# UNITED STATES PATENT OFFICE.

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## ALLOY STEEL.

1,401,925. Specification of Letters Patent. Patented Dec. 27, 1921.

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*To all whom it may concern:*

Be it known that we, GEORGE W. SARGENT, a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, and JOSEPH W. WEITZENKORN, a resident of Washington, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Alloy Steel, of which the following is a specification.

The invention relates to alloy steels and has particularly to do with so-called "silico-manganese" steels used extensively for springs, gears, and similar articles, although the invention is not limited to steels for any specific purpose, or to articles made of any particular steel.

In silico-manganese steels, silicon is generally considered to make the steels tough so that they are less liable to break particularly when subject to shock, and manganese is considered to give the steels increased tensile strength. It is well known that these steels are very sensitive to heat treatment, and that unless carefully manufactured and heat treated they become brittle and hence unsuitable for their intended purposes. This is particularly true with respect to drawing temperatures, it having been found that unless such steels are drawn or quenched within a narrow range of temperature the desired physical properties are not attained. It is also well known that the manufacture of silico-manganese steels, particularly in the open hearth, requires careful attention because of the tendency to piping and segregation which results in the requirement that a large discard be made in cropping the ingots.

The object of the invention is to provide an alloy steel containing silicon and manganese in the proportions usually used in what are commercially known as silico-manganese steel, and which has increased tensile strength and ductility, and is much less sensitive to heating and heat treatment in its course of manufacture than are the usual silico-manganese steels.

The steel alloy which we provide contains carbon from about .40% to .65%, manganese from about .50% to .80%, silicon from about 1.50% to 2.10%, and molybdenum from a fraction of 1% to not more than about 1.25%. The remainder of the alloy is iron with the exception of impurities, such as sulfur and phosphorus, which are usually found in steels. While the invention contemplates alloy steels of the range of analysis just stated, the preferred steel contains about .45% carbon, .65% manganese, 1.75% silicon and from about .30% to 1% of molybdenum.

We have found that the addition to silico-manganese steel of molybdenum in the proportions stated not only intensifies the physical properties of the steel, but also results in a steel having a wide range of hardening or quenching temperatures. With respect to the latter, the physical property curves of the present steel are of the same character as those shown in the Weitzenkorn Patent #1,287,153, in which the flattened curves clearly illustrate the uniform physical properties of the steel when drawn within a wide range of temperatures. The steel is also much less sensitive than silico-manganese steels to heating and heat treating other than drawing.

It has also been found that not only does the molybdenum itself become evenly distributed throughout the steel, but also that the molybdenum has the effect of similarly distributing the silicon and manganese, with the result that the piping and segregations are largely eliminated.

We claim:

1. An alloy steel consisting of from about .40% to .65% carbon, .50% to .80% manganese, 1.50% to 2.10% silicon, a fraction of 1% to not more than about 1.25% molybdenum, and remainder iron except for impurities.

2. An alloy steel consisting of about .45% carbon, .65% manganese, 1.75% silicon, from about .30% to 1% molybdenum, and the remainder iron except for impurities.

In testimony whereof, we have hereunto set our hands.

GEORGE W. SARGENT.
JOSEPH W. WEITZENKORN.

Witnesses:
MARX HERSCH,
WM. H. WEIS.