

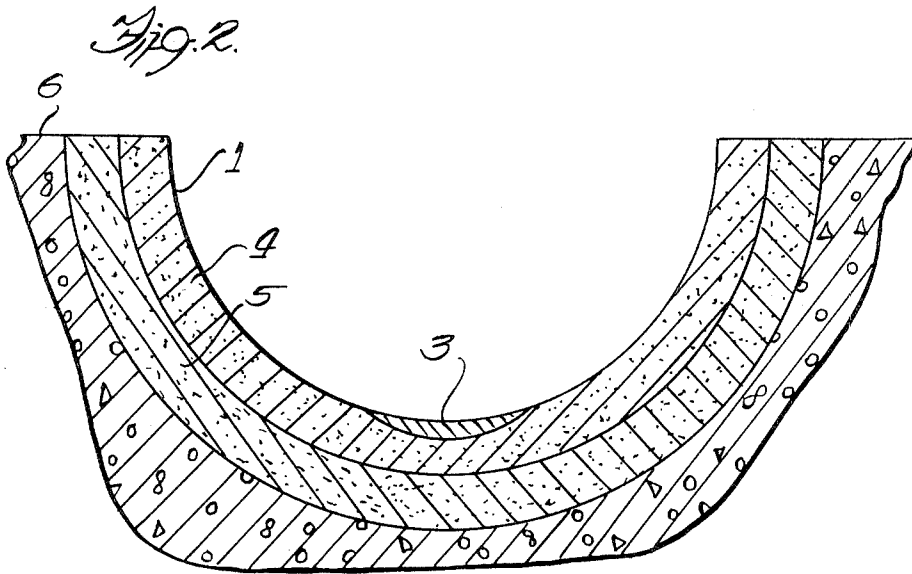
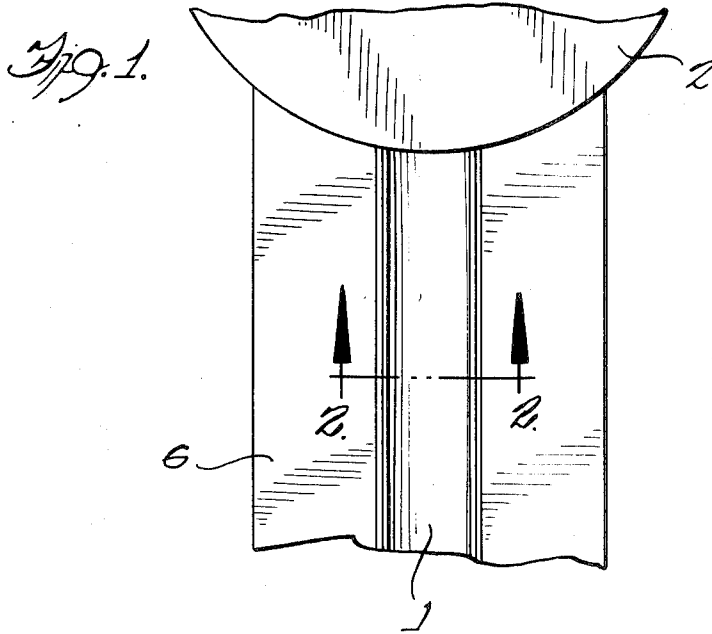
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PROCESS FOR REPAIRING RUNNERS FOR HANDLING MOLTEN METAL

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**PROCESS FOR REPAIRING RUNNERS FOR
HANDLING MOLTEN METAL**

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5 Claims

ABSTRACT OF THE DISCLOSURE

A patch composition consisting essentially of particles of pitch and particles of carbon such as particles of coke, graphite or coal is filled into the recess of the damaged portion of a runner trough of a blast furnace or cupola while the trough is at a temperature above 500° F. but below the carbonization temperature of the pitch, and then the patch is further heated by a gas flame or other means to a temperature sufficient to carbonize of coke the pitch, this forming a solid patch of carbon. Small amounts of calcium chloride, clays, bentonite or liquid pitch may be added to the patch particle composition especially to relieve the dusting problem when fine particles of carbon such as 60 mesh or finer are used.

The invention relates to a process for repairing runners used for handling molten metal such as metal from a blast furnace or cupola.

The advances in blast furnace technology, higher blast temperatures, fuel injection, oxygen enrichment, and higher top pressures to increase production have developed a new set of circumstances for the blast furnace operators. The blast furnaces are now producing greater tonnage and more casts per day than was formerly expected as standard operating practice. To cool the runners or troughs down after a cast for a quick repair there is required the use of water hoses with considerable damage done to the runner by the water itself. With my invention this cooling of the runner or trough is unnecessary.

Tap hole mixes used extensively in the past to line and patch troughs are generally clay grog mixes sometimes with a small amount of fine coke and/or sand mixed with the clay and grog. Since tap hole mixes are extruded through a mud gun they must have a high moisture content.

The general practice using tap hole mixes to patch troughs was that after the cast of the metal when the trough had cooled enough to work, the iron scrap and slag around the area to be patched was removed. The tap hole mix was then formed into slabs and rammed into place with shovels and other hand tools. When repairs were completed the patches were dried using gas burners. Minimum drying time was generally three hours. More time was necessary if the patches were thick. Four to five hours was not unusual. Tap hole mixes because of high moisture content always showed excessive cracking on drying. Coke breeze would be thrown into the cracks when the patch was hot in order to somewhat seal them before the cast.

If the patches of tap hole mix were not completely dry before the cast a "boiling action" would occur during the cast which would necessitate more extensive patch work before the next cast. This could cause lengthy delays in the casting schedule.

During the winter months additional problems would occur. The tap hole mix would freeze and increase repair time. During winter when natural gas would not be available kerosene burners were used to dry the trough.

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The kerosene burners, under these conditions, were not as efficient as gas and thus would increase drying time.

My invention eliminates the drying time of the prior art.

5 In accordance with my invention a composition consisting essentially of a bonding amount of pitch and particles of carbon is applied to a damaged area of a furnace runner and the runner at said damaged area is heated to a temperature sufficient to carbonize or coke the pitch there-
10 by forming a solid carbon patch.

In one embodiment of my invention a composition consisting essentially of a mixture of particles of pitch and particles of carbon is applied to the damaged areas of a blast furnace or cupola furnace runner while the run-
15 ner is above 500° F. If the runner is cooled to below 500° F. it is heated to above this temperature. In general the temperature of the runner when the patch compound is applied is below the carbonization temperature of the pitch. A workman, by the usual procedure, shovels the
20 pitch composition into the recess of the damaged area, and then takes a round-nosed shovel and smoothes out the material over the damaged area to complete the patch. When this smoothing operation is finished a gas flame is applied on the patch.

25 This may be carried out at first with a light gas flame and as soon as the patch has surface melted the flame can be increased to a full blast to bring about carbonization of the pitch thus coking it in place. The whole operation need not take more than 45 minutes thus giving ample
30 time between taps of the furnace.

For best results the patch should not be more than two to three inches in thickness. When thicker patches are used the coking time will be a little longer but it has been found from experience that it is more desirable to patch
35 more often and keep the thickness of the patch down to two to three inches in thickness.

A blast furnace trough-type runner on which my invention may be carried out is shown in the accompanying drawing wherein FIG. 1 is a plan view showing the trough
40 1 extending from a blast furnace 2, and FIG. 2 is a cross section along the line 2—2 of FIG. 1. The hot patch composition 3 of this invention is applied in a worn or damaged area of the trough 1. The trough is made of refractory material and preferably the inside lining 4 of the
45 trough is made of a refractory composition of carbon and clay. The outside lining 5 may be of silicon-carbide brick, and the entire trough lies within a base 6.

My repair composition for use in the process consisting essentially of particles of pitch and particles of carbon,
50 the pitch being present in sufficient amount to bond the carbon particles together, and in general ranging from approximately 10 percent-40 percent by weight of the composition, and preferably 20 percent-30 percent, with
55 the remainder being entirely or largely carbon. Small amounts of calcium chloride, clays, bentonites or liquid pitch may be added to relieve the dusting problem when the carbon particles are particles of fine coke. In general the best strengths are obtained with a mixture of fine and coarse coke. Suitable results have been obtained with
60 mixtures of pitch with all types of coke, graphite and coal.

Experimenting on the range of possible hot melt patch mixes for use in my process has brought out a number of
65 facts that have a very important bearing on the final patch. These conditions are exemplified in the following examples.

EXAMPLE NO. 1

70 Here graphite in the presence of fine coke and pitch produces the highest densities obtained in these tests.

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EXAMPLE NO. 1

	1	2	3
Materials:			
Graphite 1/4 on 20 mesh.....	60	60	50
60 mesh calcined coke.....	20	20	20
Pellet or flake pitch.....	10	20	30
Physical properties at 1,000° F.:			
Weight per cu. ft.....	94.9	83.7	72.9
Modulus of rupture.....	441	360	169
Cold crushing strength.....	756	713	393
Shrinkage.....	+0.22	+0.27	+0.29

EXAMPLE NO. 2

This example shows the highest strength obtained in the tests. The amount of carbon surface area available to the pitch seems to be an important factor for strength.

EXAMPLE NO. 2

	4	5	6
Materials:			
Metallurgical coke.....	75	60	45
Pellet or flake pitch.....	25	25	25
60 mesh coke.....	0	15	30
Physical properties at 1,000° F.:			
Weight per cu. ft.....	65.1	68.1	68.5
Modulus of rupture.....	401	472	445
Cold crushing strength.....	1,187	1,380	1,842
Shrinkage.....	-0.44	-0.29	-0.04

EXAMPLE NO. 3

This shows the use of pitch in excessive amounts, strengths do not improve and the final product becomes lighter.

EXAMPLE NO. 3

	7	8	9
Materials:			
Pellet or flake pitch.....	20	30	40
Metallurgical coke.....	60	50	40
60 mesh coke.....	20	20	20
Physical properties at 1,000° F.:			
Weight per cu. ft.....	65.7	60.9	57.9
Modulus of rupture.....	473	316	206
Cold crushing strength.....	1,385	801	887
Shrinkage.....	+0.08	+0.18	+0.18

EXAMPLE No. 4

This illustrates the introduction of uncalcined coke (or coke still containing shrinkage). This material lowers strength but a considerable amount can be used and the mixtures are suitable.

EXAMPLE NO. 4

	10	11	12
Materials:			
Metallurgical coke.....	60	45	30
Uncalcined coke.....	15	30	45
Pellet or flake pitch.....	25	25	25
Physical properties at 1,000° F.:			
Weight per cu. ft.....	65.4	65.0	62.4
Modulus of rupture.....	266	184	143
Cold crushing strength.....	956	538	472
Shrinkage.....	+0.18	+0.88	+0.52

EXAMPLE NO. 5

This illustrates the use of all fine materials.

EXAMPLE NO. 5

	13	14	15
Materials:			
60 mesh carbon.....	85	70	55
Pellet or flake pitch.....	15	30	45
Physical properties at 1,000° F.:			
Weight per cu. ft.....	69.8	67.4	58.7
Modulus of rupture.....	218	403	170
Cold crushing strength.....	920	1,459	430
Shrinkage.....	-0.03		

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EXAMPLE No 6

This illustrates the effect of pitch bonding a fine pellet coke. Here there seems to be insufficient coke area to develop the higher bonds.

EXAMPLE NO. 6

	16	17	18
Materials:			
Pellet coke.....	90	80	70
Pellet or flake pitch.....	10	20	30
Physical properties at 1,000° F.:			
Weight per cu. ft.....	62.3	65.1	59.0
Modulus of rupture.....	46	68	44
Cold crushing strength.....	452	788	360
Shrinkage.....	+0.15	-0.18	+0.15

Summing up the results of the above tests shows that the better densities are obtained with graphite or calcined coal. The best strengths were obtained when a balanced amount of fine and coarse coke was used as in Examples No. 5 and No. 6. The pitch required seems to range from 10 to 40 percent with especially satisfactory results being obtained between 20 and 30 percent. To the above basic formulas, small amounts of calcium chloride, clays, bentonites or liquid pitch can be added to relieve the dusting problem when fine particle size cokes are used.

All petroleum and coal tar pitches can be used in my process and compositions.

Pitches having the following softening points by test developed by A.S.T.M., among others, are suitable:

Grade—Softening point C.I.A., F.

Test method—D-7

1—255°-270° F.

2—290°-310° F.

3—340°-360° F.

The particle size of the pitch and coke is not critical. However, the following is a screen analysis for a typical formulation:

SCREEN ANALYSIS:

EXAMPLE NO. 3, FORMULA 11, TYLER SCREENS

Mesh size:	Percentage
+4	36.7
-4+8	22.7
-8+10	6.0
-10+14	6.7
-14+20	6.7
-20+28	4.7
-28+35	3.3
-35+65	4.0
-65+100	2.7
-100	6.7

I claim:

1. The process of repairing furnace runners in the form of a trough having recessed areas formed by wearing during the flow of molten metal from the furnace which comprises filling the recess with a composition consisting essentially of particles of solid pitch in from 10 percent to 40 percent by weight and the remainder particles of carbon while the trough at said recessed area is above 500° F. and below the carbonization temperature of the pitch, and bringing the temperature to a temperature to coke the pitch to thereby form a solid patch.

2. The process of claim 1 wherein the particles of carbon comprise particles of coke.

3. The process of claim 1 wherein the particles of carbon comprise particles of coke of -60 mesh.

4. The process of claim 2 wherein the coke is metallurgical coke of particle size greater than 60 mesh present in 45 percent to 60 percent by weight, and the pitch is selected from pellet or flake pitch in approximately 25 percent by weight.

5. The process of claim 1 wherein the particles of carbon comprise particles of graphite.

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