United States Patent **4,217,255**
Griffith **August 12, 1980**

Composition railroad friction material with synthetic fiber content

Abstract

Composition railroad friction materials having low wear rates are characterized by the use of synthetic fiber and by the absence of lead and asbestos These friction materials are particularly suitable for use in railroad brake shoes and contain, by approximate weight, 0 5-11% non-asbestos fiber, of which at least 0 5% is synthetic fiber, 66-81% filler and 14-21% organic binder

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References Cited [Referenced By]

U.S. Patent Documents

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Other References

SCF-ABEX-2385

C A vol 83 61074n, Less Abrasive Composition Railroad Brake Shoe Material, Adelmann

C A vol 85 165565f, Glass-fiber-based friction material, Sasahara
C A vol 79 80031e, Fiber Strengthened Friction Material, Augustin

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Parent Case Text

This is a continuation of application Ser No 815,637, filed July 14, 1977, now abandoned

Claims

I claim

1. An asbestos-free and lead-free composition friction material, comprising, by weight, 0 5-11% fiber, of which at least 0 5% is synthetic fiber, 66-81% filler and 14-21% organic binder

2 The friction material of claim 1, wherein the fiber content includes at least 1% glass fiber

3 An asbestos-free and lead-free composition friction material, comprising, by weight, 1 5-10% fiber, of which at least 0 5% is synthetic fiber and at least 0 4% is cellulose fiber, 66-80% filler and 14-21% organic binder

4 The friction material of claim 3, wherein the fiber content includes at least 1 5% glass fiber

5 An asbestos-free and lead-free composition friction material, comprising, by weight, 5-10% fiber, of which at least 2 5% is synthetic fiber and at least 2 5% is cellulose fiber, 72-79% filler and 14-19% organic binder

6 The friction material of claim 5, wherein the synthetic fiber is glass fiber

7 An asbestos-free and lead-free composition friction material, comprising, by weight, 2-5% fiber, of which at least 1% is synthetic fiber and at least 0 5% is cellulose fiber, 72-82% filler and 14-21% organic binder

8 The friction material of claim 7, wherein the synthetic fiber is glass fiber

9 An asbestos-free and lead-free composition friction material, comprising, by weight, 0 5-7% synthetic fiber, 72-81% filler and 15-21% organic binder

10 The friction material of claim 9, wherein the synthetic fiber is glass fiber

11 An asbestos-free and lead-free composition friction material, comprising, by weight, 0 5-2% synthetic fiber, 74-82% filler and 15-22% organic binder

12 The friction material of claim 11, wherein the synthetic fiber is polyester fiber

13 An asbestos-free and lead-free composition friction material, comprising, by weight, 1 4-3 5% synthetic fiber, 74-82% filler and 16-21% organic binder

14 The friction material of claim 13, wherein the synthetic fiber is glass fiber

15 The asbestos-free and lead-free composition friction material, comprising, by weight, 2 7-3 5% synthetic fiber, 74-82% filler and 16-19% organic binder

16 The friction material of claim 15, wherein the synthetic fiber is glass fiber

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Description

This invention relates generally to composition type railroad friction materials and, more particularly, to such materials which feature the use of synthetic fibers and the absence of asbestos and lead

BACKGROUND OF THE INVENTION

Most of the composition type railroad friction materials in use today include asbestos and lead An example of this type of material is shown in U S Pat No 3,168,487--Spokes et al Some environmentalists have warned of possible problems caused by the use of lead in friction materials As a result, demand has developed for a lead-free friction material Examples of some composition friction materials which exclude lead are U S Pat Nos 3,492,262--Griffith and 3,959,194--Adelmann The former patent discloses a composition which has no lead and includes up to 16 5% by weight asbestos fiber, while the latter patent discloses some compositions which delete lead and have up to 11 1% by weight asbestos fiber

More recently, certain environmentalists have pointed out that possible problems may be caused by the use of asbestos fiber in friction materials Thus, it may be desirable to eliminate asbestos as well as lead from composition friction materials U S Pat No 3,959,194 has some examples which utilize cellulosic fiber in a range of 3 5-8 0% by weight as a substitute for asbestos, although the patent is not concerned with eliminating asbestos in friction materials

Asbestos has traditionally been used in friction materials because of its high heat resistance and strength and its low cost. A direct substitution of other types of fiber for asbestos is expensive, since other fibers cost much more than asbestos, and difficult, since no known fiber combines all of the desirable qualities of asbestos noted above It is known to use high-content carbonized or graphitized fibers in aircraft friction materials, as shown in U S Pat No 3,552,533--Nitz The use of glass fiber in friction materials is disclosed in several patents U S Pat No 3,743,069--Barnett relates a clutch facing consisting almost entirely of bundles of continuous glass filaments U S Pat No 3,627,606--Bentz teaches a glass-filament-reinforced fabric clutch facing impregnated with a cement containing lead (litharge) U S Pat No 3,713,934--Morton discloses a clutch facing composed of glass and asbestos None of these friction materials would be suitable for railroad brake shoe use, since they are either too expensive and/or contain lead or asbestos

It is, therefore, an object of this invention to provide lead-free, asbestos-free, high coefficient of friction, composition friction materials which feature a low fiber content including synthetic fiber and low wear

rates.

SUMMARY OF THE INVENTION

I have discovered that railroad brake shoes that meet A A R (Association of American Railroads) standards for brake shoes can be made from compositions having a low, non-asbestos fiber content which includes synthetic fiber The friction materials according to this invention comprise, by weight, 0 5-11 0% non-asbestos fiber, including at least 0 5% synthetic fiber, 66-81% filler and 14-21% organic binder A preferred embodiment of this composition friction material for railroad car use contains 2 7-3 5% synthetic fiber, 74-82% filler and 16-19% organic binder

DETAILED DESCRIPTION OF THE INVENTION

The criterion for suitability of a composition friction material for railroad car brake shoe use is the ability of the friction material to pass the standards set forth in the A A R Specification M-926-72, Feb 13, 1973 Revision Some of the pertinent dynamometer performance test criteria called for in this A A R Specification are as follows.

1 Instantaneous Retarding Force During 45 Minute Dynamometer Drag Test

Drag	Retarding Force
Heavy load	400 lbs min
Light load	300 lbs min

2 Static Coefficient of Friction

9 Test Average--0 38 min

3 Stop Distances From 90, 70, 50, 30, 10 mph Under Light and Heavy Brake Shoe Loads (all stop distances must be within varying tolerances)

4 Wear Loss

Drag Tests (total)--0 60 in sup 3 max

Test Stops (total per sequence)--1 20 in sup 3 max

As used herein, the term "synthetic fiber" means fiber made from a substance which does not naturally occur in a fibrous state and includes glass, polyester and kaowool The term "synthetic fiber" excludes all forms of cellulose, which naturally occurs in a fibrous state, but which can also be processed into a different fibrous form (e g , rayon) Some example mixes used a single type of synthetic fiber, while others used several types of synthetic fibers in combination Other example mixes contained a mixture of synthetic and cellulose fibers All mixes were totally free of asbestos and lead

Organic binders, such as styrene butadiene rubber (SBR), nitrile butadiene rubber (NBR) and modified phenolic and cashew resins were used Curing agents for the organic binders included sulfur, zinc oxide and hexamethylene tetramine

A number of filler materials were used in varying combinations to produce the necessary low wear rate, hardness and high coefficient of friction The fillers used were cast iron grit, kyanite, cashew nut particles, red iron oxide (hematite), black iron oxide, powdered alumina, graphite, barytes, coke, kaolin, cryolite, carbon black and zinc powder.

Examples of the mixes formulated and tested are shown below and denoted Mixes A-R The compositions of ingredients are expressed in weight percentages

	Weight %	
MIX A		
Glass Fiber		3 02
Organic Binder		18 63
rubber	15 74	
resin	2 89	
Curative Agents		1 64
Filler Materials		76 71
iron grit	12 11	
kyanite	12 11	
powdered alumina	0 27	
black iron oxide	8 46	
barytes	21 21	
coke	22 55	
MIX B		
Glass Fiber		2 91
Organic Binder		17.25
rubber	14 47	
resin	2 78	
Curative Agents		1 62
Filler Materials		78 22
iron grit	23 37	
kyanite	11 68	
powdered alumina	0 26	
graphite	7 90	
barytes	20 42	
coke	11 68	
cryolite	2.91	
MIX C		
Glass Fiber		1.61
Organic Binder		16 98
rubber	12 03	
resin	4 95	
Curative Agents		1 54
Filler Materials		79 85
iron grit	24 54	
kyanite	13 99	
powdered alumina	0 48	
graphite	3 92	
barytes	17 11	
coke	14 99	
cryolite	4 82	
MIX D		
Glass Fiber		1 62
Organic Binder		17 18
rubber	14 59	
resin	2 59	

Curative Agents		3 08
Filler Materials		78 13
iron grit	24 75	
kyanite	14 11	
powdered alumina	0 26	
graphite	7 65	
barytes	16 22	
coke	15 12	
MIX E		
Polyester Fiber		0 71
Organic Binder		18 93
rubber	10 98	
resin	7 95	
Curative Agents		1 24
Filler Materials		79 11
iron grit	13 36	
kyanite	20 60	
powdered alumina	0 53	
graphite	8 73	
barytes	19 10	
coke	11 44	
cryolite	5 35	
MIX F		
Glass Fiber		3 20
Organic Binder		19 74
rubber	16 68	
resin	3 06	
Curative Agents		1 74
Filler Materials		75 32
kyanite	12 84	
hematite	16 04	
cashew particles	1 28	
powdered alumina	0 28	
graphite	6 40	
barytes	22 44	
coke	16 04	
MIX G		
Glass Fiber		2 87
Organic Binder		17 69
rubber	14 95	
resin	2 74	
Curative Agents		1 56
Filler Materials		77 90
iron grit	23 02	
kyanite	11 51	
powdered alumina	0 26	
graphite	5 74	
barytes	20 12	
coke	14 38	
cryolite	2 87	
MIX H		
Fiber		3 59
glass	3 06	
cellulose	0 53	
Organic Binder		17 81
rubber	6 64	
resin	11 17	
Curative Agents		2 39
Filler Materials		76 22
graphite	6 99	

barytes	13 87	
coke	7 31	
kaolin	3 62	
powdered alumina	0 53	
iron grit	22 37	
kyanite	13 17	
hematite	8 36	
MIX J		
Fiber		2 16
glass	1 45	
cellulose	0 71	
Organic Binder		17 82
rubber	15 06	
resin	2 76	
Curative Agents		1 57
Filler Materials		78 45
kyanite	11 59	
powdered alumina	0 26	
iron grit	23 19	
graphite	5 73	
barytes	20 26	
coke	14 48	
cryolite	2 89	
MIX L		
Fiber		3 32
cellulose	0 50	
polyester	0 33	
kaowool	2 49	
Organic Binder		19 57
rubber	2 95	
resin	16 62	
Curative Agents		2 65
Filler Materials		74 48
iron grit	31 08	
kyanite	12 44	
graphite	6 70	
barytes	15 56	
coke	4 98	
powdered alumina	0 50	
kaolin	3 22	
MIX M		
Glass Fiber		3 24
Organic Binder		16 97
rubber	9 46	
resin	7 51	
Curative Agents		1.17
Filler Materials		78 64
iron grit	24 71	
kyanite	14 09	
powdered alumina	1 01	
graphite	1 98	
barytes	16 81	
coke	10 26	
cryolite	4 86	
carbon black	4 92	
MIX N		
Glass Fiber		3 19
Organic Binder		16 90
rubber	14 35	
resin	2 55	

Curative Agents		1 60
Filler Materials		78 31
iron grit	24 34	
kyanite	13 88	
powdered alumina	0 26	
graphite	7 78	
barytes	17 16	
coke	10 11	
cryolite	4 78	
MIX O		
Glass Fiber		6 21
Organic Binder		16 99
rubber	4 92	
resin	12 07	
Curative Agents		3.79
Filler Materials		73 01
iron grit	31 12	
kyanite	12 46	
graphite	6 63	
barytes	12 12	
coke	7 62	
zinc powder	3 06	
MIX P		
Fiber		6 85
glass	6 34	
cellulose	0 51	
Organic Binder		17 36
rubber	5 02	
resin	12 34	
Curative Agents		2 40
Filler Materials		73 40
iron grit	31 75	
kyanite	12 71	
graphite	6 85	
barytes	13 89	
coke	5 08	
zinc powder	3 12	
MIX R		
Fiber		9 56
glass	3 18	
cellulose	6 38	
Organic Binder		18 32
rubber	10 21	
resin	8 11	
Curative Agents		4 51
Filler Materials		67 61
iron grit	26 67	
kyanite	15 21	
barytes	6 38	
coke	11 17	
powdered alumina	1 08	
carbon black	7 10	

The performance of these composition friction materials against the A A R standards is shown below, where P=passed test and F=failed test

TEST RESULTS-EXAMPLE MIXES

Mix	Static Coeff of Friction	Wear Loss Drag Tests (in sup 3) Drag/Stops	Light Drag	Heavy Drag	Light BSL	Heavy BSL
A	347	16/ 33	P	P	P	P
B	514	09/ 33	P	P	P	P
C	570	11/ 26	P	P	P	P
D	480	23/ 56	P	P	P	P
E	390	17/ 57	P	P	P	P
F	563	33/ 18	P	P	P	P
G	515	11/ 33	P	P	P	P
H	397	23/ 56	P	P	P	P
J	597	10/ 32	P	P	P	P
L	494	17/1 03	P	P	P	P
M	457	15/ 59	P	P	P	P
N	544	12/ 31	P	P	P	P

All of the above mixes passed all of the A A R performance tests, with the exception of Mix A which exhibited slightly low coefficients of friction Mix L showed a relatively high wear rate, although within the A A R standards

It can be seen from the above test results that friction materials made from compositions including various synthetic fibers along, in combination with other synthetic fiber, or in combination with cellulose fiber can meet rigorous A A R standards and exhibit low wear rates The best wear rates were exhibited by Mixes A, B, C, G and N, which contained from 1 61-3 19% of a single synthetic fiber, and by Mix J which contained a low total content fiber mixture of synthetic and cellulose fibers

Overall fiber content ranged from 0 71% polyester (Mix E) to 9 56% glass and cellulose (Mix R) Binder content ranged from 16 90% (Mix N) to 19 74% (Mix F), while filler content was from 67 61% (Mix R) to 79.85% (Mix C) The amount and type of curative agents is mainly dependent on the amount and composition of the organic binder used

In summation, I have discovered that composition friction materials suitable for railroad use can be formulated, without the use of lead or asbestos, by using a relatively low content of various synthetic fibers alone, in combinations, or in combination with cellulose fiber

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