Claims

1. A sensor system for sensing the contents of a bore, the sensor system comprising:

plural electromagnetic coils arranged facing the bore for generating an electromagnetic field directed laterally into the bore;

a drive circuit arrangement arranged to generate electrical oscillations in the coils for producing oscillating electromagnetic fields that interact with the contents of the bore; and

a detection circuit arrangement arranged to detect a parameter of the electrical oscillations generated in each coil.

2. A sensor system according to claim 1, wherein the coils include coils at different angular positions around the bore.

3. A sensor system according to claim 2, further comprising at least one additional coil extending around the bore for generating an electromagnetic field directed along the bore, the drive circuit arrangement being arranged also to generate electrical oscillations in the additional coil for producing oscillating electromagnetic fields that interact with the contents of the bore, and the detection circuit arrangement also being arranged to detect a parameter of the electrical oscillations generated in the additional coil.

4. A sensor system according to claim 1, wherein the coils include at least two sets of electromagnetic coils, the coils within each set being arranged at different angular positions around the bore overlapping in the axial direction, the sets of coils being separated along the axial direction of the bore.

5. A sensor system according to claim 1, further comprising a processing circuit supplied with the detected parameters and arranged to derive a measure of position of an elongate component in the bore.

6. A sensor system according to claim 5, wherein the processing circuit is arranged to derive a measure of the lateral position of the elongate component.

7. A sensor system according to claim 6, wherein the coils include coils at different angular positions around the bore, and the processing circuit is arranged to derive a measure of the lateral position of the elongate component based on a comparison of the detected parameters from coils at different angular positions.

8. A sensor system according to claim 7, wherein said measure of the lateral position of the elongate component comprises at least one differential measure, in respect of a lateral axis, of the detected parameters from coils aligned with the lateral axis.

9. A sensor system according to claim 8, wherein said differential measure, in respect of a lateral axis, is normalised by the total of the detected parameters from the coils aligned with the lateral axis.

10. A sensor system according to any one of claims 5 to 9, wherein the processing circuit is arranged to derive a measure of the axial position along the bore of a feature in the elongate component.

11. A sensor system according to claim 10, wherein the coils include coils at different axial positions along the axial direction of the bore, and the processing circuit is arranged to derive a measure of the axial position along the bore of a feature in the elongate component based on a comparison of the detected parameters from coils at different axial positions.

12. A sensor system according to claim 11, wherein the coils include at least two sets of electromagnetic coils, the coils within each set being arranged at different angular positions around the bore overlapping in the axial direction, the sets of coils being separated along the axial direction of the bore, wherein the processing circuit is arranged to derive the measure of the axial position along the bore of a feature in the elongate component based on a comparison, as between at least one pair of sets of coils, of a combined measure of the detected parameters from each coil in the respective set.

13. A sensor system according to claim 12, wherein the sets of coils are separated

along the axial direction of the bore by a separation that is at least the axial extent of the coils within a set.

14. A sensor system according to claim 12 or 13, wherein the coils of each set are each arranged at the same axial position along the bore.

15. A sensor system according to any one of claims 12 to 14, wherein the coils are arranged circumferentially around the bore with equal angular spacing.

16. A sensor system according to any one of claims 12 to 15, wherein the coils within each set are shaped to overlap in the axial direction.

17. A sensor system according to any one of claims 12 to 16, wherein the drive circuit arrangement is arranged to generate electrical oscillations in the coils in turn within each respective set.

18. A sensor system according to any one of claims 12 to 17, wherein said measure of the axial position along the bore of a feature in the elongate component comprises a differential measure of said combined measures of the detected parameters from each coil in the respective sets.

19. A sensor system according to claim 18, wherein said differential measure of said combined measures of the detected parameters from each coil in the respective set is normalised by the total of the combined measures from the respective sets.

20. A sensor system according to any one of claims 12 to 19, wherein said combined measures of the detected parameters from each coil in the respective sets are sums of the detected parameters from each coil in the respective sets.

21. A sensor system according to any claims 12 to 20, wherein the sensor system comprises at least three sets of electromagnetic coils, and said measure of the axial position of a feature in the elongate component is based on a comparison, as between each pair of

sets of coils within the total number of sets of coils.

22. A sensor system according to any one of the preceding claims, further comprising a processing circuit supplied with the detected parameters and arranged to derive a measure of the electromagnetic properties of the contents of the bore in a region adjacent each respective coil from the detected parameters from that coil.

23. A sensor system according to claim 22, wherein the coils include coils at different angular positions around the bore and coils at different axial positions along the axial direction of the bore.

24. A sensor system according to any one of the preceding claims, wherein the elongate component comprises a drill string of drill pipes connected by joint sections.

25. A sensor system according to any one of the preceding claims, wherein the drive circuit arrangement is arranged to generate electrical oscillations in each respective coil in turn.

26. A sensor system according to claim 25, wherein the drive circuit arrangement comprises a single oscillator circuit and a switch arrangement arranged to connect the oscillator circuit to each respective coil in turn for generating electrical oscillations in the coils in turn.

27. A sensor system according to any one of the preceding claims, wherein each coil is identically shaped.

28. A sensor system according to any one of the preceding claims, wherein the drive circuit arrangement comprises a marginal oscillator circuit.

29. A sensor system according to any one of the preceding claims, wherein said parameter of the electrical oscillations generated in each coil is the frequency of the electrical oscillations.

30. A sensor system according to any one of the preceding claims, wherein the electrical oscillations are radio frequency electrical oscillations.

31. A sensor system according to any one of the preceding claims, wherein the coils are disposed behind a non-metallic lining of the bore.

32. A sensor system according to any one of the preceding claims, wherein the coils are embedded within a non-metallic lining of the bore.

33. A sensor system according to claim 32, wherein the non-metallic lining is a insert that seals a joint between two sections of a tube forming the bore.