SUMMARY

[0004a] In a first aspect, there is provided a downhole measurement apparatus comprising: a longitudinal body including a nuclear logging tool, the logging tool further comprising an outsert containing a detector, the outsert disposed in an exterior pocket of the body and coupled therein; and a stabilizer coupled to the body adjacent the nuclear logging tool to deflect the logging tool and the outsert toward an earth formation; wherein the logging tool further comprises a nuclear source axially spaced from the detector, and the axial space between the nuclear source and the detector is calibrated.

[0004b] In a second aspect, there is provided a downhole measurement apparatus comprising: a longitudinal body including a nuclear logging tool, the logging tool further comprising an outsert containing a detector, the outsert disposed in an exterior pocket of the body and coupled therein; and a stabilizer coupled to the body adjacent the nuclear logging tool to deflect the logging tool and the outsert toward an earth formation; wherein the outsert is a pressure housing sealing the detector from the exterior of the body, and the pressure-sealed outsert is removable from the pocket.

[0004c] In a third aspect, there is provided a downhole measurement apparatus comprising: a longitudinal drill collar body including a nuclear logging tool, the logging tool further comprising: a nuclear source holder containing a nuclear source; and an outsert containing a detector, the outsert coupled in an exterior pocket of the drill collar body; wherein the nuclear source is axially spaced a calibrated distance from the detector; and a stabilizer coupled to the body adjacent the nuclear logging tool; wherein the nuclear source holder and the outsert are exposed to an exterior of the drill collar body to dispose the nuclear source and the detector adjacent an outer diameter of the drill collar body.

[0004d] In a fourth aspect, there is provided a downhole measurement apparatus comprising: a longitudinal drill collar body having an exterior pocket and an outer diameter; an outsert coupled into and exposed through the exterior pocket to position the outer surface of the outsert adjacent to the outer diameter of the drill collar body, the outsert containing a logging sensor; a nuclear source holder disposed in the drill collar body containing a nuclear source axially spaced a calibrated distance from the logging sensor; and a stabilizer coupled to the body adjacent the nuclear logging tool to increase proximity of the outer surface of the outsert to an earth formation.

CLAIMS

~~What is claimed is:~~

1. A downhole measurement apparatus comprising:

a longitudinal body including a nuclear logging tool, the logging tool further comprising an outsert containing a detector, the outsert disposed in an exterior pocket of the body and coupled therein; and

a stabilizer coupled to the body adjacent the nuclear logging tool to deflect the logging tool and the outsert toward an earth formation;

wherein the logging tool further comprises a nuclear source axially spaced from the detector, and the axial space between the nuclear source and the detector is calibrated.

~~2. The apparatus of claim 1 wherein the outsert is a pressure housing sealing the detector from the exterior of the body.~~

~~3~~2. A downhole measurement apparatus comprising:

a longitudinal body including a nuclear logging tool, the logging tool further comprising an outsert containing a detector, the outsert disposed in an exterior pocket of the body and coupled therein; and

a stabilizer coupled to the body adjacent the nuclear logging tool to deflect the logging tool and the outsert toward an earth formation;

wherein the outsert is a pressure housing sealing the detector from the exterior of the body, and~~The apparatus of claim 2 wherein~~ the pressure-sealed outsert is removable from the pocket.

~~4. The apparatus of claim 1 wherein the logging tool further comprises a nuclear source axially spaced from the detector.~~

~~5. The apparatus of claim 4 wherein the axial space between the nuclear source and the detector is calibrated.~~

~~6~~3. The apparatus of claim ~~5~~1 wherein the axial space is calibrated via a source holder coupled to the outsert to form a sensor package.

~~7~~4. The apparatus of claim ~~5~~1 wherein the axial space is calibrated via a fixed position of the nuclear source in an integrated source holder portion of the body.

~~8~~5. The apparatus of claim ~~6~~3 wherein the source holder includes interlocking tabs coupled to the body.

~~9~~6. The apparatus of claim 1 further comprising a hydrostatic locking screw coupling the outsert to the body.

~~10~~7. The apparatus of claim 1 further comprising a spacer block coupled between the outsert and the body pocket.

~~11~~8. The apparatus of claim 1 further comprising a finger retention mechanism coupling the outsert in the pocket.

~~12~~9. The apparatus of claim 1 further comprising an interlocking wedge mechanism coupling the outsert in the pocket.

~~13~~10. The apparatus of claim 1 further comprising an interconnect junction coupling the outsert to a second outsert in the pocket.

~~14~~11. A downhole measurement apparatus comprising:

a longitudinal drill collar body including a nuclear logging tool, the logging tool further comprising:

a nuclear source holder containing a nuclear source; and

an outsert containing a detector, the outsert coupled in an exterior pocket of the drill collar body;

wherein the nuclear source is axially spaced a calibrated distance from the detector; and

a stabilizer coupled to the body adjacent the nuclear logging tool;

wherein the nuclear source holder and the outsert are exposed to an exterior of the drill collar body to dispose the nuclear source and the detector adjacent an outer diameter of the drill collar body.

~~15. The apparatus of claim 14 wherein the nuclear source holder and the outsert are exposed to an exterior of the drill collar body to dispose the nuclear source and the detector adjacent an outer diameter of the drill collar body.~~

~~16~~12. The apparatus of claim ~~15~~11 wherein the stabilizer deflects the logging tool toward an earth formation to position the nuclear source and the detector in close proximity to the earth formation.

~~17~~13. The apparatus of claim ~~14~~11 wherein the nuclear source holder is coupled to the outsert to form a sensor package.

~~18~~14. The apparatus of claim ~~14~~11 wherein the nuclear source holder is an integrated portion of the drill collar body.

~~19~~15. A downhole measurement apparatus comprising:

a longitudinal drill collar body having an exterior pocket and an outer diameter;

an outsert coupled into and exposed through the exterior pocket to position the outer surface of the outsert adjacent to the outer diameter of the drill collar body, the outsert containing a logging sensor;

a nuclear source holder disposed in the drill collar body containing a nuclear source axially spaced a calibrated distance from the logging sensor; and

a stabilizer coupled to the body adjacent the nuclear logging tool to increase proximity of the outer surface of the outsert to an earth formation.

~~20~~16. The apparatus of claim ~~19~~15 wherein the stabilizer is an off-center stabilizer including a radially greatest blade opposite the outsert on the drill collar body.

~~21~~17. The apparatus of claim ~~19~~15 wherein the outsert is removable and interchangeable between multiple drill collar bodies.

~~22~~18. The apparatus of claim ~~19~~15 wherein the nuclear source holder is coupled to the outsert to form a sensor package.

~~23~~19. The apparatus of claim ~~19~~15 wherein the nuclear source holder is an integrated portion of the drill collar body.

~~24~~20. The apparatus of claim ~~19~~15 further comprising an outsert retention mechanism including a hydrostatic locking screw, a spacer block, a finger retention mechanism, an interlocking wedge mechanism, an interconnect junction, or a combination thereof.