

# UNITED STATES PATENT OFFICE

2,381,674

## PROCESS OF PRODUCING TUNGSTEN CONTAINING FERROUS ALLOYS

Arthur Linz, New York, N. Y., assignor to Climax  
Molybdenum Company, New York, N. Y., a cor-  
poration of Delaware

No Drawing. Application July 8, 1941,  
Serial No. 401,468

3 Claims. (Cl. 75—133)

The present invention relates to a novel and improved process in producing tungsten containing ferrous alloys.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the processes, steps and combinations pointed out in the appended claims.

The invention consists in the novel steps, processes, combinations and improvements herein shown and described.

The present invention has for its object the provision of a novel and improved process for the rapid, efficient production of tungsten containing ferrous alloys. A further object is the provision of an improved process of adding tungsten to ferrous metals which does not result in the evolution of a large amount of gas, which does not introduce slag into the alloy and may serve for the introduction of relatively large amounts of tungsten such as are now generally accomplished with the more expensive ferro-tungsten.

In accordance with the present invention, I produce tungsten containing ferrous alloys by adding to the molten or melting iron or steel, a suboxide of tungsten having a composition corresponding in general to tungsten monoxide. The addition may be made to the furnace charge or may be made directly to the ladle just prior to pouring, and the process is advantageous inasmuch as it gives not only a high yield but also reduces greatly the time required for the solution of the tungsten in the ferrous metal and results in a greater homogeneity of the finished alloy. Furthermore, the process does not have the disadvantage of producing a large amount of gas, does not increase the slag, has a high specific gravity, and provides a rich, relatively simple and inexpensive source of tungsten.

Referring now in detail to the present preferred manner of carrying out the process of the present invention, I preferably form a monoxide or suboxide of tungsten which corresponds generally to the formula  $WO$  and is produced by reducing tungstic oxide with enough carbon so that it contains approximately 8% oxygen and probably comprises a mixture of tungsten, tungsten monoxide, tungsten dioxide, the tungsten monoxide greatly predominating. This crude tungsten monoxide is then preferably formed into pellets, although the granular or powdered material may be packaged in cardboard or paper containers, each containing a definite quantity of tungsten.

This crude tungsten monoxide in the desired form, is added directly to the furnace charge, in the correct quantity to produce the desired al-

loy, or the additions may be made directly to the ladle a few minutes before the metal is to be poured.

The tungsten monoxide reacts with the molten or melting iron and is reduced to metallic tungsten which is immediately dissolved in the iron or steel. Thereafter, the other desired additions, such as manganese, silicon, etc., are added in the desired manner and quantities, dependent upon the specification of the alloy to be produced.

Due to the relatively great specific gravity of the tungsten monoxide, large percentage additions of tungsten may be made as the briquettes, pellets or containers of tungsten monoxide are rapidly reduced while sinking through the molten steel, and the evolution of gas is not so rapid or violent that it prevents this sinking nor is it so rapid that it interferes with proper control of the heating of the molten alloy. The rate of solution of the tungsten monoxide is much more rapid than for Scheelite and is almost the same as for ferro-tungsten.

The tungsten monoxide is superior to ferro-tungsten in that relatively large additions of it may be used without cooling the molten metal and the monoxide can be produced so much more simply and economically.

The invention in its broader aspects is not limited to the specific process and steps shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. A process for the production of tungsten containing ferrous alloys which comprises adding tungsten substantially entirely in the form of tungsten monoxide to the ferrous metal, reducing the monoxide and absorbing the tungsten in the ferrous metal.

2. A process for the production of tungsten containing ferrous alloys which comprises adding tungsten substantially entirely in the form of a crude tungsten compound corresponding approximately to the composition of tungsten monoxide to molten ferrous metal to reduce the compound and absorb the tungsten in the ferrous metal.

3. A process for the production of tungsten containing ferrous alloys which comprises adding tungsten substantially entirely in the form of tungsten monoxide to the molten ferrous metal, reducing the monoxide by reaction with the molten ferrous metal and absorbing the tungsten in the ferrous metal.

ARTHUR LINZ.