Claims

1. Safety system for an inductive power transfer system for transferring power to a vehicle on a surface of a route (11),
   wherein the primary unit comprises at least one primary winding (7) for generating an electromagnetic primary field for the inductive power transfer, wherein a charging surface (10) of the route (11) is assigned to the primary winding,
   wherein the safety system (5) comprises at least one inductive sensing system,
   wherein the inductive sensing system comprises multiple detection windings (2) ~~characterized in that~~ wherein
   the multiple detection windings (2) are arranged in an array structure (27), wherein the array structure (27) covers the charging surface (10) at least partially,
   characterized in that the inductive sensing system comprises at least one excitation winding (12, 12a, 12b).

2. The safety system of claim 1, wherein a detection winding (2) is part of an LC oscillating circuit.

3. The safety system of claim 2, wherein a predetermined number of oscillating circuits are connected parallel to each other, wherein the inductive elements of each of the oscillating circuits are at least partially provided by one detection winding.

4. The safety system of claim 1 to 3, wherein the inductive sensing system is designed as a primary field or total field compensating sensing system and/or each detection winding (2) is designed and/or arranged as a primary field or total field compensating winding.

5. The safety system of claim 4, wherein at least one of the detection windings (2) comprises an even number of counter-oriented subwindings (2a, 2b).

~~6. The safety system according to one of the claims 1 to 5, wherein the inductive sensing system comprises at least one excitation winding (12, 12a, 12b).~~

~~7.~~6. The safety system according to any one of claims 1 to 5~~claim 6~~, wherein the excitation winding (12a, 12b, 12) is part of a LC oscillating circuit.

8.7. The safety system according to one of the claims 6 1 or to 76, wherein the excitation winding(s) (12, 12a, 12b) and the detection windings (2) are arranged such that a foreign object (4) located on or in a proximity of the charging surface (11) is arranged in between the excitation winding(s) (12, 12a, 12b) and the detection windings (2).

9.8. The safety system according to one of the claims 6 or 71 to 6, wherein the excitation winding(s) (12, 12a, 12b) and the detection windings (2) are arranged such that a foreign object (4) located on or in a proximity of the charging surface (11) is arranged above the excitation winding(s) (12, 12a, 12b) and above the detection windings (2).

10.9. The safety system according to one of the claims 6 to 91 to 8, wherein at least one excitation winding (12) is provided by the primary winding (7).

11.10. The safety system according to one of the claims 6 to 91 to 8, wherein the excitation winding (12, 12a, 12b) is provided by a winding structure different from the primary winding (7).

12.11. The safety system according to claim 1110, wherein an excitation winding (12, 12a, 12b)
or a group of excitation windings (12, 12a, 12b) is/are designed and arranged such that an excitation field (8) is generated such that a magnetic flux received by (a) corresponding detection winding(s) (2) is zero in a normal operating mode.

13.12. The safety system according to claim 1211, wherein the excitation winding (12, 12a, 12b) is designed such that an even number of poles is provided, wherein the excitation winding (12, 12a, 12b) and a corresponding detection winding (2) are arranged and/or designed such that the magnetic flux generated by different poles extends through the detection surface of the detection winding (2).

14.13. The safety system according to one of the claims 1 to 1312, characterized in that the safety system (5) comprises an acoustic sensor (31) and a current impulse generating means.

~~15.~~14. The safety system according to one of the claims 1 to ~~14~~13, wherein the safety system (5) comprises a microwave transmitting device and a microwave receiving device.

~~16.~~15. The safety system according to claim ~~15~~14, wherein at least one of the detection windings (2) is designed as the microwave receiving device and/or one excitation winding (12, 12a, 12b) is designed as the microwave transmitting device.

~~17.~~16. The safety system according to one of the claims 1 to ~~16~~15, wherein the detection windings (2) are designed as circular detection windings.

~~18.~~17. The safety system according to claim ~~17~~16, wherein the circular detection surfaces (9) of at least two circular detection windings (2) at least partly overlap.

~~19.~~18. The safety system according to one of the claims 1 to ~~16~~15, the detection windings (2) are designed as hexagonal-shaped or rectangular-shaped detection windings.

~~20.~~19. The safety system according to one of the claims 1 to ~~19~~18, wherein the safety system (5) comprises at least one primary field or total field cancellation means for generating a cancellation field (25), wherein the cancellation means is designed and/or arranged such that the primary field or total field (24) can be at least partially cancelled by the cancellation field (25).

~~21.~~20. Method of operating a safety system (5) of an inductive power transfer system for transferring power to a vehicle on a surface of a route (11),
wherein the primary unit comprises at least one primary winding (7) for generating an electromagnetic primary field for the inductive power transfer, wherein a charging surface (10) of the route is assigned to the primary winding (7),
wherein the safety system (5) comprises at least one inductive sensing system,
wherein the inductive sensing system comprises multiple detection windings (2) arranged in an array structure (27) covering the charging surface (10) at least partially,
characterized in that
the inductive sensing system comprises at least one excitation winding (12, 12a, 12b),
wherein

- an output signal of each of the the multiple detection windings (2) is measured,

- an electrical characteristic or parameter is determined depending on the measured output signal and
- the electrical characteristic or parameter is compared to a reference value.

~~22.~~21. The method of claim ~~21~~20, wherein
- an excitation field (8) is generated by at least one excitation winding (12, 12a, 12b),
- the excitation field (8) is received by at least one corresponding detection winding (2) and
- an output voltage of the at least one detection winding (2) is evaluated.

~~23.~~22. The method according to one of the claims ~~21~~ 20 to ~~22~~21, wherein
- an acoustic sensor (31) captures sound waves after the excitation field (8) has been generated and
- an output signal of the acoustic sensor (31) is evaluated.

~~24.~~23. The method according to claims ~~21~~ 20 to ~~23~~22, wherein a radar or microwave signal is emitted along the charging surface (10), wherein the reflected radar or microwave signal is received by at least one microwave receiving device, wherein a radar- or microwave-based object detection based on the received signal is conducted.

~~25.~~24. The method according to claims ~~21~~ 20 to ~~24~~23, wherein a cancellation field (25) is generated by at least one primary field or total field cancellation means if a foreign object (4) has been detected.

~~26. Method of building a safety system (5) for an inductive power transfer for transferring power to a vehicle on a surface of a route (11), wherein the primary unit comprises at least one primary winding (7) for generating an electromagnetic primary field for the inductive power transfer, wherein a charging surface (10) of the route is assigned to the primary winding (7), wherein~~
- ~~multiple detection windings (2) are provided,~~
- ~~the detection windings (2) are arranged in an array structure (27), wherein the array structure (27) covers the charging surface (10) at least partially.~~