June 5, 1962
N. B. ORNITZ
3,037,756

COMPOSITE CARBONACEOUS MEMBER FOR FURNACE CONVEYOR UNITS OR THE LIKE

Filed Sept. 22, 1959
2 Sheets-Sheet 1

Fig.1.

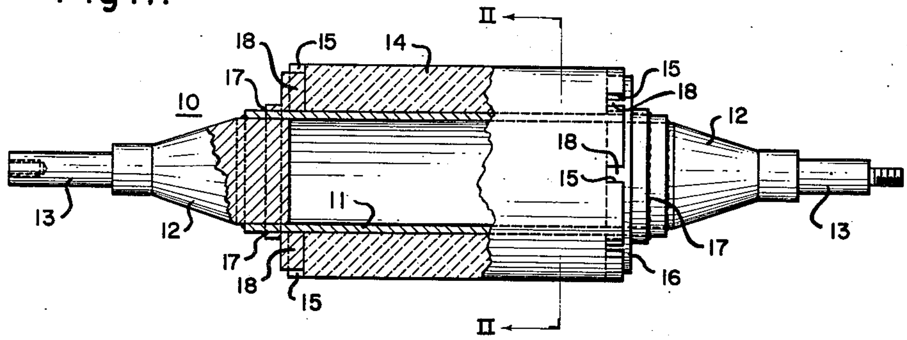


Fig.3.

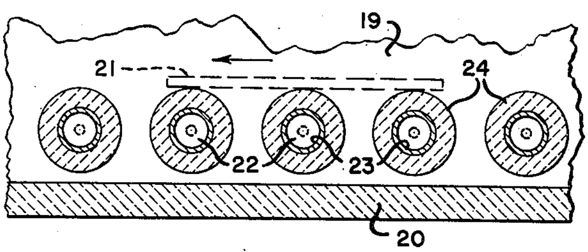


Fig.2.

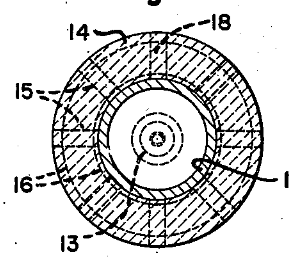


Fig.4.

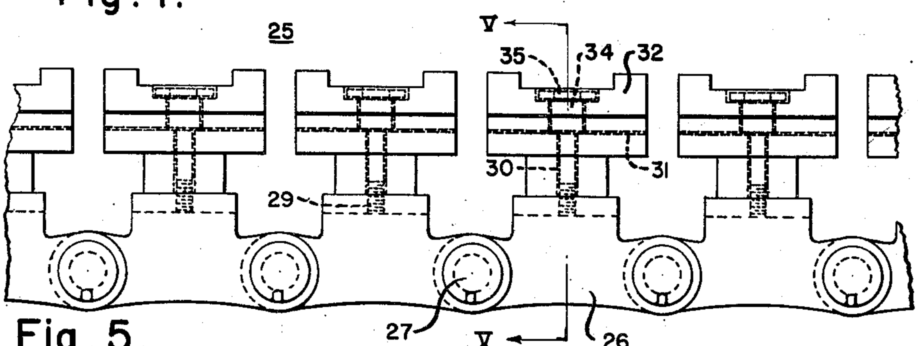
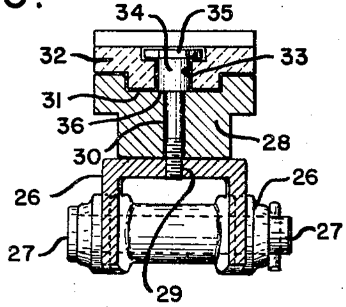


Fig.5.



INVENTOR.
Nathaniel B. Ornitz
BY Hooper, Leonard & Buell
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2 Sheets-Sheet 2

Fig. 7.

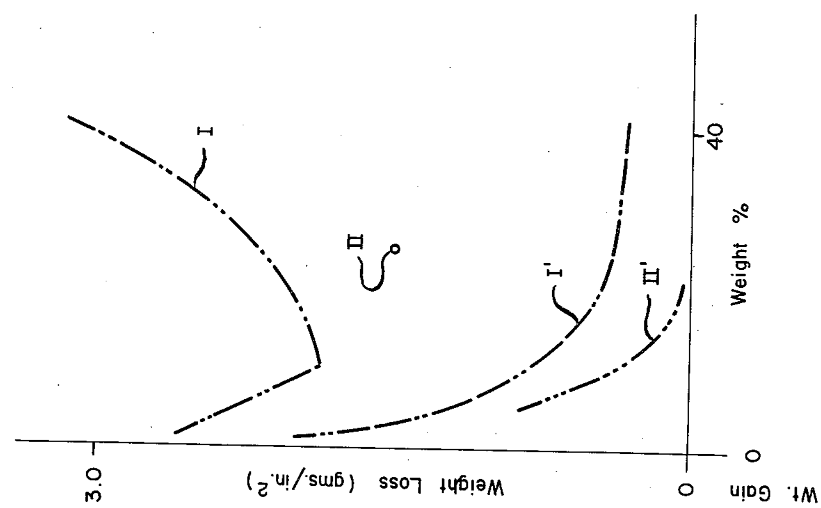
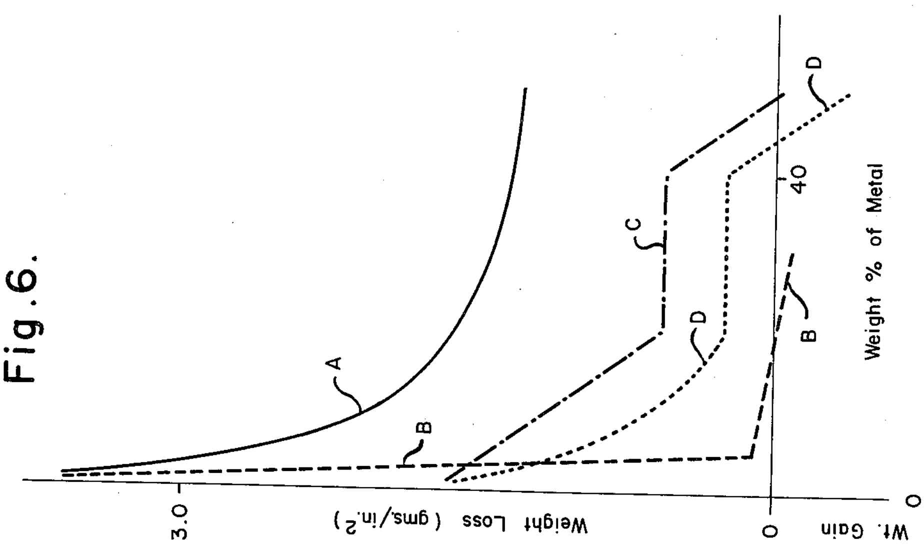


Fig. 6.



INVENTOR

Nathaniel B. Ornitz

By Hooper, Leonard & Buell

his attorneys

United States Patent Office

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COMPOSITE CARBONACEOUS MEMBER FOR FURNACE CONVEYOR UNITS OR THE LIKE

Nathaniel B. Ornitz, Golden Beach, Fla., assignor to Blaw-Knox Company, Pittsburgh, Pa., a corporation of Delaware

Filed Sept. 22, 1959, Ser. No. 841,927
30 Claims. (Cl. 263—6)

This invention relates to a composite carbonaceous member for surfacing furnace conveyor units or the like. More particularly, this invention pertains to a composite carbon-and-metal member to supportably engage metal work in strip, sheet and/or plate form at elevated temperatures and in varying furnace atmospheres while inhibiting development of the so-called "pickup" phenomenon, undue wear and untimely breakdown of such surfacing member. This application is in part a continuation of my abandoned application Serial No. 571,474, filed March 14, 1956.

The phenomenon of so-called "pickup," which has occurred in some heat-treating furnaces in connection with certain metal work, has been known for some time and much effort and expense have been incurred to try to prevent its occurrence which has been particularly severe at relatively elevated temperatures (usually above 1600° F.) in the heat treating of ferrous sheets and strip such as silicon steels and stainless steels. The pickup phenomenon has also caused difficulty in the heat treating of non-ferrous metals such as brass, copper and Monel metal.

Different kinds of work-engaging surfaces for furnace conveyor units have been suggested for inhibiting such "pickup." In the case of the heat treatment of silicon steel, furnace rolls are being successfully used for that purpose with work-supporting portions of carbon in the presence of substantially non-oxidizing or inert controlled atmospheres in the furnace as shown in my Patent Nos. 2,603,578 and 2,772,872. However, particularly when a furnace atmosphere is strongly reactive with respect to carbon (as, for example, when the dew point of such atmosphere is high), it has been discovered that such carbon tends to react to form a gas with corresponding disappearance of solid phase carbon, undue wear and untimely breakdown of the roll surface in some cases. That in turn limits the trouble-free period of operation in the furnace and increases maintenance expense and replacement cost.

In my present invention, I have been able to overcome the problem of undue wear and shortened life in furnace rolls or other furnace conveyor units and the like having a surface inhibiting "pick-up" on the work or the surface, even though the furnace atmosphere may be reactive with carbon. Other objects and advantages will be apparent from the following description and from the accompanying drawings, which are illustrative only, in which

FIGURE 1 is a view of a furnace roll, partly in section through the axis of said roll, embodying my invention;

FIGURE 2 is a section of said roll taken along the line II—II of FIGURE 1;

FIGURE 3 is a partial and sectional view of a roller hearth in a furnace in which such rollers are provided with composite carbonaceous work-engaging members made in accordance with my invention;

FIGURE 4 is a view of another kind of furnace conveyor unit assembly provided with preshaped composite carbonaceous members made in accordance with my invention;

FIGURE 5 is a view taken along line V—V of FIGURE 4;

FIGURE 6 is an illustrative chart showing reaction resistance advantages of anti-pickup carbon-and-metal work-engaging compositions of this invention; and

FIGURE 7 is a chart illustrating advantages which may be secured by addition of boric oxide as an addition ingredient.

Referring to FIGURES 1 and 2 of the drawings, there is shown a furnace conveyor unit **10** in the shape of a furnace roll having a body **11**, laterally outwardly tapered necked portions **12** and journals **13** for mounting in any appropriate manner. Roll **10** is provided with a surfacing member **14** made in accordance with my invention. In the embodiment so illustrated, member **14** is in the form of a cylindrical sleeve having indentation recesses **15** around the edge of each end thereof. After member **14** is axially moved into position during the assembling of roll **10** to surround supporting bdoy **11**, retainer rings **16** may be moved into engagement with the respective ends of sleeve **14** to secure it in place in roll **10**, and a welding bead **17** being employable to lock the retainer rings **16** in place. If desired, one or both of such retainer rings **16** may instead be fastened to body **11** by bolding or other means. Temperature resistant alloys are used preferably on exposed parts since a roll such as roll **10** may be employed in a furnace in which metal work passing therethrough is raised to a temperature as high in some cases as about 2000° F.

The retainer rings **16** may be provided with axially extending lugs **18** in spaced circumferential relation to each other, such spacing being such that the lugs **18** fit into the recesses **15** so that there is no relative movement in operation between surfacing member **14** and the remainder of furnace conveyor unit **10**. It will be recognized that in some installations, other holding means may be employed if some relative rotational movement between the surfacing member and the remainder of the unit is to be permitted and, further, that in other installations, no need will arise or be desired for any positive keying relation between a surfacing member and the remainder of the unit. In some cases also, the interior of the body **11** may be cooled by a fluid introduced through axial passages in one or both ends of the unit.

One employment of furnace conveyor units like rolls **10** may be found in a roller hearth furnace **19**, the interior furnace space of which would generally be surrounded by a refractory **20** while metal work **21** being treated in furnace **19** might progress through the furnace in the direction shown by the arrow while being supported on rollers **22** having a body **23** and a new surfacing member **24** of my invention. The rollers **22** may be idle or driven as desired, depending upon the means used to cause movement of the metal work **21** through the furnace. An even more likely present-day use of such furnace roll compositions of this invention will be in continuous heat-treating tower furnaces for the processing of metal in strip or strand form at high temperatures.

The instant invention is particularly applicable to inhibiting the development of pick-up when the metal work **21** is of a ferrous metal composition such as silicon strip or stainless steel but the invention is not confined to such ferrous compositions and may also be applied to non-ferrous metals. My invention further is resistant to untimely loss of weight of carbon in solid phase, and to change in shape or diameter of the work-supporting members like members **14** and **24** therefor. Thereby the respective units **10** and **22** have longer life and dimensional stability even when the controlled atmosphere used in the furnace interior may be reactive with carbon resulting in depletion of the element carbon in its solid phase in the member by conversion thereof into a gas.

Surfacing members, such as members **14** and **24**, are composite carbonaceous members made essentially of an admixture of carbon and metal. Such a new oxidation and pickup resistant surfacing member to engage work may be manufactured, for example, by mixing carbon particles in the amorphous or graphitic state with particles of a metal like silicon, titanium, zirconium, chromium and/or aluminum, which metals form stable solid predominantly non-alkaline oxides, and have an affinity for oxygen higher than carbon does at the heat-treating temperatures which will prevail in such furnaces. The oxidation resistance of such carbon-and-metal work-engaging members may be enhanced by the addition during the manufacture of the member of a quantity of boric oxide (B_2O_3) in an amount generally less than the amount of such metal present. Such metal may be provided as substantially commercially pure metal, or it may be in the form of an alloy or mixture with one another or with other preferential affinity metals having intermediate melting points such as calcium and/or magnesium. One source of such carbon may be petroleum coke which may be somewhat lower in cost compared to other sources of carbon.

Such mixture of carbon and metal may be shaped by mixing it with a binder preferably in the nature of a bituminous product like pitch or tar, whether with or without boric oxide therein, as the case may be. Then the admixture of carbon and metal and binder is molded or otherwise shaped into the desired shape which the new composite carbonaceous member is to have. Such molding may be performed, for example, by extruding in the case of a cylindrical sleeve like surfacing members **14** and **24**. The shaped admixture may then be heated to a temperature, for example, in the neighborhood of 1800° F. (or the expected furnace temperature) in the course of which it cures or hardens and its shape is set. If pitch or tar is used as a binder to bond the new surface member, the pitch or tar is carbonized in the heating and becomes a part of the member.

After such shaping and curing, my new surfacing member is assembled with the remainder of a furnace conveyor unit or the like with which it is to be used as the work-engaging surface thereof. Such a new composite carbonaceous member for such surfacing has been found to be relatively stable in dimensions and longer wearing even in cases where the controlled atmosphere used in the furnace in which the member is employed causes some loss in weight by reaction of such atmosphere with the carbon in such member, any such reaction occurring, moreover, at a slower rate than would be the case with a surfacing member of carbon alone. Even should any loss of carbon in such a new composite member begin to give an appearance of "porosity," the dimensions of the member and its ability to support the metal work it engages, remain for a relatively longer period of time. In addition, my new surfacing members inhibit development of the phenomenon of "pickup" while exhibiting such resistance to wear, to change in dimension and to carbon loss deterioration.

It appears that my new composite carbonaceous members may be compounded without clays or fillers. Components in such members may be employed in a range by weight running from about 8 parts of the metal and 2 parts of carbon inclusive of any residue of a binder like pitch or tar, by weight, on the one hand, to about 1 part of metal, 7 parts of carbon in the form of coke or other carbon and 2 parts in the form of pitch or tar binder, on the other hand, with realization of new results of this invention. Good results occur in a narrower range band using between about 60% of metal, based on the combined weight of metal and carbon (inclusive of any carbon left after curing from the bonding material used), and 15% of metal based on the total weight of metal and carbon. The quantity of binder originally added preferably would be in the neighborhood of about 20% of the combined weight of carbon and metal and binder in the original admixture and when the binder is bituminous it may be considered a part of the carbon component. In general, a minimum of 20% of such combined weight should be carbon.

The addition of boric oxide appears to act as a promoter to enhance the mechanical strength and the resistance of such carbon-and-metal to loss of weight due to any tendency to react with oxygen, whether as free oxygen or reactive oxygen-containing gases, in the furnace, when the boric oxide is present in amounts of about five parts by weight or more in a hundred parts of the entire mixture.

One of my new surfacing members may be made up before curing, for example, in proportions of about 6 parts carbon from petroleum coke, about 2 parts silicon and about 2 parts bituminous tar, all on a weight basis, and yield a highly satisfactory composite carbonaceous member of this invention. Silicon may be in the form of a commercially pure powdered silicon or added in the form of an addition alloy like ferrosilicon or of a mixture such as calcium-silicon. Titanium, zirconium and chromium are other metals I have discovered to be advantageous when used in accomplishing my invention and such is also the case with aluminum. Aluminum, however, appears to be more useful as a member component in situations where there is an absence of sulfur (such as occurs in some pitches and tars) when there is moisture in the atmosphere surrounding a new carbonaceous member containing aluminum. In general, of the metals named above, silicon, titanium and zirconium are preferred. Boron oxide (B_2O_3) when used, may also be added in the form of a commercial grade powder, preferably in a selected weight percentage amount between from about 5% to 40%.

Such a metal as silicon, titanium, zirconium, chromium and aluminum, with their preferential affinity for oxygen relative to the affinity of carbon for such oxygen at operative temperatures, may be used alone or as an alloy or mixture with one another, and/or as an alloy or mixture with intermediate melting point preferential affinity metals like calcium or magnesium, as the metal component in my new carbon-and-metal work-engaging members. However, I have also discovered that relatively lower melting point metals with a preferential affinity for oxygen greater than carbon, such as sodium, potassium and lithium in their elemental form, are not suitable for the manufacture of my new composite members. Further, I have discovered that a metal like molybdenum, in which the oxide thereof is not relatively stable in the solid phase at temperatures generally used in a heat-treating furnace, also is not suitable. As used herein, the term "preferential affinity" metal refers to a metal having an affinity for oxygen greater than that of carbon for such oxygen at furnace operating temperatures, such a metal or metals being other than such aforesaid relatively lower melting point metals and other than a metal as aforesaid in which the oxide of such metal is not a stable solid at such temperatures.

In FIGURE 4, a further form of furnace conveyor unit assembly is shown which may be employed and embody new composite carbonaceous members of my invention for engagement with metal work carried by such assembly. Thus, conveyor assembly **25** is endless and operates by movement in a vertical plane in its furnace. Furnace conveyor unit assembly **25** is provided with links **26** pinned at each end to an adjoining link **26** by a pin **27**, the axes of which are horizontal. The upper side of each link **26** is flat and supports a body **28**, the link being provided with a tapped and drilled hole **29** in registry with an opening **30** extending through body **28**. A recess **31** in the upper side of body **28** engages a downward projection of a composite carbonaceous work-engaging member **32** made in accordance with my invention. Carbonaceous member **32** is provided with a central opening **33** through which a headed bolt **34** passes downwardly, the lower end of bolt **34** being threaded to engage the hole **29** when head **35** is rotated by a socket wrench. Bolt **34** is shouldered at **36** to bear against the face of recess **31** on the metal body **28**, thereby avoiding bolting pressure against the more frangible carbon-and-metal supporting member **32**. The upper face of member **32** may be provided with a recess for the seating of metal work objects to be heat-treated, such metal work being in direct contact with and supported by my composite carbonaceous member **32** which in turn are supported by the furnace conveyor unit body **28**.

Various laboratory test examples are included at this point to illustrate the marked reaction resistance and anti-pickup character of carbon-and-metal compositions of this invention:

Laboratory Test Examples (Reaction Resistance)

Test	Cylinders in Test	Exposed Area (sq. in.)	Original Weight (gms.)	Ingredients (weight percent)	Test Temp. (° F.)	Atmosphere (vol. percent)	Dew-point (° F.)	Duration (hours)	Weight After Test (gms.)
I	A—phase (1) (control).	4.3	15.13	20 pitch; 80 coke[1]	1,850	dissoc. NH_3	65–70	19	14.86.
	A—phase (2) (control).		14.86		1,850	do	65–70	18	14.03.
	A—phase (3) (control).		14.03		1,850	do	85	18	disintegrated.
	B—phase (1)	4.9	15.22	20 pitch; 60 coke; 20 Al	1,850	do	65–70	19	15.17.
	B—phase (2)		15.17		1,850	do	65–70	18	14.48.
	B—phase (3)		14.48		1,850	do	85	18	12.89.
II	C (control)	6.32	23.56	20 pitch; 80 coke	1,850	do	60–74	64.5	disintegrated.
	D	6.32	30.17	20 pitch; 70 coke; 10 Si	1,850	do	65–74	64.5	23.93.
	E	5.4	31.14	20 pitch; 50 coke; 30 Si	1,850	do	60–74	64.5	25.96.
	F	6.32	30.90	20 pitch; 60 coke; 20 Ca-Si	1,850	do	60–74	64.5	23.82.
III	G	G and H had same area.	30.27	20 pitch; 80 Si	1,850	do	about 66	166.5	30.13.
	H (control)		27.33	20 pitch; 80 coke	1,850	do	about 66	166.5	17.86.
IV	I	5.66	33.73	20 pitch; 20 Ti; 60 coke	1,850	90 N_2—10 H_2	50–70	48	35.07.
	J (control)	7.07	48.43	20 pitch; 80 coke	1,850	90 N_2—10 H_2	50–70	48	40.58.

[1] All coke used was petroleum coke.

Laboratory Test Examples (Pickup Resistance)[1]

Test	Composition of Work-Engaging Cylinder (weight Percent)	Test Temp. (° F.)	Atmosphere (vol. Percent)	Dewpoint (° F.)	Duration (hours)	Result
A	60 carbon; 20 pitch; 20 Al	1,850	$90N_2$—$10H_2$	60	18	no pickup.
B	60 carbon; 20 pitch; 20 Si	1,850	$90N_2$—$10H_2$	70	16½	Do.
C	20 carbon; 20 pitch; 60 Si	1,800	8-1 Air-Gas	60	16	Do.
D	40 carbon; 20 pitch; 40 Si	1,800	8-1 Air-Gas	60	16	Do.
E	45 carbon; 20 pitch; 25 Si; 10 B_2O_3	1,800	8-1 Air-Gas	60	16	Do.
F	20 carbon; 20 pitch; 60 Ti	1,800	8-1 Air-Gas	65	18	Do.
G	20 carbon; 20 pitch; 60 Cr	1,800	8-1 Air-Gas	65	18	Do.
H	15 carbon; 20 pitch; 65 Si	1,800	$75H_2$—$25N_2$	72	18	Do.
I	15 carbon; 20 pitch; 65 Ti	1,800	$75H_2$—$25N_2$	72	18	Do.
J	10 carbon; 20 pitch; 70 Si-Mg	1,800	$90N_2$—$10H_2$	50	18	Do.
K	20 pitch; 70 Zr; 10 B_2O_3	1,800	$90N_2$—$10H_2$	50	18	Do.
L	20 pitch; 40 Si; 30 Al; 10 B_2O_3	1,800	$90N_2$—$10H_2$	50	18	Do.
M	15 carbon; 20 pitch; 65 Si	1,800	$90N_2$—$10H_2$	65	18	Do.
N	20 pitch; 80 Zr	1,800	$90N_2$—$10H_2$	65	18	Do.
O	15 carbon; 20 pitch; 65 Ti	1,800	$90N_2$—$10H_2$	70	18	Do.
P	20 pitch; 80 Zr-Al [51%–36%].	1,800	$90N_2$—$10H_2$	70	18	Do.
Q	20 pitch; 80 Si	1,800	$90N_2$—$10H_2$	70	18	Do.
R	20 pitch; 80 Si	1,800	7-1 DX	70	18	Do.
S	20 pitch; 80 Ti	1,600	$90N_2$—$10H_2$	55	18	Do.

[1] Silicon steel used in these tests.

FIGURE 6 also illustrates oxidation resistance of my carbon-and-metal members for respective metals used in increasing weight percentages in the combined weight of the tested mixture. Thus, solid line A represents the increasing oxidation resistance effect of increasing amounts of silicon in a mixture, the balance of which was carbon in the form of graphite with a pitch binder, tested for eighteen hours at a temperature of 1800° F. in a 90% nitrogen-10% hydrogen atmosphere with a dew point of about 95° F. The long-dash line B in FIGURE 6 represents the oxidation resistance effect of increasing amounts of silicon in the admixture when tested at the same temperature for the same period of time in an 8 to 1 air-gas atmosphere (a DX gas atmosphere having the following approximate volume percentages in its composition, 7.5 H_2, 6.2 CO, 8.2 CO_2, balance N_2) with a dew point of about 60° F.

Chainline C on the FIGURE 6 chart illustrates the improvement effect of increasing weight percentage of chromium in a mixture with the balance graphite, inclusive of 20% by weight of pitch binder, tested for eighteen hours at 1800° F. in a 90% nitrogen-10% hydrogen atmosphere with a dew point of about 70° F. Short-dash line D in FIGURE 6 illustrates the advantage of increased titanium amounts on the oxidation reaction resistance of a mixture having the balance graphite, inclusive of 20% by weight of pitch binder, tested for eighteen hours at 1800° F. in a 90% nitrogen-10% hydrogen atmosphere with a dew point of about 70° F.

The tests shown on FIGURE 7 illustrate benefits obtained by the addition of boron oxide (B_2O_3) as an ingredient in carbon-and-metal members of this invention. The FIGURE 7 tests of lines I and I' were conducted in air, a much more reactive atmosphere than would generally be encountered in a metal heating furnace utilizing carbon-and-metal rolls of this invention. Line I in FIGURE 7 represents the variable oxidation resistance of increasing amounts of silicon-magnesium alloy (52% Si-31% Mg) with the mixture balance graphite, inclusive of 20% of a pitch binder, tested for four hours at 1800° F. in air. However, when 5% by weight of B_2O_3 was added to the compositions producing the line I test results, the boric oxide yielded test results summarized by line I' showing marked benefits in the oxidation resistance of the carbon-and-Si-Mg mixtures. The "weight percent" scale for lines I and I' refers to the percentage of silicon-magnesium alloy in the test specimens.

Further, in FIGURE 7, a reference point II represents a weight loss in grams per square inch of a test cylinder mixture containing 25% silicon metal with the balance graphite, inclusive of a pitch binder, tested for eighteen hours at 1800° F. in a 90% nitrogen-10% hydrogen atmosphere with a dew point of about 95° F. The addition of boric oxide to such a mixture in increasing percentages ranging from 5% to 20% while retaining 25% silicon and the balance graphite and pitch, greatly improved oxidation resistance as shown by line II' during testing of the specimens for sixty-nine hours at 1800° F. in a 90% nitrogen-10% hydrogen atmosphere with a dew point of about 60° F. The "weight percent" scale for line II' refers to the percentage of boric oxide in the test specimens. Such beneficial effects by the addition of boric oxide appear when it is an ingredient of the carbon-and-metal mixture in a range, in general, from about 5% to about 30% by weight of the total weight of the member, with the preferred addition quantity of such boron oxide being in the range of about 10% to about 20% of that total weight.

Various modifications in proportions of member components, in aspects of my invention as hereinabove outlined and as hereinafter claimed, may be made without departure from the spirit of my invention or the scope of such claims.

I claim:

1. A work-engaging member for a heat treating furnace conveyor unit or the like, comprising, in combination, carbon and metal in shaped bonded admixture, said carbon being in the range from about 95% to about 20% by weight of the total weight of carbon and metal, said metal being in the range from about 5% to about 80% by weight of the total weight of carbon and metal, said metal further having a preferential affinity relative to carbon at furnace temeperature for free oxygen and reactive oxygen-containing gases, said metal still further having the ability to form stable solid predominantly non-alkaline oxide.

2. A work-engaging member for a heat treating furnace conveyor unit or the like, comprising, in combination, carbon and metal in an admixture of predetermined shape, said carbon being in the range from about 85% to about 40% of the total weight of said member, said metal being in the range from about 15% to about 60% of the total weight of said member, said metal being selected from the group consisting of silicon, titanium, zirconium, chromium, aluminum and alloys and metal mixtures thereof in which at least one of said last-named metals predominates.

3. A work-engaging member as set forth in claim 2 in which said metal is silicon.

4. A work-engaging member as set forth in claim 2 in which said metal is titanium.

5. A work-engaging member as set forth in claim 2 in which said metal is zirconium.

6. A work-engaging member as set forth in claim 2 in which said metal is chromium.

7. A work-engaging member as set forth in claim 2 in which said metal is aluminum.

8. A work-engaging member as set forth in claim 2 in which said carbon and metal admixture is in the range of from about 95% to about 60% of the total weight of said member and in which from about 5% to about 40% by weight of boric oxide is present in the total weight of said member.

9. A work supporting unit for a heat treating furnace or the like, comprising, in combination, a supporting body, a work-engaging member supported by said body, said member consisting essentially of a major proportion by weight of carbon in admixture with a minor proportion by weight of one or more metals selected from a group consisting of silicon, titanium, zirconium, chromium, aluminum and alloys and metal mixtures thereof in which at least one of said last-named metals predominates.

10. A supporting unit as set forth in claim 9 in which boron oxide is present in said admixture.

11. A support unit or the like for metal work subjected to elevated temperatures in an atmosphere containing reactive oxygen, comprising, in combination, a supporting body, a work-engaging member supported by said body, said member comprising a major proportion of carbon sufficient to inhibit pick-up and a minor proportion of metal sufficient to inhibit reaction deterioration, said metal being characterized by its preferential affinity relative to carbon at such temperatures for any such reactive oxygen and its ability to form stable solid predominantly non-alkaline oxide thereby, said oxide having a melting point at least as high as said temperatures.

12. A support unit or the like as set forth in claim 11 in which said member further comprises a quantity of boric oxide less by weight than said minor proportion of metal.

13. A support member to engage metal work at elevated temperatures being a bonded admixture of at least one metal characterized by its preferential affinity relative to carbon at such temperatures for any free oxygen and reactive oxygen-containing gases present and by its ability to form stable solid predominantly non-alkaline oxide in any such gases, said oxide having a melting point not lower than such temperatures, said metal being in a sufficient quantity to inhibit deterioration of such member

in any such gases, with the balance of said admixture being substantially carbon.

14. A support member as set forth in claim 13 in which said metal, further, is silicon.

15. A support member as set forth in claim 13 in which said metal, further, is titanium.

16. A support member as set forth in claim 13 in which said metal, further, is zirconium.

17. A support member as set forth in claim 13 in which said metal, further, is chromium.

18. A support member as set forth in claim 13 in which said metal, further, is aluminum.

19. A support member as set forth in claim 13 in which said metal is present in said admixture in an amount between about 5% and about 60%, by weight.

20. A support member as set forth in claim 13 in which boric oxide is present in said admixture in an amount between about 5% and 30%, by weight, said amount being less than the amount of said metal present in said admixture.

21. In a process of subjecting metal work to heat-treating temperatures in an atmosphere having reactive oxygen therein, wherein members in supporting and guiding contact with such work are normally subject to at least one of two problems of pickup and deterioration through reaction with such oxygen, the improvement which comprises subjecting the work to such a temperature in the presence of such an atmosphere and contacting such work therein for support and guidance with a bonded admixture consisting essentially of a major proportion of carbon sufficient to inhibit pickup and a minor proportion of metal sufficient to inhibit deterioration, said metal being characterized by its preferential affinity relative to carbon at such temperatures for any such reactive oxygen and its ability to form stable solid predominantly non-alkaline oxide thereby, said oxide having a melting point at least as high as such temperatures.

22. In a process of subjecting metal work to heat-treating temperatures in an atmosphere having reactive oxygen therein, wherein members in supporting and guiding contact with such work are normally subject to at least one of two problems of pickup and deterioration through reaction with such oxygen, the improvement which comprises subjecting the work to such a temperature in the presence of such an atmosphere and contacting such work therein for support and guidance with a bonded admixture consisting essentially of a major proportion of carbon sufficient to inhibit pickup and a minor proportion of metal and boron oxide sufficient to inhibit deterioration and to increase the mechanical strength of said bonded admixture, said metal being characterized by its preferential affinity relative to carbon at such temperatures for any such reactive oxygen and its ability to form stable solid predominantly non-alkaline oxide thereby, said last-named oxide having a melting point at least as high as such a temperature.

23. In a process of subjecting metal work to heat-treating temperatures in an atmosphere containing reactive oxygen, wherein members in supporting and guiding contact with such work are normally subject to at least one of two problems of pickup and deterioration through reaction with such oxygen, the improvement which comprises subjecting the work to such a temperature in the presence of such an atmosphere and contacting such work therein for support and guidance with a shaped member comprising essentially a sufficient amount of carbon to inhibit pickup in admixture a sufficient amount of metal to inhibit deterioration, said last-named metal being selected from the group consisting of silicon, titanium, zirconium, chromium, aluminum and alloys and metal mixtures thereof in which at least one of said last-named metals predominates.

24. In a process as set forth in claim 23, in which said last-named metal is silicon in a quantity at least about 5% by weight of metal and carbon.

25. In a process as set forth in claim 23, in which said last-named metal is titanium in a quantity at least about 5% by weight of metal and carbon.

26. In a process as set forth in claim 23, in which said last-named metal is zirconium in a quantity at least about 5% by weight of metal and carbon.

27. In a process as set forth in claim 23, in which said last-named metal is chromium in a quantity at least about 5% by weight of metal and carbon.

28. In a process as set forth in claim 23, in which said last-named metal is aluminum in a quantity at least about 5% by weight of metal and carbon.

29. In a process of making a work-engaging composition which inhibits pickup and reaction with free oxygen and reactive oxygen-containing gases and supporting work directly upon said composition in a high temperature industrial furnace, the steps comprising, mixing carbon and metal particles with a bonding substance present, said metal being selected from the group consisting of silicon, titanium, zirconium, chromium, aluminum and alloys and metal mixtures thereof in which at least one of said last-named metals predominates, molding said mixture to a desired shape, heating said molded mixture to a hardened bonded condition, and supporting work directly upon said molded mixture in said hardened bonded condition in a relatively high temperature industrial furnace for heat treating said work.

30. In a process of making a work-engaging composition which inhibits pickup and reaction with free oxygen and reactive oxygen-containing gases and supporting work directly upon said composition in a high temperature industrial furnace, the steps comprising, mixing carbon, metal and boric oxide particles with a bonding substance present, said metal being selected from the group consisting of silicon, titanium, zirconium, chromium, aluminum and alloys and metal mixtures thereof in which at least one of said last-named metals predominates, molding said mixture to a desired shape, heating said molded mixture to a hardened bonded condition, said carbon being in an amount of at least 20 weight percent, said metal being present in an amount of at least 5 weight percent, said boric oxide being present in an amount of at least 5 weight percent, and supporting work directly upon said molded mixture in said hardened bonded condition in a relatively high temperature industrial furnace for heat treating said work.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,037,756 June 5, 1962

Nathaniel B. Ornitz

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 14, for "bdoy" read -- body --; line 16, strike out "and"; line 20, for "bolding" read -- bolting --.

Signed and sealed this 11th day of September 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents