UNITED STATES PATENT OFFICE.

MARTIN A. HOWELL, JR., OF CHICAGO, ILLINOIS.

MANUFACTURE OF FILES.

SPECIFICATION forming part of Letters Patent No. 273,536, dated March 6, 1883.

Application filed January 25, 1883. (No model.)

To all whom it may concern:

Be it known that I, MARTIN A. HOWELL, Jr., a citizen of the United States, residing at Chicago, Cook county, Illinois, have invented new and useful Improvements in the Manufacture of Files, of which the following is a specification.

My invention relates to certain improvements in the manufacture of files from cast-iron blanks, in contradistinction from those files made from forged blanks, whether the latter be steel or wrought-iron subsequently converted into steel.

The object of my invention is to effect an improvement in the manufacture by casting the blanks, oxidizing the free carbon therein, and thereby restoring the cohesion of the metal, which is practically destroyed by the crystallization of the carbon, while the metal is yet soft and at a high heat; surfacing and cutting said blanks while in this decarbonized state; and, finally, in the saturation of the cut files with carbon in the absence of oxygen, whereby the metal is restored to its carburized condition, atmospheric air or any traces of oxygen being wholly excluded during the process of saturation and the subsequent cooling.

In the Letters Patent granted to me dated May 23, 1882, No. 258,301, I have described and claimed a process of decarburizing cast-iron blanks, surfacing and cutting the same while in this condition, and subsequently recarburizing the finished files or restoring the carbon, thereby preserving the original granular structure of the metal. By this process I avoid all forging, whereby the particles are crushed and the crystalline structure of the surface more or less destroyed. In practicing this process the generation of the vapors and gases of hydrocarbon begins at a point far in advance of the time when the required temperature of the enveloped metal is reached. As the heat increases, the rapid generation and expansion of these vapors force an outlet for escape, and by the time the metal is heated to the point of saturation the gases and vapors of hydrocarbon have become nearly wasted and intermingled with atmospheric air through leakage. Not only, therefore, is the process of saturation an imperfect one, but the presence of the oxygen of the intermingled air causes a partial oxidation of the surface of the file, thereby greatly injuring, if not ruining, it for the performance of its work. In order, therefore, to avoid this result and obtain a perfect saturation of the files, and the consequent reconversion of the metal to carburet of iron throughout the entire body of each file, I provide flasks or chargers capable of being hermetically sealed and of sufficient strength to withstand the required pressure. The cut files are placed in these flasks, interlaid with or surrounded by materials which are rich in hydrocarbon—such, for example, as animal or vegetable carbon, petroleum and its products, resins, &c. The flask or flasks thus charged are sealed and connected, by means of a pipe or escape-tube, with a vessel from which the air has been previously exhausted. This vessel is placed in any suitable receptacle containing water and weighted to keep it submerged. The shape and construction of this vessel is wholly immaterial, so long as it answers the purpose of holding the gas which flows into it from the flasks. The pipe connecting the flasks with this vessel is furnished with a cock, for a purpose presently to be mentioned. As the heat of the furnace advances, the vapors are generated, as already mentioned, long in advance of the temperature which is necessary to saturate the metal. The flasks containing the files also necessarily contain atmospheric air, and this air being mingled with the first vapors generated, the moisture is allowed to flow off through any suitable escape until the current is free from traces of oxygen. The outlet is then closed, and the cock in the escape-pipe is opened and the vapors allowed to flow into the exhausted vessel or gas-holder, where they are stored up for use at such time as the advancing heat shall have raised the files to the point of saturation, when the presence of said vapors will be required under heavy pressure to the end of the operation. By this means the vapors which under the former methods of carburization were dissipated and lost are stored up and retained for use, and all danger of an imperfect or partial saturation is avoided, as well as the further danger of injuring the metal by the oxidation of its surface through the presence of air. When the process is com-

plete and the files become saturated, the cock in the escape-pipe is closed and the flask is taken from the muffle or furnace and placed in a pit, where it is covered with dry sand, lime, clay, or any suitable material which will preserve the heated flask from oxidation. Here it is allowed to cool down gradually, after which the contents are removed. The files being now charged with pure carbon, and no oxide being present, they will withstand a much higher heat in hardening than ordinary steel, or any partially-oxidized metal. Therefore they are hardened in the usual manner without risk of oxidation, the result being the production of a tool showing all the characteristics of true carbon. These files resist the abrasion of all ordinary metals to a degree unsurpassed by any known product of steel.

It will be noticed that some of the steps of my process are old. For example, the decarbonization of iron and its subsequent recarbonization has been long known, and to this I lay no claim. The essential feature of the process of manufacture I employ is in the exclusion of oxygen in the stage of recarburization and the storing of the hydrocarbon vapors under pressure until the point of saturation is reached.

The files produced by this process are cast-iron. This is evidenced by the facts that the blanks are cast, (in contradistinction to being forged,) whereby the granular structure of the metal is left unaltered.

By the process hereinbefore described the graphitic carbon of the file-blanks (viz., the carbon crystallized between the particles of metal) is removed in order that the cohesion of the metal may be restored by running the blanks to a high heat. The entire decarburizing process is necessary to soften the blanks preparatory to cutting, to restore the cohesion of the metal and give a greater body for the subsequent saturation with combined carbon. The metal treated in this manner possesses many of the well-known characteristics of white cast-iron.

It should be noted that one of the essential features of this invention consists in the removability of the flasks from the muffle and their gradual cooling while sealed to prevent the admission of air, the blanks not being removed until they are cold, up to which time they are surrounded by the vapors of hydrocarbon. The importance of this step should not be overlooked, as the presence of small traces of oxygen, even when the metal is at a low red heat, would result in oxidation. When the flask is drawn it is immediately replaced by another, so that the cooling, charging, heating, &c., may go on without delay.

In the present application I have described only the process of manufacture, the article produced thereby being claimed in an application filed by me the 10th day of November, 1882.

It will be noticed that the files are first cut and then carburized. They can be first carburized and then cut, which, in some cases, may be more advantageous, but preferably I employ the former operation.

Having thus described my invention, what I claim is—

In the manufacture of files, the decarburization, surfacing, and cutting of the cast blanks, and their recarburization in a hermetically-closed flask from which all atmospheric air and traces of oxygen are suffered to escape, the flask being connected by a pipe with a vessel from which the air is exhausted, and in which the vapors of hydrocarbon are stored, under pressure, until the degree of temperature is reached at which saturation begins, the sealed flask being subsequently removed and allowed to cool before it is opened, whereby all danger of oxidation is avoided, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

MARTIN A. HOWELL, JR.

Witnesses:

THOMAS H. HOWELL,

JOHN W. HOWELL.