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P. KEMERY.

PROCESS OF ALLOYING TUNGSTEN, MOLYBDENUM, &c., WITH IRON AND STEEL.

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FIG. 1

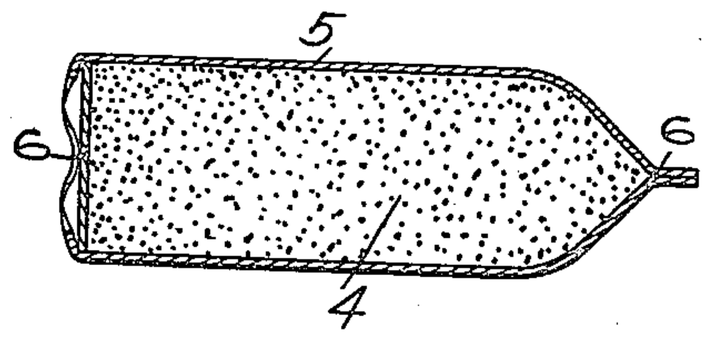
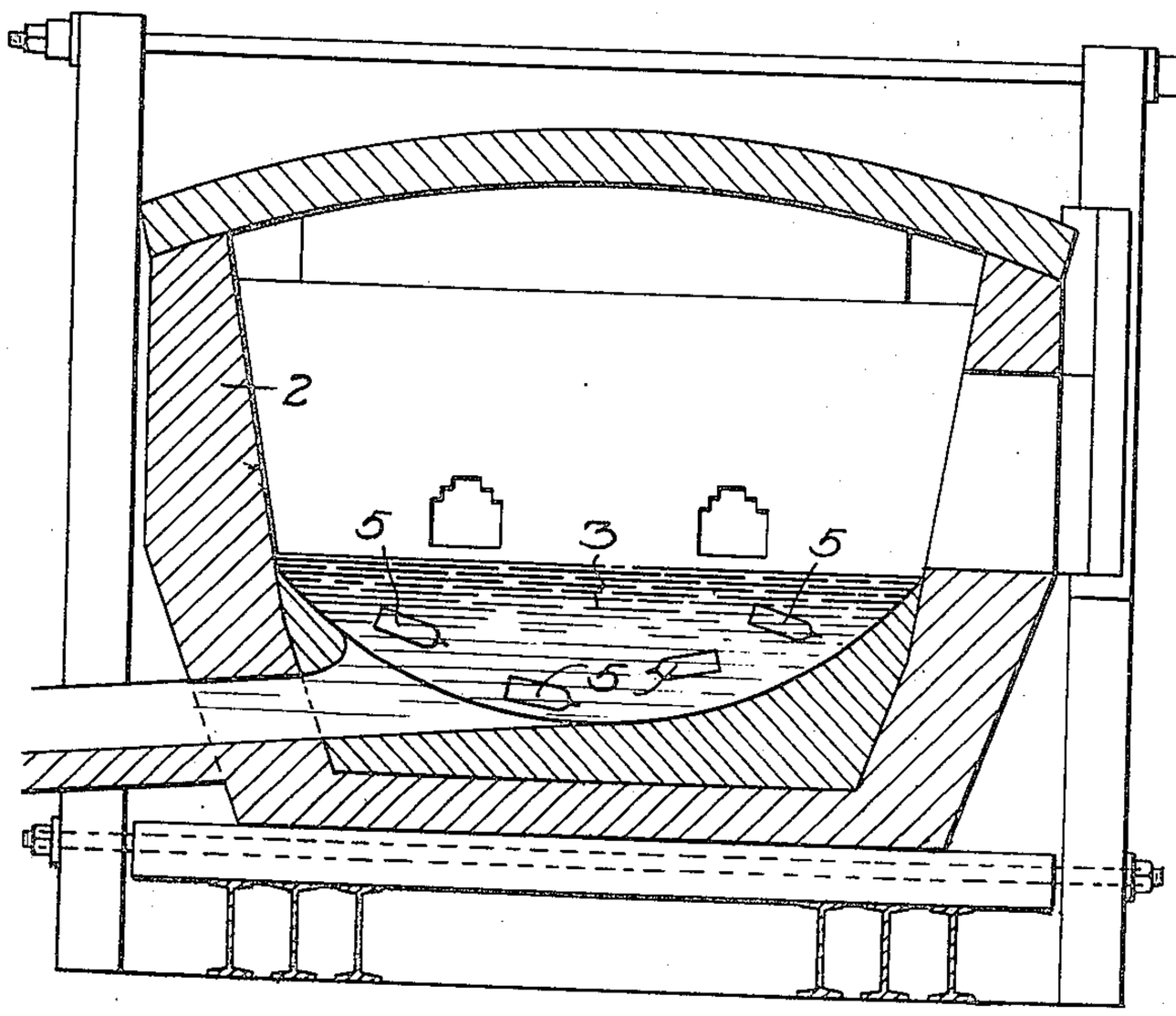


FIG. 2



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PROCESS OF ALLOYING TUNGSTEN, MOLYBDENUM, &c., WITH IRON AND STEEL.

No. 887,648. Specification of Letters Patent. Patented May 12, 1908.

Application filed March 28, 1907. Serial No. 364,970.

To all whom it may concern:

Be it known that I, PHILO KEMERY, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Processes of Alloying Tungsten, Molybdenum, &c., with Iron and Steel; and I do hereby declare the following to be a full, clear, and exact description thereof.

This invention relates to a process of making alloys of iron and steel with tungsten, molybdenum, vanadium or similar comparatively rare metals.

The object of the invention is to provide a process whereby such alloys can be formed without danger of loss of the rare metal or metals and so as to insure uniformity in successive heats or castings.

In the process of manufacturing tungsten steel, as carried out in open hearth furnaces, two methods are followed. In one, the tungsten in the form of a powder is thrown into the furnace on top of the molten bath contained therein. The intense heat in the furnace oxidizes a portion of the powdered metal before it strikes the bath, and since the bath is covered with slag which is less liquid than the molten metal, a considerably further portion of the powdered tungsten lodges in the slag and does not reach the metal at all. In actual practice it is never possible to determine what percentage of tungsten will remain in the bath after being cast and frequently entire heats are lost because of an excessive loss of tungsten in the slag and by oxidation. Inasmuch as tungsten is quite rare and very expensive, this is a severe loss. In the other method the tungsten is supplied in the form of ferro-tungsten which is added to the heat at the proper time. The objections to this method are first, that the ferro-tungsten contains a considerable quantity of carbon which is likely to disturb the carbon contents of the heat, making it difficult to get an alloy with just the right quantity of carbon, and second, that since the ferro-tungsten contains only a percentage of tungsten it is necessary to add such a quantity of the ferro-tungsten that the temperature of the furnace is materially reduced, making it necessary to again bring up the temperature for casting, which not only consumes time but also results in oxidizing a portion of the tungsten so that it is never certain just what percentage of tungsten remains in the heat or casting.

The object of this invention is to provide a method whereby the loss of the tungsten, or other easy oxidizable metal, is largely overcome and also whereby it is possible to determine with reasonable certainty the percentage of tungsten or other metal in the alloy. This is accomplished by introducing the tungsten or other metal into the body of the bath instead of throwing the same on the surface, preferably by inclosing the tungsten in a fusible envelop, such as a thin metal tube which can be thrown into the furnace and sinks to the bottom of the bath.

The invention applies not only to the method of making tungsten steel but also to the formation of alloys of iron and steel with metals of the same general characteristics, such as molybdenum, chromium, uranium, and vanadium, either singly or in combination.

In the accompanying drawings Figure 1 is a sectional view showing the manner of preparing the rare metal for introduction into the furnace, and Fig. 2 is a section through an open hearth furnace illustrating the manner of introducing the prepared rare metal thereinto.

In carrying out my process the iron or steel to be alloyed is melted in any desired furnace, such as an open hearth furnace 2, shown in Fig. 2, in which the bath is indicated by the reference numeral 3. The burden is made up in the usual way and is melted in the furnace and refined until nearly ready for casting. Preferably the bath is raised to a temperature somewhat in excess of the proper temperature for tapping and casting.

The rare metal or metals 4 to be added to the iron or steel are used in the form containing the least foreign elements, such as commercial tungsten powder, and is or are inclosed in a suitable envelop, such as the thin iron or steel tube 5, having its ends closed in any suitable way, as shown at 6, so as to retain the rare metal therein. One or more, preferably a number, of tubes thus prepared, are thrown into the furnace when the bath reaches the proper temperature. These tubes at once sink to the bottom of the bath and rapidly fuse or melt, thus liberating the rare metal or metals contained therein and therefore securing the addition of such metals directly in the body of the bath. The introduction of the cold tubes and rare metals lowers the temperature of the bath only slightly and it is to offset such slight lowering of the temperature that the bath is first

preferably raised to a temperature slightly above that necessary for tapping and casting, it being the object to permit the cold tubes and metal to bring the bath down to the proper tapping and casting temperature.

The batch or heat is tapped from the furnace as soon after the introduction of the rare metal as possible, a sufficient interval being allowed to insure the fusing of the tubes and of the rare metal contained therein. Consequently, there is practically no opportunity for oxidizing the rare metal and the result is that practically all of such rare metal or metals remain in the batch when cast. This is an important step over the old methods wherein the rare metal was either thrown on top of the bath, much of it immediately lodging in the slag, other portions immediately oxidizing, and a considerable further portion oxidizing in the metal itself, or where it was introduced with a large percentage of another element, such as in ferrotungsten, in which case there is considerable oxidization in the bath, due to the fact that the introduction of the rare metal with such a large mass of other elements lowered the temperature of the bath so that considerable time was required to again bring it to the proper temperature.

The alloy resulting from my method contains a maximum percentage of the rare metal in proportion to the quantity introduced. There is practically no danger of losing a heat or casting and it is also possible to have successive heats or castings practically uniform.

In my method the tungsten or other rare metal or combination of rare metals are employed in the metallic state and not as oxids or salts of the metal, and are used alone, that is, without the presence of the carbon or other ingredient other than the rare metal or metals.

What I claim is:

1. The process of alloying tungsten, molybdenum, vanadium, or similar metals with iron or steel, consisting in forming in a suitable furnace a molten bath of iron or steel, inclosing a rare metal in powdered form in a fusible envelop, introducing the same directly into the body of the bath while still contained in the furnace in which it is formed, and as soon as the rare metal has melted casting the bath.

2. The process of alloying tungsten, molybdenum, vanadium, or similar metals with iron or steel, consisting in forming in a suitable furnace a molten bath of iron or steel, refining the same, inclosing the rare metal in powdered form in a fusible envelop, introducing the same directly into the body of the refined bath while still contained in the furnace in which it is formed, and as soon as the rare metal has melted casting the bath.

3. The process of alloying tungsten, molybdenum, vanadium, or similar metals with iron or steel, consisting in forming in a suitable furnace a molten bath of iron or steel, and raising the temperature thereof slightly above that necessary for casting, inclosing the rare metal in powdered form in a fusible envelop, introducing the same directly into the body of the bath while still contained in the furnace in which it is formed, and casting the bath as soon as the rare metal has melted.

In testimony whereof, I the said PHILO KEMERY have hereunto set my hand.

PHILO KEMERY

Witnesses:
WM. A. SIPE, Jr.,
F. W. WINTER.