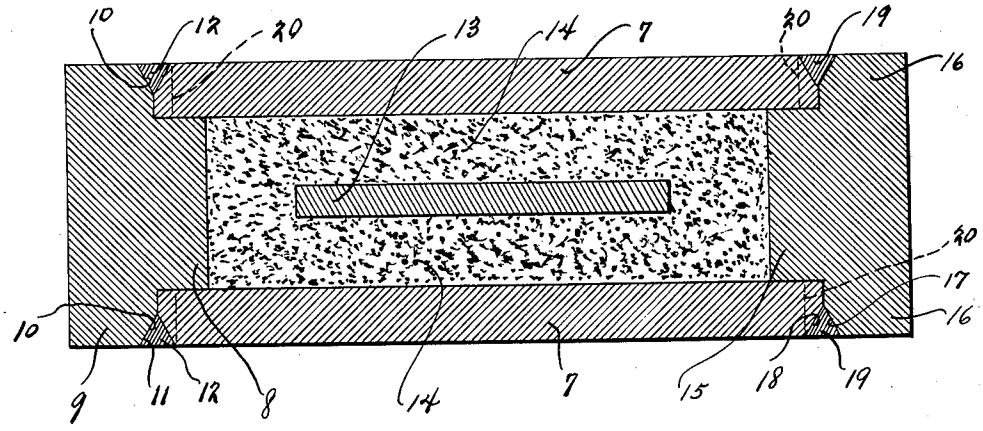
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PROCESS OF HARDENING METAL

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INVENTOR.
W. Reuen Fisher
BY Thos. F. Donnelly
ATTORNEY.

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PROCESS OF HARDENING METAL

W. Reuen Fisher, Frankenmuth, Mich.

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My invention relates to a new and useful improvement in a process of hardening metal and particularly adapted for use in hardening steel and especially high speed steel. With steel and especially high speed steel, it has been found that when the material is raised to a high temperature sufficient for effecting the hardening operation, because of the action of the air and the gases on the material, the steel has a tendency to blister and decarbonize for a depth in some cases extending from forty to fifty thousandths of an inch so that the surface of the material is damaged to such an extent as to necessitate a removal of the damaged layer or coating after the hardening operation. This removal of the damaged layer is a laborious and expensive operation which can generally be effected only in a grinding operation, and particularly it is an expensive operation where the material is of uneven contour. With some types of pieces, it is impossible to grind after the hardening operation with the result that portions of the surface remain in a defective state or condition.

It is an object of the present invention to provide a process whereby hardening of metal and especially steel and high speed steel may be effected without in any manner damaging or disintegrating or deleteriously affecting the surface.

Another object of the invention is the provision of a process whereby the material may be raised to any desired temperature and maintained at this temperature without danger of injuring the material since the surface thereof is not affected by any disintegrating action of gases or air.

Another object of the invention is the provision of a process whereby a metal may be raised to the necessary temperature for hardening and maintained at that temperature free from gases or air and subsequently quenched while still maintained in the gas and air free condition.

Another object of the invention is the provision of a container in which the material may be positioned and maintained free from contact with gases and air during the heating operation and in which it may be quenched subsequent to the heating operation.

Another object of the invention is the provision of a process whereby the material to be hardened may be surrounded by heat conducting material during the heating operation which will serve to effectively conduct the heat to the workpiece being heated while at the same time serve to prevent access of air and gases to the workpiece.

Another object of the invention is the provision of a process of hardening metal whereby, while the workpiece may be heated to and maintained at the desired temperature for a specified length of time free from air and gases, it may also be quickly quenched after the heating operation.

Another object of the invention is the provision of a process of hardening metal and especially steel whereby the metal may be quenched by water after the heating operation.

Other objects will appear hereinafter.

The invention consists in the combination and arrangement of parts hereinafter described and claimed.

The invention will be best understood by a reference to the accompanying drawing which is a longitudinal central vertical sectional view of a container or cartridge used in carrying out the process.

In the drawing I have illustrated a sleeve or tubular body 7 which is closed at one end by a cap having the portion 8 adapted to snugly enter the portion 7 at one end and provided with the peripheral flange portion 9 which is cut away on one face adjacent its periphery as at 10 to provide the beveled surface 11 of the end of the tube or container 7, forming a V shaped peripheral groove in which the weld 12 may accumulate when these parts are welded together. The workpiece is represented by the body 13 and this workpiece is enclosed in the container or cartridge or tube 7 packed in a packing 14 of suitable heat conducting material which will serve to exclude air and gases from the container, such as iron filings, graphite or the like. A closure for the opposite end embodying the portion 15 which snugly engages in the end of the sleeve 7 is provided. The peripheral flange 16 is cut away as at 17 to cooperate with the beveled end 18 of the tube to provide the V shaped groove for reception of the weld 19. When the material 13 is sealed in the container, packed in the packing 14, the container or cartridge is then placed in a suitable oven or other source of heat and raised to the desired temperature and maintained at this temperature for the desired period of time. The packing 14 being formed from material of high thermal conductivity will serve to readily raise the body 13 to the temperature of the oven. Since no air or gases have access to the workpiece 13, it is not necessary that particular attention be paid to the length of time the workpiece 13 is maintained at the elevated temperature as no injury or damage to the surface of the workpiece will be effected. In this regard the present process has a marked advantage over known processes because with known processes it is ordinarily nec-

essary to remove the workpiece from the oven after the elevated temperature has been maintained for a definite period of time as further heating of the workpiece will result in further blistering or scaling of the surface and a decarbonization thereof.

After the workpiece has been raised to the desired temperature, it is not necessary to remove the workpiece from the cartridge in order to quench it as the quenching may be effected while the workpiece is in the cartridge. The quenching is, of course, most efficient when the packing **14** is of high thermal conductivity. Furthermore, since the workpiece **13** is not brought directly into contact with the quenching material, it becomes possible to quench by use of water instead of oil or air although it is believed obvious that either oil or air may be used. The advantage, however, is in the fact that water may be used for quenching.

It is of course obvious that the packing material **14** must be of a material possessing a higher melting point than the workpiece **13** which is to be heated.

A workpiece treated in this manner will be found to possess all of the desired characteristics and when removed from the cartridge or container its surface will be free from any blistering, scaling or decarbonization. The workpiece does not need to be sandblasted as it has a satin silver finish when removed from the container. As a result of this, a workpiece to be hardened may, before the hardening process be finished to within a few thousandths of an inch of the desired dimensions so that a considerable saving in labor is thus effected. Furthermore, if the workpiece is to be nitrated, the same may be effected without grinding the workpiece after the hardening operation because of the freedom from decarbonization or scaling.

In removing the workpiece from the container, it is but necessary to mill or machine off the tube **7** on the dotted line **20** whereupon the closure may be removed. It is evident therefore that the body **7** may be used again by beveling off its end prior to the welding of the closure therein.

While I have illustrated and described the preferred form of construction of my invention, I do not wish to limit myself to the precise details of structure shown, but desire to avail myself of such variations and modifications as may come within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A process of hardening materials consisting in enclosing the metal to be hardened in a container, surrounding the metal by an air excluding heat conducting material in friable form, and sealing the container against entry or escape of gases, raising the container with the contents thereof to the desired temperature for hardening purposes, and subsequently to the heating and, prior to the removal of the metal, quenching the metal while in the container.

2. The process of hardening a metal piece consisting in surrounding the material with a packing of air and gas excluding, heat conducting material, sealing the piece while so packed against entry or escape of gases, raising the piece to an elevated temperature, and subsequently quenching the same while surrounded by the packing.

3. The process of hardening a metal piece consisting in enclosing the metal piece in a packing of gas excluding, heat conducting material within a sealed container, and elevating the temperature of the same for a predetermined period of time, and then quenching the same prior to the opening of the container.

4. The process of hardening a metal piece, consisting in placing the metal piece in a container, surrounding said piece with air excluding, heat conducting material, spacing said piece from the walls of said container; welding closures on said container for preventing escape of gases therefrom or thereinto, and raising the temperature of the container with the contents thereof to the desired temperature for hardening purposes, and, subsequently to the heating, quenching the metal piece while in the container and prior to the opening of said container.

W. REUEN FISHER.