

DETACHABLE FAN BLADE PLATFORM AND METHOD OF REPAIRING SAME

BACKGROUND

[0001] This disclosure relates to a detachable fan blade platform for a fan section of a gas turbine engine. More particularly, the disclosure relates to a seal arrangement supported by the platform for sealing against adjacent fan blades.

[0002] Some fan sections of gas turbine engines utilize fan blades with nonintegral platforms. The platforms are provided by discrete structures arranged between adjoining fan blades. The fan blades and platforms are supported by a fan hub.

[0003] In one example arrangement, seals are provided on lateral sides of the platform to seal against the fan blades and provide a sealed inner flowpath. Each of the lateral sides is provided by a relatively flat surface. An L or P-shaped seal is bonded to each of the lateral surfaces with epoxy. A typically platform body is constructed from fiber reinforced composite material and the seals are constructed from fabric reinforced silicone.

[0004] The seals must be periodically replaced during engine service, which requires a significant amount of lead time. The seals must be cut or torn from the platform, and the old resin scraped away without damaging the platform. The new seals must then be bonded with an adhesive to each of the lateral sides.

SUMMARY

[0005] In one exemplary embodiment, a detachable fan blade platform includes a body having lateral sides each having a channel. A seal is removably received in each of the channels.

[0006] In a further embodiment of any of the above, the body is constructed from fiber reinforced composite material.

[0007] In a further embodiment of any of the above, the seal is constructed from an elastomer.

[0008] In a further embodiment of any of the above, the channels provide C-shape grooves. The seals include a bulb that is received in its respective channel and a flexible wall

extends from the bulb and away from the body. The wall is configured to seal against a fan blade surface.

[0009] In a further embodiment of any of the above, the bulb includes a hole, and the platform includes a pin that is received in the hole preventing the bulb from collapsing radially inward.

[0010] In a further embodiment of any of the above, the pin is plastic.

[0011] In a further embodiment of any of the above, the pin includes a head having a diameter larger than that of the hole.

[0012] In a further embodiment of any of the above, the body is integral with a portion of the channels and each channel includes another portion that is secured to the body.

[0013] In a further embodiment of any of the above, the other portion is secured to the body by thermal or chemical welding.

[0014] In a further embodiment of any of the above, the body includes flanges opposite an inner flow path. The brackets include attachment features that are configured to secure the body to a hub.

[0015] In another exemplary embodiment, a method of repairing a fan blade platform includes the steps of removing a nose cone to provide access to a fan hub, detaching a platform from the fan hub, and pulling a removable seal from a groove in the platform.

[0016] In a further embodiment of any of the above, the removing step includes removing a cap and a spinner.

[0017] In a further embodiment of any of the above, the pulling step includes sliding a pin out of the seal and removing the seal from a channel in the platform.

[0018] In a further embodiment of any of the above, the method includes the step of installing a new seal in the groove.

[0019] In a further embodiment of any of the above, the installing step includes sliding the new seal into the groove.

[0020] In a further embodiment of any of the above, the installing step includes sliding the pin into a longitudinal hole in the new seal.

[0021] In a further embodiment of any of the above, the installing step includes reattaching the nose cone to the fan hub. The nose cone blocks the pin in an axial direction.

[0022] In another exemplary embodiment, a seal for a detachable fan blade platform includes a longitudinally extending elastomeric body that provides a bulb having a longitudinal hole. A flexible wall is integral with and extends from the bulb.

[0023] In another exemplary embodiment, a fan section for a gas turbine engine includes a hub. The gas turbine engine includes a fan blade secured to the hub. A platform is removably secured to the hub and adjacent to the fan blade. The platform has a body with lateral sides that each have a channel. A seal is removably received in each of the channels, with one of the seals abutting the fan blade.

[0024] In a further embodiment of any of the above, a pin is received in a hole in the seals and a nose cone is secured to the hub and blocks the pin in an axial direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The disclosure can be further understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0026] Figure 1 is a perspective view of a portion of a fan section having fan blades and discrete platforms.

[0027] Figure 2 is a cross-sectional view through a portion of the fan section shown in Figure 1.

[0028] Figure 3 is an exploded view of an example platform including removable seals and a pin.

[0029] Figure 4 is an enlarged end view of a portion of the platform shown in Figure 3.

[0030] Figure 5 is a cross-section through the platform taken along line 5-5 in Figure 3 with a spinner arranged at a forward end of the platform.

[0031] Figure 6 is a view similar to Figure 4 but with a fan blade schematically depicted in an installed position.

DETAILED DESCRIPTION

[0032] A fan section 10 of a gas turbine engine is schematically depicted in Figure 1. The fan section 10 includes multiple circumferentially arranged fan blades 12. The fan blades 12 include non-integral, discrete platforms 24 arranged between adjacent fan blades 12. Referring to Figures 1 and 2, the fan blades 12 are mounted to a fan hub 14. A nose cone is arranged forward of the fan blades 12 to provide an aerodynamic inner flowpath through the fan section 10. The nose cone is provided by a spinner 16 secured to the fan hub 14 by fasteners 18. A cap 20 is secured to the spinner 16 by fasteners 22.

[0033] Referring to Figure 2, the platform 24 includes first and second flanges 26, 28 secured to corresponding attachment features on the fan hub 14 respectively by fasteners 30, 32. The fasteners 18, 22, 30, 32 are schematically depicted in Figure 2 by simple, thickened lines for clarity.

[0034] Referring to Figures 3-5, the platform 24 is provided by a body 54 having lateral sides 36 that each include a channel 34 providing a C-shaped groove. In one example, the grooves may be 1/4"- 3/8" (6.35 – 9.53 mm) in diameter. The body 54 may be an injection molded part. The channels 34 may be difficult to injection mold due to their complex shape. To this end, it may be desirable to secure a portion 52 to the body 54 by thermal or chemical welding, for example. Portions of the channels 34 may be integrally molded with the body 54. In this manner, portions of the channels 34 may be provided by separate molded parts and then assembled into a unitary body 54 to provide the entire channel length. Alternatively, the groove may be machined into the body 54.

[0035] A seal 38 is provided in each of the channels 34. In one example, the seal 38 includes a bulb 40 receiving the channel. A stop may be provide at the aft end of each channel 34 to limit the travel of the seal 38 during its insertion into the channel 34. In one example, the bulb 40 has a circular cross-section, although it should be understood that the bulb 40 may have any suitable shape. The bulb 40 is hollow in one example and includes a longitudinally extending hole 42. The hole 42 increase the flexibility of the bulb 40, which enables the seal 38 to more easily be slid into the channel 34 during replacement. The hole 42

receives a pin 46 that prevents the bulb 40 from collapsing during operation. A flexible wall 44 extends outwardly from the bulb 40 away from the body 54.

[0036] In one example, the pin 46 and body 54 are fiber reinforced thermoplastic, and the seal 38 is an elastomeric material. In one example, the body 54 may be constructed from a polyetherimide, such as ULTEM, that is carbon and/or glass filled. The pin 46 may be constructed from a nylon material or a polyether ether ketone (PEEK), for example. The seal 38 may be constructed from silicone, for example. In one example, the bulb 40 may have a fabric embedded into its exterior to provide improved durability in scenarios in which the seals rub within the channel 34 and against the fan blade 12.

[0037] The pin 46 includes a head 48 that may be provided at one end, for example, the forward end. As illustrated in Figure 5, the spinner 16 may abut the head 48 subsequent to installation of the nose cone onto the fan hub, preventing the pin 46 from moving in an axial direction and coming unseated from the seal 38.

[0038] The disclosed fan blade platform may be more easily repaired in that adhesive need not be used. As a result, the seals 38 may be slid into and out of the platform 24 during repair. In one example, the cap 20 and spinner 16 are removed from the hub 14. The affected platform is removed from the fan hub for access. The pin 46 is slid out of the hole 42 of the seal 38. The seal 38 may be slid or pulled from the channel 34. There is no adhesive that must be removed from the platform, enabling the technician to repair the platform at the engine. A new seal is slid into the channel 34, and the pin 46 is inserted into the hole 42 of the new seal. The platform is reattached to the fan hub. The fan blade 12 includes a surface 50 that deflects the wall 44 radially inward, as shown in Figure 6. The nose cone is again installed onto the hub 14, which blocks the pin 46.

[0039] Although an example embodiment has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of the claims. For that reason, the following claims should be studied to determine their true scope and content.

CLAIMS

1. A detachable fan blade platform comprising:
a body having lateral sides each having a channel; and
a seal removably and slidably received in each of the channels and retained therein without adhesive.
2. The platform according to claim 1, wherein the body is constructed from fiber reinforced composite material.
3. The platform according to claim 1, wherein the seal is constructed from an elastomer.
4. The platform according to claim 1, wherein the channels provide C-shape grooves, the seals include a bulb received in its respective channel, and a flexible wall extends from the bulb and away from the body, the wall configured to seal against a fan blade surface.
5. The platform according to claim 4, wherein the bulb includes a hole, and comprising a pin received in the hole preventing the bulb from collapsing radially inward.
6. The platform according to claim 5, wherein the pin is plastic.
7. The platform according to claim 5, wherein the pin includes a head having a diameter larger than that of the hole.
8. The platform according to claim 1, wherein the body is integral with a portion of each of the channels, and each channel includes another portion secured to the body.
9. The platform according to claim 8, wherein the other portions are secured to the body by thermal or chemical welding.

10. The platform according to claim 1, wherein the body includes flanges opposite an inner flow path, the flanges including attachment features configured to secure the body to a hub.

11. A method of repairing a fan blade platform comprising the steps of:
removing a nose cone to provide access to a fan hub;
detaching the platform from the fan hub;
pulling a removable seal from a groove in the platform; and
sliding a new seal in the groove and retaining the new seal therein without adhesive.
12. The method according to claim 11, wherein the removing step includes removing a cap and a spinner.
13. The method according to claim 11, wherein the pulling step includes sliding a pin out of the seal and removing the seal from a channel in the platform.
14. The method according to claim 11, comprising the step of installing a new seal in the groove.
15. The method according to claim 14, wherein the installing step includes sliding the new seal into the groove.
16. The method according to claim 13, wherein the installing step includes sliding the pin into a longitudinal hole in the new seal.
17. The method according to claim 16, wherein the installing step includes reattaching the nose cone to the fan hub, the nose cone blocking the pin in an axial direction.
18. A seal for a detachable fan blade platform comprising:
a longitudinally extending elastomeric body providing a bulb having a longitudinal hole, a flexible wall is integral with and extending from the bulb.
19. A fan section for a gas turbine engine comprising:
a hub;
a fan blade secured to the hub;

a platform removably secured to the hub and adjacent to the fan blade, the platform having a body with lateral sides, wherein each of the lateral sides have a channel; and

a seal removably and slidably received in each of the channels and retained therein without adhesive, with one of the seals abutting the fan blade.

20. The fan section according to claim 19, comprising a pin received in a hole in each of the seals, and a nose cone secured to the hub and blocking the pin in an axial direction.