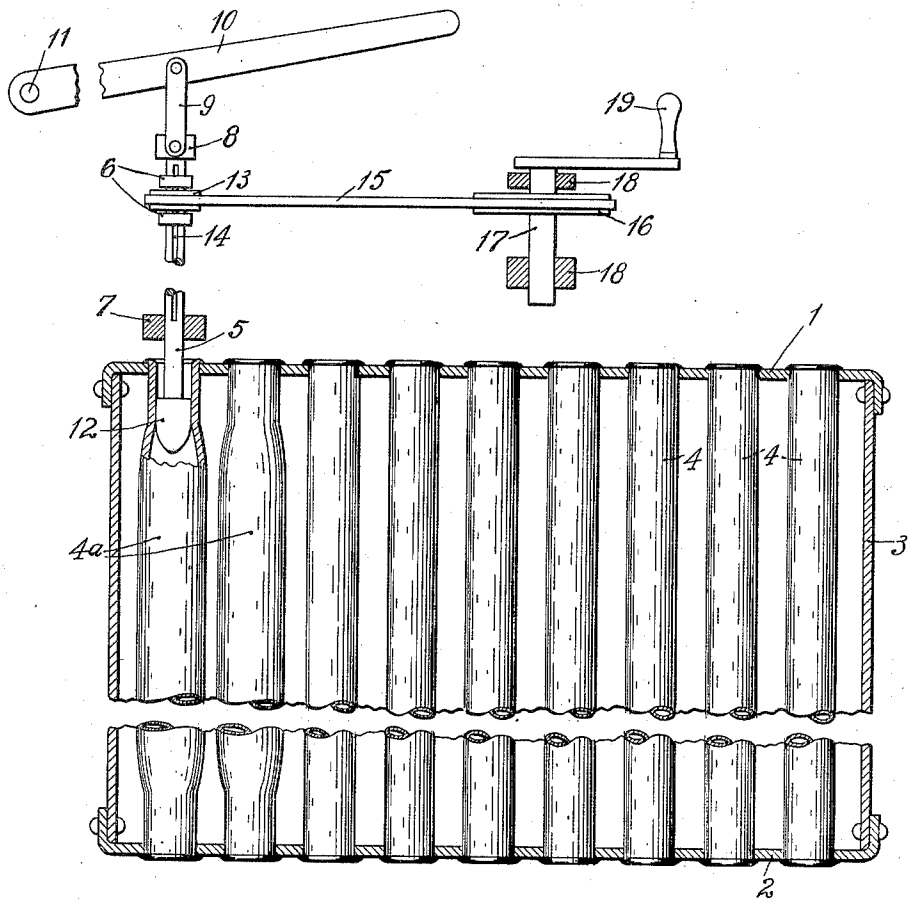
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PROCESS OF HARDENING COPPER BOILER TUBES.

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1,078,583. Patented Nov. 11, 1913.



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PHILIP D. JOHNSON, OF CHICAGO, ILLINOIS.

PROCESS OF HARDENING COPPER BOILER-TUBES.

1,078,583. Specification of Letters Patent. Patented Nov. 11, 1913.

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To all whom it may concern:

Be it known that I, PHILIP D. JOHNSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Processes of Hardening Copper Boiler-Tubes, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an improved process or method of hardening boiler tubes of copper or brass and is particularly adapted to "renewing" these tubes in boilers after they have been overheated and softened by improper use of the boiler.

As is well-known in the art, copper tubes are frequently employed in automobile boilers and, while they give good results in many ways on account of their high conductivity, they are subject to the disadvantage that they are readily overheated if the water should become too low in the boiler for any reason and when thus overheated or "burned" they lose their temper or hardness and when again subjected to pressure they readily collapse and cause leaks in the boiler between the ends of the flues and the boiler heads and prevent further use of the boiler until the same is repaired. Heretofore it has been necessary under such conditions to remove the softened and collapsed tubes and replace them with new ones, but by my process the need for doing this is entirely eliminated, since the softened and collapsed tubes may be restored to proper shape and hardness simply and effectively so that the boiler may be again used and successfully subjected to the same treatment as when the boiler was first made.

By my process in restoring or reclaiming a boiler damaged by overheating or burning, I first introduce water into the boiler under high pressure sufficient to collapse all of the tubes that have been softened by the burning. Any leaks that develop at the ends of the tubes are then stopped by expanding the tubes until all of the joints in the boiler heads are tight. The water is then withdrawn from the boiler and the boiler with its collapsed tubes is placed in a machine provided with a spinning tool mounted on a long arbor, so controlled that it may be rapidly rotated and at the same time moved longitudinally through one tube after another. The spinning tool is of substantially the diameter of the bore of the boiler tubes and is pointed so that, as it moves through one collapsed tube after another, it opens up the flattened portion and by its mechanical manipulation of the metal of the tube spins and hardens it so that by the single operation of moving the rotating tool through the tube, the tube is restored both to its proper shape and proper hardness. Under certain circumstances, it is not necessary to collapse the tubes as, for example, when the boiler is so badly overheated that it is known that all of the tubes are injured, for in this case the spinning tool may be taken of slightly larger external diameter than the bore of the tubes and it may be run through the tubes without first collapsing them, and the result secured by the spinning operation in hardening the tubes just as though they had been previously collapsed. It is generally desirable, however, to collapse the damaged tubes, since frequently but few of them are injured and it would be a useless amount of work to treat all of them as described when only a small number of them were in need of it.

In carrying out my invention, it will be understood that it is not necessary to employ a particular form of mechanism carrying the spinning tool. Any mechanism that will impart the necessary rotary and longitudinal motions to the tool may be employed. Thus, in many cases, it will be found convenient to employ an ordinary drill press to operate the spinning tool or, if preferred, a lathe may be so employed. On the other hand, if desired, special mechanism may be devised peculiarly adapted to rotate the arbor and feed it through the tubes, one after another, with a minimum amount of attention on the part of the operator. As the particular mechanism which is employed for accomplishing this result does not constitute a part of the present invention, I have illustrated in the accompanying drawing a simple diagrammatic form of apparatus in order that the process may be clearly understood.

In the drawing illustrating my invention, I have shown a boiler consisting of the heads 1 and 2 connected together by the shell 3 surrounding the boiler tubes 4 which extend between the heads and are expanded in them so as to make tight joints. The tubes 4^a are shown as collapsed, either as a

result of the softening of the tubes by overheating or by the application of high water pressure, as described, and the boiler is assumed to be in condition for the hardening operation, all of the tubes 4^a having been collapsed which are sufficiently softened to weaken them.

In the drawings an arbor 5 is shown as mounted in bearings 6 and 7 so that it may move longitudinally therein, the upper end of the arbor being connected by a rotatable lock 8 with a link 9, the other end of which engages a lever 10 pivotally supported at 11, so that by moving the lever 10 up and down the arbor 5 is moved vertically in its bearings. The lower end of the arbor 5 has rigidly secured to it a spinning tool 12 of an external diameter substantially the same as the inner bore of the tubes 4, and the lower end of the spinning tool is pointed so that as it is moved down into the tubes 4^a they will be spread from flattened condition gradually into circular form.

The arbor 5 has slidably mounted thereon a driving gear 13 which rotates the arbor by engagement with a keyway 14. The gear 13 is engaged by a driving chain 15 which is driven by a gear 16 mounted upon a driving shaft 17 which may be actuated in any desired manner. In the drawings, the shaft 17 is shown as mounted in bearings 18 and provided with a crank 19 by which said shaft may be rotated. Obviously, power may be employed to rotate the shaft 17 and may be communicated thereto in any desired manner.

Broadly considered, therefore, my invention consists in the method of reforming and rehardening distorted boiler tubes, although it is also applicable, as pointed out, to the rehardening of boiler tubes which have been softened or which are found to be too soft for practical use after they are in place in a boiler, whether they have been distorted or not since the essential feature of the reforming operation is the mechanical manipulation of the surface of the tubes in place in the boiler heads by means of a suitable spinning tool. In practice it is frequently desirable to expand all of the tubes at each end to see that the joints are tight before subjecting them to water pressure. The tubes are then collapsed and treated as explained above.

What I claim is:

1. The process of restoring burned boiler tubes which consists in expanding the ends of the burned tubes to make tight joints in the heads of the boiler, collapsing the burned tubes by the application of pressure in the boiler, and restoring the tubes to circular cross-section and hardening them by means of a rotating spinning tool passing through them.

2. The process of repairing a tubular boiler *in situ* which consists in first subjecting the tubes to pressure to cause them to collapse, and then restoring the tubes to circular cross-section and manipulating them by passing a rotating tool through them.

In witness whereof, I hereunto subscribe my name this 13th day of July, A. D., 1912.

PHILIP D. JOHNSON.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."