No. 522,247. I subject them to an intermediate treatment by heating with cyanid of potassium or prussiate of potash.

My chain works the same as a chain made with the Wilson process except that it will better endure wear by reason of the peculiar steel coating on the body of the rivet, having not only the coating of moderately high steel, which is due to the original surface carbonizing of the wire, but also having the extreme outer portion of such coating of still harder steel, due to the additional treatment with chemicals.

In the accompanying drawings, which form a part of this specification, Figures 1, 2, and 3 are longitudinal sectional views on a large scale showing one of my rivets in three conditions after the successive steps taken in its production. Fig. 4 is a corresponding section showing the rivet and the adjacent portions of the side plates and of the blocks after the riveting has been effected. The remaining figures are on a smaller scale. Fig. 5 is a section through the carbonizing-case in which the wires are treated in considerable lengths. This figure shows the case in the act of receiving the broken bone. Fig. 6 is a corresponding view of this case completely filled and closed ready for exposure to heat to effect the first carbonizing. Fig. 7 is a plan view of the evener used for the first carbonizing treatment. Fig. 8 is a central vertical section through the vessel used for effecting the second carbonizing after the rivets have been cut into shape.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

Referring to Figs. 1, 2, 3, and 4, all showing the same rivet at different stages in its manufacture, A is the soft iron or low steel, and A' is a moderate thickness on the exterior thereof, which has been raised to a moderately-steelified condition not quite up to that of tool-steel. In Fig. 1 this coating

extends the whole length. The wire may be purchased in that condition from some manufacturers, being known in the arts, uniform low steel or soft iron along the center and uniform higher steel on the whole exterior surface. I prefer to use the apparatus shown in Figs. 5 and 6, believing that it will produce a wire having a more certain and uniform coating of moderately high steel than can at present be purchased.

Fig. 2 shows the partially-manufactured rivet after its necks have been machined down and the wire cut off into proper lengths for rivets. The operation of machining leaves the necks with little or none of the first coating of steel. A quantity of the rivets thus far advanced are next placed in a suitable vessel M, (see Fig. 8,) with sufficient cyanid of potassium or prussiate of potash to have them completely immersed, and are heated to a cherry red, when they are withdrawn from the fire and poured into a tank of cold water or oil. (Not shown.) The useful effect of this treatment with the chemical is to raise the steelified condition on the surface of the body still higher. The carbonized condition thus induced, due to the double carbonizing on the surface of the body, does not extend inward to the same depth as the more moderately-carbonized coating A′. This thin high-steel coating over the whole surface is marked A^2. (See Figs. 3 and 4.) It will be understood that the entire rivet retains its original soft condition in the interior and its fairly-hardened condition on the exterior of the body to about the same depth as in the ordinary well-known rivets which are produced by the Wilson process, with the further quality that a thin portion A^2 on the exterior of the body is still more hard, because of the higher condition of the steel induced by the chemical, and will allow the rivet to wear longer.

Fig. 3 shows the rivet after the thin coating of high steel has been induced over the whole surface and before the riveting. Fig. 4 shows the same after the parts have been assembled and the heading has been effected. In the heading operation the soft material in the interior is spread at the ends, carrying with it the intensely hard but very thin surface coating.

I will now describe the apparatus for effecting the surface carbonizing.

D is a cylindrical case of cast-iron screw-threaded to receive a cap at each end. One cap, D′, may be permanently set. The other, D^2, should be removable. Both are made to fit with tolerable tightness.

Soft-iron or low-steel wire of the proper size is cut into lengths a little less than that of the casing D and accurately straightened. To properly charge the case D, it is set upright and the upper cover D^2 removed.

E is a frame of small wire having a long handle E′, by which it may be raised and lowered in the interior of the case D, the lower end being branched and formed into rings which loosely inclose the several wires A, set upright, and hold them evenly spaced in the interior of the casing. The proper number of wires being inserted in the rings in the evener-frame E are lowered into the case D, and a small stream of broken bone G being poured into the casing the light frame E is raised and lowered to small extents, allowing the broken bone to move down past it and packing the latter in the even spaces between the several wires. This is continued, the evener-frame E reciprocating in higher and higher positions as the broken bone accumulates and always holding the wires evenly spaced at the proper level where the packing is being effected. The case may be shaken during the filling. The case is ultimately filled above the tops of the wires, and the cover D^2 being applied attention may be given to the next case, and so on. These cases are put in the highly-heated oven or furnace and rolled a little from time to time during the one hour or longer in which it is found expedient to subject them to this treatment. The cases are then removed and preferably piled together and covered with ashes or other non-conductor, so that the cooling will be slow; but if occasion arises for rapid work the cap D^2 can be removed and the cases emptied and recharged while hot. The wires now steelified to a moderately high condition to a considerable depth over the whole surface should be cooled slowly to facilitate the subsequent cutting operations. The tightness with which this form of case may be closed makes it practicable to mingle a small quantity of cyanid of potassium or prussiate of potash with the broken bone. I prefer to do this. Thereby the carbonizing effect of the first treatment is increased and the time necessary to attain the proper depth and condition of the first steelifying is shortened. It is important not to use a large proportion of the chemical in this first treatment. The wires are subsequently machined to properly reduce the ends and to cut the several rivets apart one from another.

The vessel M is used for the second carbonizing. A cover N is fitted on the vessel by a hinge N′ and secured by a swinging catch P, hinged to the cover at the point P′ and engaging under a lip or flange M′ on the vessel. This cover allows the vessel to be shaken to facilitate the distribution of the chemical among the rivets and prevents the escape of the fumes, which would otherwise be annoying to the workmen and are somewhat poisonous. With this hinged cover and the fastening therefor the quantity of chemical supplied for a given quantity of rivets may be accurately determined beforehand, and the heat of the vessel after one treatment is over may be utilized, putting a handful of cold rivets into the open vessel, throwing the chemical upon those cold rivets, and rapidly closing and securing the cover. In such mode of op-

erating the vessel may be agitated to effect the thorough distribution of the chemical and the rivets, and they may be allowed to remain for a longer period until practically the whole of the carbonizing effect of the chemical is exhausted. This contributes to insure a uniformity of thickness of the high-steel coating induced by the chemical. The opening of the apparatus is easy, requiring simply a slight blow on the beveled under face of the locking-catch P to liberate it and allow the vessel to be inverted and emptied.

The treatment with the chemical in the vessel M has the additional and objectionable effect to coat the reduced necks and also the offsets or shoulders at the junctions of the bodies with the necks and also the circular ends of the necks. All are encumbered with a thin coating of high steel which in the operation of sudden cooling to which it is subjected becomes hardened steel. The thickness of this very high steel coating is so slight that the disadvantage is of little importance. Practice will determine for how long a period the operation should be continued. It should be such as to add appreciably to the hardness of the surface of the body portion and yet not be continued so long as to make an impracticable thickness of hardened steel on the ends which have to be subsequently distorted by riveting or heading.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. The first surface carbonizing may be carried to a greater depth, so that all the steel will not be removed from the neck by the machining process; but it is important not to have so thick a coating of steel on the necks, and especially on the ends thereof, either from the first or second carbonizing, as will when the coating is hardened offer serious difficulty to the riveting operation.

Instead of the cylindrical cases, with provisions for tightly closing, I can use other forms with much less efficient closing. Cases of rectangular cross-section lying on the sides and being closed simply by resting one upon another may serve. I can omit the provisions shown for the equal distribution of the wires in the carbonizing material G and allow the distribution to be effected according to the judgment of the operator. I can omit the small quantity of chemical in the first carbonizing process and allow that treatment to be effected by the broken bone or other milder carbonizing material alone.

I do not in this patent claim the process, such being made the subject of a separate application for patent filed by me January 14, 1897, Serial No. 619,152.

I claim as my invention—

A rivet for bicycle-chains, having a body and reduced ends, and composed of a core of rivetable metal extending through the ends and body, a very hard surface layer over the body and ends, and a layer of intermediate hardness on the body between said core and surface layer, said intermediate layer being absent wholly or in large part from the reduced ends of the rivet, substantially as described.

In testimony that I claim the invention above set forth I affix my signature in presence of two witnesses.

HUMPHREY HARRINGTON.

Witnesses:
HENRY F. FLETCHER,
GEO. H. MATHESON.