SUMMARY OF THE DISCLOSURE

A need exists for an efficient method of repairing a composite material, such as within a layup that forms a portion of a component, such as a portion of an aircraft wing.

With that need in mind, certain embodiments of the present disclosure provide a method of repairing a through-hole formed in a structure having at least one composite material. The method includes filling at least a portion of the through-hole with a potting compound, initially heating the potting compound to set the potting compound within the through-hole, drilling a hole through the potting component that is set within the through-hole, and inserting a portion of a cartridge heater into the through-hole. The inserting includes inserting a shaft of the cartridge heater into the hole through the potting component. The method also includes~~, and~~ curing the potting compound with the cartridge heater.

The method may include plugging a first end of the through-hole. The filling occurs after the plugging.

In at least one embodiment, the curing includes concentrating heat energy within an intermediate portion of a shaft of the cartridge heater. The intermediate portion is between a proximal end and a distal end of the shaft. The concentrating may also include generating lesser amounts of heat energy at the proximal end and the distal end than at the intermediate portion.

~~In at least one embodiment, the method includes initially heating the potting compound to set the potting compound within the through-hole. The method may also include drilling a hole through the potting compound that is set within the through-hole. The inserting may include inserting a shaft of the cartridge heater in the hole through the potting compound.~~

The method also includes removing the portion of the cartridge heater from the through-hole after the curing. In at least one embodiment, the method includes drilling a full-size hole through the potting compound within the through-hole of the structure after the curing (and/or the removing).

The method may include applying a release agent to the portion of the cartridge heater before the inserting.

In at least one embodiment, the filling occurs before the inserting. In at least one other embodiment, the filling occurs after the inserting. In at least one embodiment, the inserting includes inserting the portion of the cartridge heater into the potting compound within the through-hole before the potting compound sets.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagrammatic representation of a front perspective view of a vehicle, according to an embodiment of the present disclosure.

~~WHAT IS CLAIMED IS:~~CLAIMS

1. A method of repairing a through-hole ~~(352)~~ formed in a structure ~~(204, 302)~~ having at least one composite material, the method comprising:

filling at least a portion of the through-hole ~~(352)~~ with a potting compound ~~(322, 508)~~;

initially heating the potting compound to set the potting compound within the through-hole;

drilling a hole through the potting component that is set within the through-hole;

inserting a portion of a cartridge heater ~~(100)~~ into the through-hole ~~(352)~~, wherein the inserting comprises inserting a shaft of the cartridge heater into the hole through the potting component; and

curing the potting compound ~~(322, 508)~~ with the cartridge heater ~~(100)~~.

2. The method of claim 1, further comprising plugging a first end ~~(321)~~ of the through-hole ~~(352)~~, wherein the filling occurs after the plugging.

3. The method of claims 1 or 2, wherein the curing comprises concentrating heat energy within an intermediate portion ~~(110)~~ of a shaft ~~(102)~~ of the cartridge heater ~~(100)~~, wherein the intermediate portion ~~(110)~~ is between a proximal end ~~(108) (321)~~ and a distal end ~~(112)~~ of the shaft ~~(102)~~.

4. The method of claim 3, wherein the concentrating further comprises generating lesser amounts of heat energy at the proximal end ~~(108, 321)~~ and the distal end ~~(112)~~ than at the intermediate portion ~~(110)~~.

~~5. The method of any one of claims 1-4, further comprising initially heating the potting compound (322, 508) to set the potting compound (322, 508) within the through-hole (352).~~

~~6. The method of any one of claims 1-5, further comprising drilling a hole (352) through the potting compound (322, 508) that is set within the through-hole (352), and wherein the inserting comprises inserting a shaft (102) of the cartridge heater (100) in the hole (352) through the potting compound (322, 508).~~

~~7~~5. The method of any one of claims 1-~~6~~4, further comprising removing the portion of the cartridge heater ~~(100)~~ from the through-hole ~~(352)~~ after the curing.

~~8~~6. The method of any one of claims 1-~~7~~5, further comprising drilling a full-size hole ~~(352)~~ through the potting compound ~~(322, 508)~~ within the through-hole ~~(352)~~ of the structure ~~(204, 302)~~ after the curing.

~~9~~7. The method of any one of claims 1-~~8~~6, further comprising applying a release agent to the portion of the cartridge heater ~~(100)~~ before the inserting.

~~10~~8. The method of any one of claims 1-~~9~~7, wherein the filling occurs before the inserting.

~~11~~9. The method of any one of claims 1-~~9~~7, wherein the filling occurs after the inserting.

~~12~~10. The method of any one of claims 1-~~11~~9, wherein the inserting comprises inserting the portion of the cartridge heater ~~(100)~~ into the potting compound ~~(322, 508)~~ within the through-hole ~~(352)~~ before the potting compound ~~(322, 508)~~ sets.

~~13. A method of repairing a through-hole (352) formed in a structure (204, 302) having at least one composite material, the method comprising:~~

~~filling at least a portion of the through-hole (352) with a potting compound (322, 508);~~

~~inserting a portion of a cartridge heater (100) into the through-hole (352);~~

~~curing the potting compound (322, 508) with the cartridge heater (100), wherein the curing comprises concentrating heat energy within an intermediate portion (110) of a shaft (102) of the cartridge heater (100), wherein the intermediate portion (110) is between a proximal end (108) (321) and a distal end (321, 112) of the shaft (102), wherein the concentrating heat energy comprises generating lesser amounts of heat energy at the proximal end (108, 321) and the distal end (321, 112) than at the intermediate portion (110);~~

~~removing the portion of the cartridge heater (100) from the through-hole (352) after the curing; and~~

~~drilling a full-size hole (352) through the potting compound (322, 508) within the through-hole (352) of the structure (204, 302) after the curing and the removing.~~

~~14. The method of claim 13, further comprising plugging a first end (321) of the through-hole (352), wherein the filling occurs after the plugging.~~

~~15. The method of claims 13 or 14, further comprising initially heating the potting compound (322, 508) to set the potting compound (322, 508) within the through-hole (352).~~

~~16. The method of any one of claims 13-15, further comprising drilling a hole (352) through the potting compound (322, 508) that is set within the through-hole (352), and wherein the inserting comprises inserting a shaft (102) of the cartridge heater (100) in the hole (352) through the potting compound (322, 508).~~

~~17. The method of any one of claims 13-16, further comprising applying a release agent to the portion of the cartridge heater (100) before the inserting.~~

~~18. The method of any one of claims 13-17, wherein the filling occurs before the inserting.~~

~~19. The method of any one of claims 13-17, wherein the filling occurs after the inserting.~~

~~20. The method of any one of claims 13-19, wherein the inserting comprises inserting the portion of the cartridge heater (100) into the potting compound (322, 508) within the through-hole (352) before the potting compound (322, 508) sets.~~