UNITED STATES PATENT OFFICE.

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CORROSION-RESISTING FERROUS ALLOY.

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To all whom it may concern:

Be it known that I, SILAS McCLURE, a citizen of the United States, residing at Beaver Dam, in the county of Dodge, State of Wisconsin, have invented certain new and useful Improvements in Corrosion-Resisting Ferrous Alloys; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to ferrous alloys and articles made therefrom, and has for its object the provision of an improved corrosion-resisting ferrous alloy. More particularly, the object of the invention is the provision of an improved ferrous alloy which will better resist the corrosive action of the products of combustion of fuel, and which is hence peculiarly adapted for use in the manufacture of those parts of stoves, ranges, furnaces, and the like, subjected to the action of such products of combustion.

It appears to be definitely established that when copper in small amounts, from 0.15 to 0.25 per cent. is added to ordinary mild steel and iron, its resistance to the usual atmosphric corrosion is increased considerably. It also has been shown by investigators that under such conditions an increase of the copper content above that specified does not increase the resistance to corrosion. While such copper steels, low in copper, show high resistance to atmospheric corrosion, such data cannot be applied to the corrosion under different conditions such as is obtained in the interior surface of water pipes, in salt water, and where steel is subjected to the corrosive action of the products of combustion of fuels.

The products of combustion of fuels cause severe corrosion as is evidenced by the short life of the various parts of stoves, stove pipes, smoke stacks, and other constructions subjected to such action. This action is especially severe in domestic ranges in which the fire is not maintained continually. In such a range the parts in contact with the products of combustion are subjected to the destructive action of several corrosive agents. In addition to the carbon dioxid and moisture resulting from the combustion of the carbon in the fuel there are also present pyroligneous acid, tar and other distillation products from wood and coal, soot, ammonia and sulfur dioxid, and other products when fuels other than wood and coal are used. When the stove is allowed to cool moisture usually collects in the sooty deposits on the various surfaces that were hot enough to be dry during the time the fire was maintained. On or near the sea coast this moisture is usually salt-laden and is highly corrosive. When this moisture condenses in the soot, a condition results that corrodes iron or steel rapidly.

I have not only found that copper steel containing from 0.20% to 0.25% of copper also resists the corrosive action of the products of combustion of fuel much better than the ordinary steels and iron substantially free from copper, but have in addition discovered that the resistance to corrosion of such ferrous alloys is materially improved and increased when the copper content is in excess of 0.50%. I have further found that as the copper content of such an alloy is increased beyond 0.50%, its corrosion-resisting properties become better, or in other words, the corrosion losses decrease as the copper percentage increases. However, due to the difficulties of working ferrous alloys containing a high percentage of copper, and in cast metals to the difficulty in securing an even distribution of the copper in the iron or steel, the copper content cannot be indefinitely increased, and in the practice of the invention, I prefer to employ a copper content not much in excess of 1.0%. It will therefore be understood that the upper limit of the copper content is determined by the ability to secure an even distribution of the copper in the ferrous alloy, or by the ability to mechanically work the resulting ferrous alloy, as, for example, the ability of the mills to roll the alloy into sheets.

In carrying out the invention the copper may be added to the ingot during casting or may be added to the molten iron or steel before casting, at any suitable stage and in any suitable manner. I have successfully rolled into sheets mild steel ingots containing about 1.12% of copper, and have found such copper steel sheets to be remarkably resistant to the corrosive action of the products of combustion of fuel. As an example of the beneficial effects in this connection resulting from the addition of approximately 1.0% of copper to mild or soft steels, I call attention to the following table which gives the analysis of certain copper steel

sheets together with the average losses in grams of equal areas of surface when exposed to the action of the products of combustion of burning fuel:

Copper-steel sheet.	Carb.	Mang.	Sul.	Phos.	Copper.	Average loss.
1	.02	.05	.030	.008	.06	37.98
2	.05	.05	.036	.004	.07	39.52
3	.12	.42	.041	.063	.24	26.10
4	.10	.47	.043	.018	.572	20.75
5	.11	.45	.032	.010	.950	14.41
6	.12	.46	.047	.014	1.118	13.56

The present invention particularly contemplates the use of copper steel containing in excess of 0.50% of copper in the manufacture of articles which are subjected to the action of the products of combustion of fuel. In this connection, the invention is of particular value in the manufacture of articles made of sheet material, such as smoke stacks, stove flues and the like. Such articles when made of steel containing copper in the proportions contemplated by the present invention are much more resistant to the corrosive action of the products of combustion of burning fuel than if made of ordinary steel or iron substantially free from copper, or containing less than about 0.25% of copper.

I claim:

1. An article of manufacture in the form of sheet metal which is subjected to the action of the products of combustion of fuel made of a ferrous alloy consisting principally of iron and containing copper in excess of 0.50 of one per cent. but not in excess of such amount as will prevent rolling of the ferrous alloy into sheets.

2. An articles of manufacture which is subjected to the action of the products of combustion of fuel and made from an alloy consisting principally of iron and containing copper in excess of 0.50 of one per cent. and capable of being mechanically worked.

3. Articles of manufacture consisting of parts of stoves that are subjected to the action of the products of combustion of fuel and which are made from an alloy consisting principally of iron and containing copper in excess of 0.50 of one per cent. but not in excess of such amount as will preclude a substantially even distribution of the copper in the alloy.

4. An article of manufacture designed to be subjected to the products of combustion of burning fuel and made of a corrosion-resisting alloy consisting principally of iron and containing approximately 1.0 per cent. of copper.

5. An article of manufacture which is subjected to the action of the products of combustion of fuel and made from an alloy consisting principally of iron and containing copper in excess of 0.50 of one per cent. but not in excess of such amount as will preclude a substantially even distribution of the copper in the alloy.

In testimony whereof I affix my signature.

SILAS McCLURE