F. E. Session,

Carbonizing Iron & Steel.

No. 75,986. Patented Mar. 24. 1868.

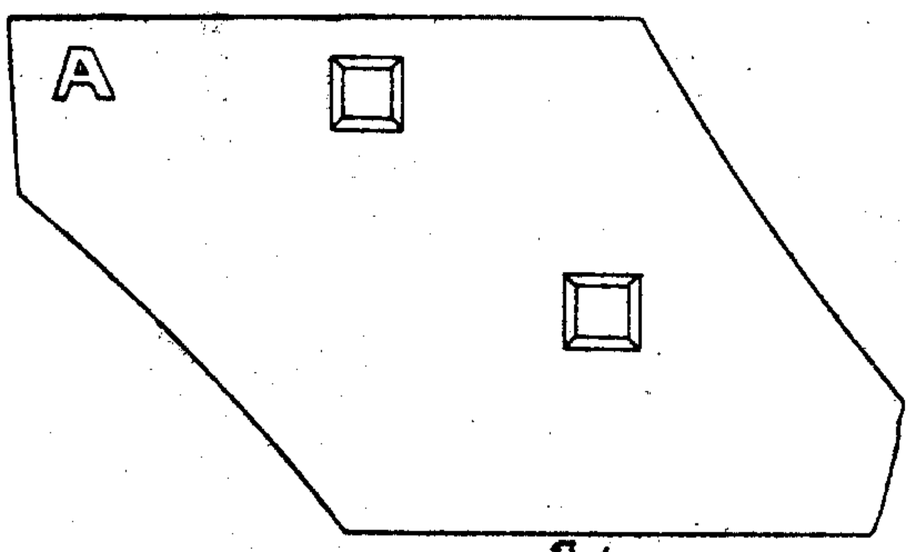

Fig. 1

Fig. 2

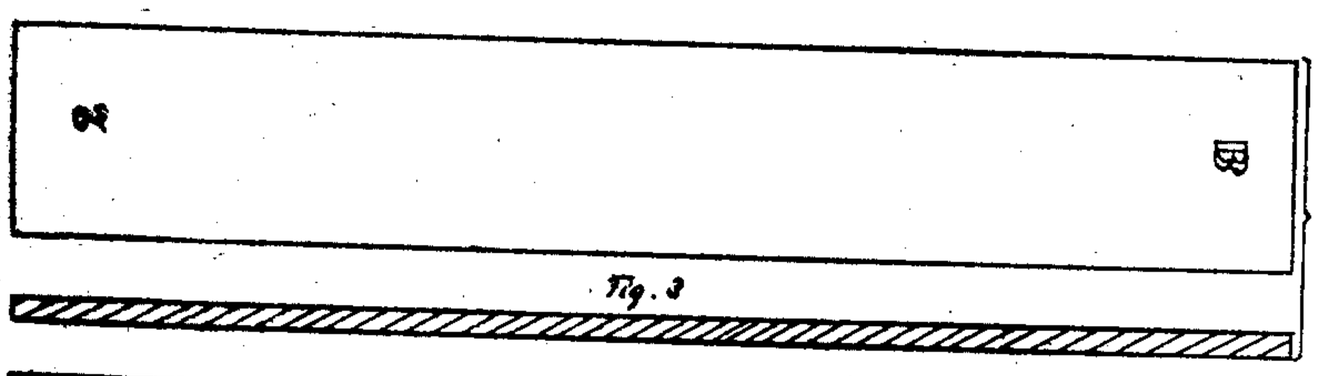

Fig. 3

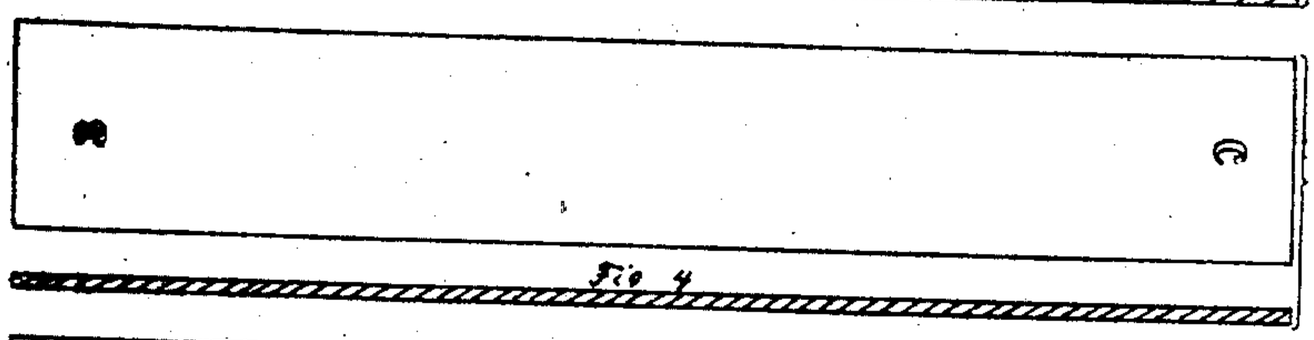

Fig. 4

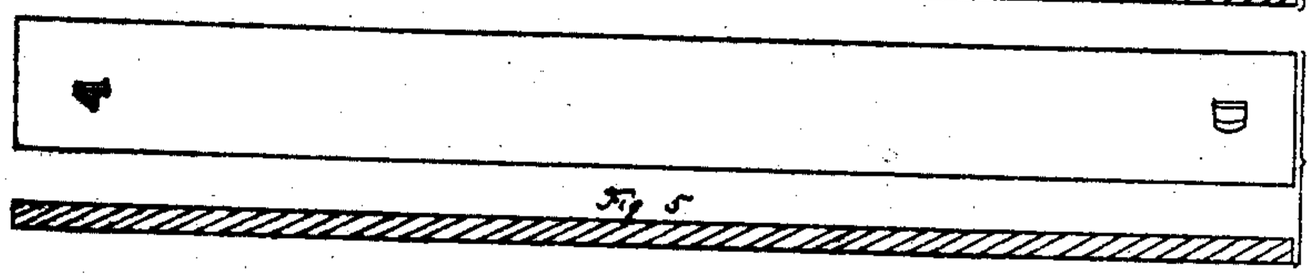

Fig. 5

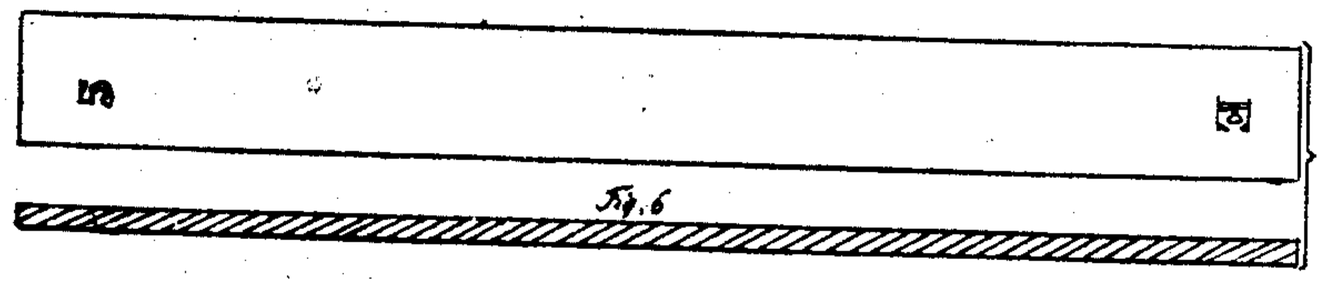

Fig. 6

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Letters Patent No. 75,986, *dated March* 24, 1868.

IMPROVEMENT IN CARBONIZING AND HARDENING IRON AND STEEL.

The Schedule referred to in these Letters Patent and making part of the same.

KNOW ALL MEN BY THESE PRESENTS:

That I, FRANCIS E. SESSIONS, of the city and county of Worcester, and Commonwealth of Massachusetts, have invented a certain new and useful Improvement in the Process or Mode of Carbonizing and Hardening Iron and Steel; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a steel mould board to a plough or cultivator, the point being shown broken off, and turned around to show the fracture, and indicate the depth to which the metal has been carbonized and hardened by my improved process.

Figure 2 represents a similar mould-board, without the point being broken off, and made in the ordinary way.

Figure 3 represents a side view of a bar of steel, marked B^2, and also a longitudinal section of the same.

Figure 4 represents a side view of a bar of steel, marked C^3, and also a longitudinal section of the same.

Figure 5 represents a side view of a bar of steel, marked D^4, and also a longitudinal section of the same; and

Figure 6 represents a side view of a bar of common iron, marked E^5, and also a longitudinal section of the same.

The sections are designed to illustrate by different shades of color, the extent to which the metal of the ends B, C, D, and E has been carbonized or hardened, as will be hereafter explained.

To enable those skilled in the art to which my invention belongs to make and use the same, I will proceed to describe it more in detail.

The piece of iron or steel, or the article made of iron or steel, to be carbonized or hardened, is first immersed in a bath of molten cast iron, and allowed to remain the desired length of time, after which it is removed and thrown into cold water. I have found that the melted cast iron, or bath of molten cast iron, works the best when heated to the degree required by founders for pouring good castings, and when thick or large pieces are to be carbonized or hardened, it may be well to raise the heat of the molten metal still higher.

In the drawings, the steel mould-board, marked A, fig. 1, after having been subjected to my process of carbonizing and hardening, above described, has a very hard surface or shell, indicated by the dark color in the section, while the interior or central part of the metal, indicated by the light color, remains tough and malleable, or nearly, if not quite, in the natural state in which it was when the mould was first struck or formed from the sheet of steel. The shell *a* of the mould is so hard as to resist effectually even the action of a good file. The steel bars, marked B^2 and C^3, after having their ends B C carbonized and hardened by my process, have similar shells, indicated by dark colors in the sections, while the central parts, indicated by the light colors, remain of the same or nearly the same toughness as the ends marked 2 and 3, which have not been subjected to the process. The same is true of the end, E, of the iron bar marked E^5, after it has been subjected to the process, while the bar marked D^4, which is made of a little higher grade of steel than the other bars, after being subjected to the same process, but allowed to remain in the molten bath a short time longer, has its end, D, carbonized and hardened entirely through, as indicated by the dark shading in the section in fig. 5.

The depth at which the metal will be carbonized and hardened will depend much upon the length of time it is allowed to remain in the molten bath of cast iron, and also somewhat upon the degree of heat to which the melted metal is raised, so that each operator can by a few trials obtain almost any desired depth of carbonization or hardness, whether operating upon iron or steel.

The bar or article, if instantly withdrawn from the molten bath, as soon as immersed, and plunged or thrown into cold water, will be carbonized or hardened to a slight depth, and which, in case of thin bars or articles made from thin sheets of iron or steel, may be all-sufficient.

It is unnecessary to recapitulate and enumerate the advantages of my invention, since all, and especially workers in metal, will readily appreciate the value and extent to which my invention may be applied successfully. Articles made from iron can be carbonized and hardened at a slight expense, so as to have a surface equal in resistance and hardness to the best tempered steel, while at the same time having an elasticity, owing to the malleability and toughness of the central parts, which prevents the breaking or cracking of the articles, so that in many cases articles made from iron, and then carbonized and hardened by my process, are

far superior, in a practical point of view, to similar articles made from the best cast steel by the common modes of manufacture. For instance, take moulds for ploughs and cultivators; if made of cast steel, they are liable to break, while they are expansive. By my process, similar moulds made from iron and low grades of steel can be carbonized and hardened so as to be quite as hard upon the wearing-surface as the best cast steel, while at the same time they can be bolted to the plough without danger of breaking or cracking, the central part being tough and malleable, so much so as to prevent the breaking of the article, even though deflected or sprung to a considerable extent.

The above-cited case serves to illustrate the great practical utility of my invention. Common iron, after having been carbonized and hardened by my said process, can be heated in a furnace, and then drawn or hammered into any desired form, then tempered by the common mode of tempering steel, so that the best file will not act upon its surface.

What I claim as new, and of my invention, and desire to secure by Letters Patent, is—

The process above described for carbonizing and hardening iron and steel.

FRANCIS E. SESSIONS.

Witnesses:

THOS. H. DODGE,

D. L. MILLER.