

CLAIMS

1. A gas turbine engine having an electrical harness formed from a flexible printed circuit board which provides a plurality of spaced conductive tracks, wherein:
the conductive tracks are grouped into plural layers (303a, 303b) of tracks (301a, 301b), the track layers being spaced apart and extending substantially parallel to each other,
5 the tracks of each track layer forming respective circuits which all have impedances lying within a respective range for that track layer; and the impedances ranges being non-overlapping.
2. A gas turbine engine according to claim 1 having a first track layer (303a) and a
10 second track layer (303b), the tracks (301a) of the first track layer all forming relatively low impedance circuits, and the tracks (301b) of the second track layer all forming relatively high impedance circuits.
3. A gas turbine engine according to claim 2, wherein the low impedance circuits are circuits that are protected directly or indirectly to ground.
- 15 4. A gas turbine engine according to claim 2 or 3, wherein the low impedance circuits are circuits that have an impedance of less than 10 Ohms when subjected to lightning strike indirect waveforms at all frequencies below 10 kHz.
5. A gas turbine engine according to any one of claims 2 to 4, wherein the high impedance circuits are circuits that are not protected directly or indirectly to ground.
- 20 6. A gas turbine engine according to any one of claims 2 to 5, wherein the high impedance circuits are circuits that have an impedance of greater than 100 Ohms when subjected to lightning strike indirect waveforms at all frequencies below 10 kHz.
7. A gas turbine engine according to any one of claims 2 to 6, wherein all the conductive tracks of the flexible printed circuit board are grouped into either the first track layer or the
25 second track layer.
8. A gas turbine engine according to any one of claims 2 to 6, wherein the conductive tracks are grouped into the first track layer, the second track layer, and a third track layer,
the first, the second and the third track layers being spaced apart and extending substantially parallel to each other, and the tracks of the third track layer forming

intermediate impedance circuits having impedances greater than the low impedance circuits but lower than the high impedance circuits.

9. A gas turbine engine according to claim 8, wherein the intermediate impedance circuits have impedances of from 10 to 100 Ohms when subjected to lightning strike indirect waveforms at all frequencies below 10 kHz, and/or

all the conductive tracks of the flexible printed circuit board are grouped into the first track layer, the second track layer or the third track layer.

10. An electrical harness according to any one of the preceding claims, wherein a part of the flexible printed circuit board (201) is embedded in a rigid material (285) and wherein, optionally, the rigid material is a rigid composite material.

11. A gas turbine engine according to any one of the previous claims, wherein the flexible printed circuit board has respective dielectric layers (305) between adjacent track layers, the or each dielectric layer being configured to withstand a differential voltage between the adjacent track layers of at least 1500 V.

12. A gas turbine engine according to any one of the previous claims, wherein each track layer is configured to withstand a differential voltage of at most 1500 V between adjacent tracks of that track layer.

13. A gas turbine engine according to any one of the previous claims, wherein each track layer is configured to withstand a differential voltage of at least 200 V between adjacent tracks of that track layer.

14. A gas turbine engine according to any one of the previous claims, wherein each track layer has at least four tracks.

15. The use of an electrical harness formed from a flexible printed circuit board for avoiding excessive induced voltage differentials during indirect lightning strikes between spaced conductive tracks (301a, 301b) grouped into respective layers (303a, 303b) of tracks of the electrical harness, the track layers being spaced apart and extending substantially parallel to each other, the tracks of each track layer forming respective circuits which all have impedances lying within a respective range for that layer, and the impedances ranges being non-overlapping.

CLAIMS

1. A gas turbine engine having an electrical harness formed from a flexible printed circuit board which provides a plurality of spaced conductive tracks, wherein:

5 the conductive tracks are grouped into plural layers (303a, 303b) of tracks (301a, 301b), the track layers being spaced apart and extending substantially parallel to each other, the tracks of each track layer forming respective circuits which all have impedances lying within a respective range for that track layer; and the impedances ranges being non-overlapping.

10 2. A gas turbine engine according to claim 1 having a first track layer (303a) and a second track layer (303b), the tracks (301a) of the first track layer all forming relatively low impedance circuits having low impedance relative to relatively high impedance circuits formed by the tracks of the second track layer.

3. A gas turbine engine according to claim 2, wherein the relatively low impedance circuits are circuits that are protected directly or indirectly to ground.

15 4. A gas turbine engine according to claim 2 or 3, wherein the relatively low impedance circuits are circuits that have an impedance of less than 10 Ohms when subjected to lightning strike indirect waveforms at all frequencies below 10 kHz.

5. A gas turbine engine according to any one of claims 2 to 4, wherein the relatively high impedance circuits are circuits that are not protected directly or indirectly to ground.

20 6. A gas turbine engine according to any one of claims 2 to 5, wherein the relatively high impedance circuits are circuits that have an impedance of greater than 100 Ohms when subjected to lightning strike indirect waveforms at all frequencies below 10 kHz.

25 7. A gas turbine engine according to any one of claims 2 to 6, wherein all the conductive tracks of the flexible printed circuit board are grouped into either the first track layer or the second track layer.

8. A gas turbine engine according to any one of claims 2 to 6, wherein the conductive tracks are grouped into the first track layer, the second track layer, and a third track layer, the first, the second and the third track layers being spaced apart and extending substantially parallel to each other, and the tracks of the third track layer forming

intermediate impedance circuits having impedances greater than the relatively low impedance circuits but lower than the relatively high impedance circuits.

9. A gas turbine engine according to any one of claims 8, wherein the intermediate impedance circuits have impedances of from 10 to 100 Ohms when subjected to lightning strike indirect waveforms at all frequencies below 10 kHz, and/or

all the conductive tracks of the flexible printed circuit board are grouped into the first track layer, the second track layer and the third track layer.

10. A gas turbine engine according to any one of the preceding claims, wherein a part of the flexible printed circuit board (201) is embedded in a rigid material (285) and wherein, optionally, the rigid material is a rigid composite material.

11. A gas turbine engine according to any one of the previous claims, wherein the flexible printed circuit board has respective dielectric layers (305) between adjacent track layers, the or each dielectric layer being configured to withstand a differential voltage between the adjacent track layers of at least 1500 V.

12. A gas turbine engine according to any one of the previous claims, wherein each track layer is configured to withstand a differential voltage of at most 1500 V between adjacent tracks of that track layer.

13. A gas turbine engine according to any one of the previous claims, wherein each track layer is configured to withstand a differential voltage of at least 200 V between adjacent tracks of that track layer.

14. A gas turbine engine according to any one of the previous claims, wherein each track layer has at least four tracks.

15. The use of an electrical harness formed from a flexible printed circuit board for avoiding excessive induced voltage differentials that would damage the electrical harness during indirect lightning strikes between spaced conductive tracks (301a, 301b) grouped into respective layers (303a, 303b) of tracks of the electrical harness, the track layers being spaced apart and extending substantially parallel to each other, the tracks of each track layer forming respective circuits which all have impedances lying within a respective range for that layer, and the impedances ranges being non-overlapping..