UNITED STATES PATENT OFFICE.

RICHARD BROWN, OF AYR, COUNTY OF AYR, SCOTLAND.

IMPROVEMENT IN THE MANUFACTURE OF CHROME-STEEL.

Specification forming part of Letters Patent No. **221,281**, dated November 4, 1879; application filed May 9, 1879.

To all whom it may concern:

Be it known that I, RICHARD BROWN, residing at Ayr, in the county of Ayr, Scotland, have invented certain Improvements in the Manufacture of Chrome-Steel, of which the following is a specification.

The object of my invention is to combine chromium with iron in a better and more satisfactory manner than has been hitherto accomplished, in order to obtain what are known as "chrome-steels," or steel-like metals of improved qualities

Chrome-steel may by my invention be made either of the hard or mild variety or of an intermediate quality by suitably proportioning the substance I employ for effecting the improvements. My invention has also the advantage that castings of the steel made by it are very solid and comparatively free from the blow-holes which give so much trouble with castings of steel made by the Bessemer or Siemens-Martin or other processes.

My invention consists in combining the chromium with the iron or steel by employing one or more of certain compounds of chromium, hereinafter specified, these compounds having the important practical advantage over what has been previously used of not only being a convenient, expeditious, certain, and effective means of introducing the chromium into the iron or steel, but also of eliminating impurities or injurious ingredients to a greater or less extent, and of neutralizing the injurious action of impurities or utilizing such ingredients as are not eliminated.

Analyses of so-called chrome-steel as made by processes hitherto used have shown that such processes have been extremely uncertain, and in many cases altogether ineffective in combining chromium with the iron or steel, whereas by my process there is no difficulty in effecting the desired combination.

The compounds to be used in carrying out my invention are bichromates of potash and soda and chromates of potash, soda, lime, and magnesia. Of these compounds I believe the bichromates to be the most advantageous, and I prefer to employ the bichromate of potash, especially when the metal operated on contains phosphorus.

In carrying out my said invention the iron or metal to be operated on, and which may, if found desirable, have been previously treated in any known way, may be contained in a converter, such as is used in the Bessemer process; or it may be contained in a reverberatory furnace, or in a crucible, or in any furnace or vessel in which it can be conveniently held in a molten state. The bichromate of potash or other compound or compounds may be added by being blown in, in powder, by a blast applied as in the Bessemer process; or it may be simply mixed into the molten metal. It should, however, in all cases be thoroughly intermixed, and the temperature should be such as to keep the metal sufficiently fluid for the mixing to be effectively performed. The powdered material may be introduced into the blast-pipe of the Bessemer converter by means of a small hopper communicating with the pipe by a descending passage fitted with two valves, the material being first admitted into the space between the valves, and, after closing the upper valve, allowed to descend gradually by opening the lower valve; or the material may be introduced into the metal from the mouth of the converter, the blast being stopped during the introduction, and afterward renewed for a few minutes, in order to effect a thorough mixture. When adding the material in a reverberatory furnace or crucible, or other vessel, it may be in powder or in small pieces put up in several paper bags or other wrappers, which will afford a slight protection while it is being introduced, and while introducing the material the slag must be pushed aside by means of an iron rod or other instrument. When the metal is in a crucible the cover must be kept more or less open for a short time after adding the material, in order to allow of the escape of gas, and the crucible should be kept in the furnace for about fifteen minutes after closing the cover.

The selection of bichromate of potash or other compound or compounds and the proportion thereof to be employed will vary in each case with the particular qualities of steel desired, and also with the kind and proportion of impurities present in the iron or metal operated on.

When the iron or metal to be operated on contains much carbon the excess of carbon

should be eliminated by means of the Bessemer or other suitable process before treating the metal according to my present invention. Taking, for example, cast-iron containing .75 per centum of phosphorus and a variable quantity of carbon, the proportion of carbon should be reduced to about .2 per centum, and about .75 per centum of bichromate of potash should then be mixed with the melted metal. This will yield a ductile steel. A larger proportion of bichromate of potash will give a harder steel. Only a portion of the phosphorus is, in practice, found to be removed; but when the proportion of carbon is small, or is reduced, as above directed, the phosphorus remaining in the metal no longer has injurious action, nor imparts undesirable qualities, but, on the contrary, improves the metal, particularly by rendering it capable of being cast in a very solid condition, and free, or nearly so, from cavities or blow-holes. With a larger proportion of phosphorus present in the metal than that given in the above example, the steel will be harder, other things remaining the same. When the proportion of phosphorus is less than that given in the example a larger proportion of carbon may be retained; and similar results may be obtained with a smaller proportion of bichromate of potash.

After the iron or metal has been treated as hereinbefore described, spiegeleisen or ferromanganese or peroxide of manganese may be added to it; but in many cases this will not be necessary.

I claim as my invention—

In the manufacture of chrome-steel, the method of facilitating the introduction of the chromium and of improving the quality of the steel produced—that is to say, by mixing with the molten bath chromates or bichromates, such as bichromate of potash or soda or chromate of potash, soda, lime, or magnesia, substantially in the manner described.

RICHARD BROWN.

Witnesses:
EDMUND HUNT,
LOCK MOORE.