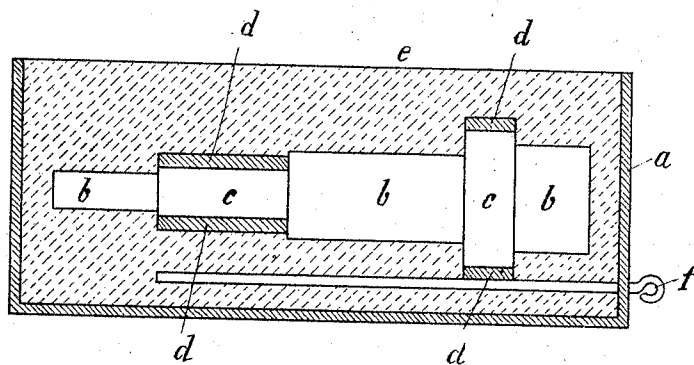


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PROCESS OF HARDENING STEEL POOR IN CARBON.
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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CARL BURIAN, a citizen of the Empire of Germany, and residing at Berlin, Germany, have invented a certain new and useful Improved Process of Hardening Steel Poor in Carbon, of which the following is a specification.

My invention relates to processes of hardening steel poor in carbon.

The case-hardening process as employed heretofore consists in packing the objects to be hardened in any desired cementation powder and in exposing them in a receptacle, *e. g.* a sheet-iron box, to the action of the fire. Now this case-hardening process is connected with special difficulties when the objects are to be hardened only at predetermined places, and a clear demarcation of the hard and soft parts is necessary. Heretofore, for attaining this end, only processes difficult of execution could be used which, in spite of their troublesomeness, were by no means reliable in the results produced.

Heretofore, those portions of the articles to be hardened have been covered with a carburizing medium, and those portions of the articles to remain soft were covered with sand, brick-dust or the like. In this connection, the well known procedure of painting upon those portions of the article to be hardened, the medium containing the carbon, by the aid of a binder, or in the form of a paste, may be used.

According to the present invention, the articles after being coated with the hardening medium are packed in pure burned silicious sand, and hence in a sand which contains neither calcium nor alumina, nor does such sand contain any organic constituents owing to the burning thereof. By using burned silicious sand, all injurious influences upon those portions of the articles to be kept soft are avoided. Likewise, the layer of hardening medium coated upon the articles to be hardened and which coat may be only a few millimeters in thickness, is protected from injurious influences.

My process may be carried into practice as follows:—The object to be hardened is coated with a known binder or adhesive substance such as glue, molasses, starch, flour, gum arabic, fish glue and dextrin mixed with a liquid, whereupon the hardening agent is applied, by scattering it for example, until sufficient hardening substance is present.

The coating is then dried. Those places not to be hardened are then liberated from the coating by scraping it off with a knife, file or the like, and it is thus possible to demarcate exceedingly sharply. In this manner it is possible, for example, to scratch in the object to be hardened a drawing or name which is to be excepted from the hardening.

My process may be modified by mixing the hardening agent with the adhesive substance or binder to form a paste which is then applied to the object and subsequently removed in like manner as the hardening agent from the predetermined parts.

The object is now packed in pure silicious burned sand in a can or similar casing, the sand being caused to closely surround the object. The can is then subjected in the usual manner to the action of the fire.

One form of apparatus adapted for carrying my process into practice is represented by way of example in vertical longitudinal section in the accompanying drawing.

Referring to the drawing, *a* designates a box or can and *b* the parts of the object which are to remain soft.

The parts *c* to be hardened are coated with the hardening agent *d* according to my invention.

e designates the pure burned sand in which the object is packed after the application of the hardening mass.

f designates a rod which is introduced for determining the hardness.

When carrying my process into practice the box or can *a* is highly heated, preferably to a bright cherry red, about 850° C., when the applied hardening agent acts. It is preferable to allow the object to cool in the box after the termination of the hardening operation, then to remove it and to heat it afresh to a temperature of about 760° C., dark cherry-red, whereupon it is cooled in very cold water or oil.

If desired, the binder may be applied to only predetermined parts, that is to say the whole object need not be coated with the binder and hardening agent and the excess subsequently removed, but a demarcation can be made from the first. In a known process the hardening agent has also been mixed with a binder and applied in the form of dough to the places to be hardened. In this case, however, the heating took place either in a muffle or in chambers filled with

powdered charcoal. When such a mode of operation is adopted the objects which are not to be hardened are by no means protected from the hardening or from other
5 disturbing influences. On the contrary, this is only obtained by packing the objects provided with the hardening layer in pure, burned, silicious sand, as is the case in my above-described improved process. My improved process may also be carried into
10 practice as follows:—Instead of providing the parts to be hardened with a doughy hardening or cementation mass and working with a liquid binder, I may surround them with a portable mold, composed of a
15 hardening or cementation powder, which is adapted to the objects to be hardened and made by itself, and subsequently highly heat them according to the above-described process packed in pure, burned, silicious sand.

The cementation powder can be readily brought by pressure in suitable matrices, if desired by using a binder, into a rigid mold exactly adapted to the parts or places of the
25 metallic objects to be hardened. The objects can then be fitted into this mold or the places or parts to be hardened are surrounded with molds adapted to them. Those places of the objects which are not to be
30 hardened are left free. After inserting the objects into the mold or after adapting the mold to the places to be hardened the objects are highly heated, as described above, packed in pure burned silicious sand.

The molds composed of the described 35 pressed cementation-powder mass may be fitted as desired to the objects, and may have for example the form of a cylinder, tube, disk, plate or angle.

The use of cementation or hardening 40 masses composed of pressed carboniferous material is known in itself, but no entirely satisfactory result can be obtained with these pressed cementation masses alone. Only by
45 packing the objects provided with the molds composed of the pressed cementation mass in pure burned sand is it possible exactly to demarcate the places or parts of the metallic objects which are to be hardened and to remain soft, and simultaneously to ob- 50
tain a certain protection of the places which are to remain soft.

I claim:—

The hereindescribed process of hardening steel bodies poor in carbon at predetermined 55 places only, which consists in packing the steel body provided at one or more predetermined places to be hardened with a hardening mass in pure burned silicious sand, and in subsequently highly heating the 60 packed steel body.

In testimony whereof, I affix my signature in the presence of two witnesses.

CARL BURIAN.

Witnesses:

HENRY HASPER,
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