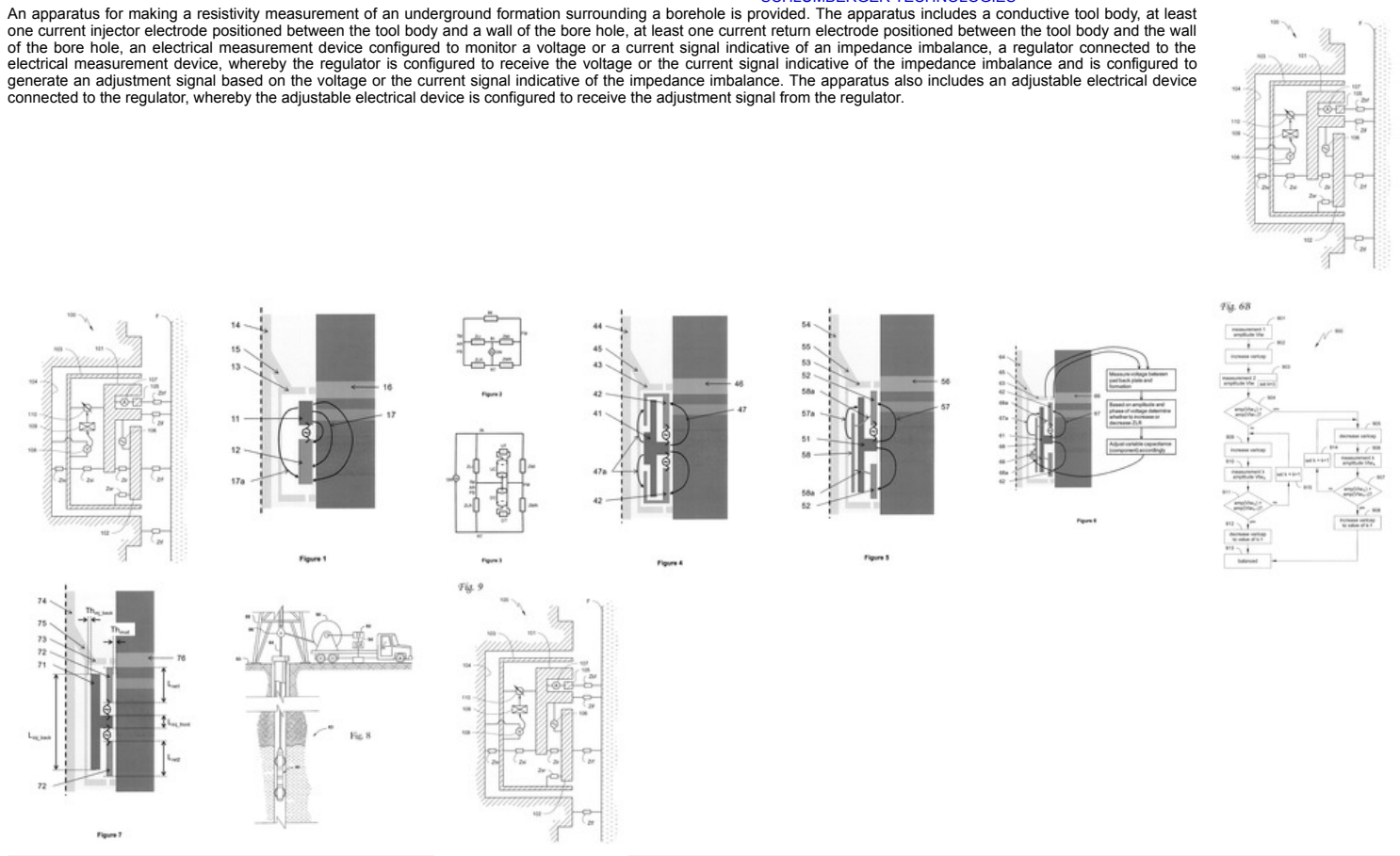


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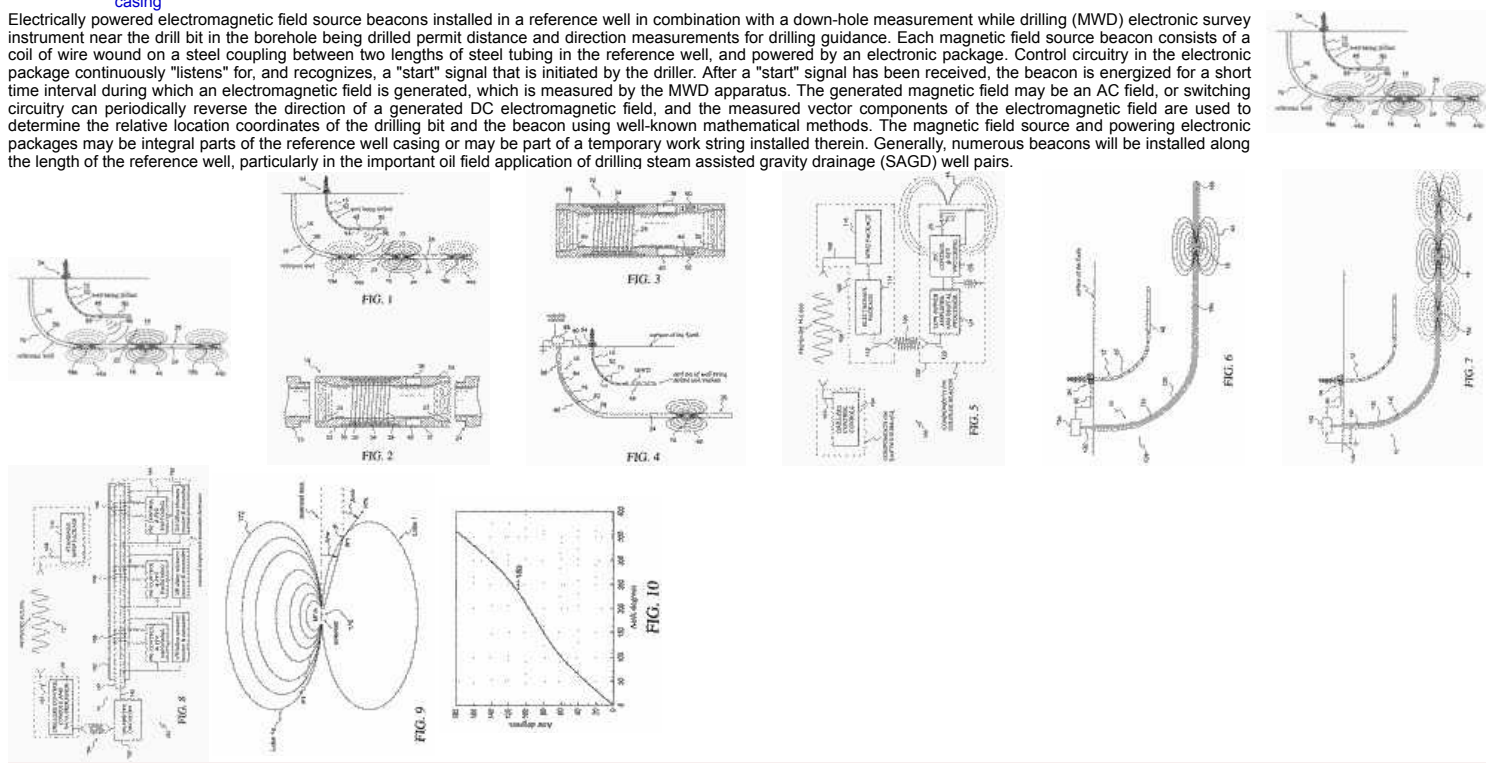
#	Title	Publication number	1st app. date	Applicant/Assignee	1st publ. date	Publ. date
1.	Apparatus and method for actively balancing impedance of a resistivity measuring tool	WO2012174317	2011-06-16	POLICY RESEARCH & DEVELOPMENT PRAD SCHLUMBERGER SCHLUMBERGER SERVICES PETROLIERS SCHLUMBERGER TECHNOLOGIES*	2012-12-20	2012-12-20

An apparatus for making a resistivity measurement of an underground formation surrounding a borehole is provided. The apparatus includes a conductive tool body, at least one current injector electrode positioned between the tool body and a wall of the bore hole, at least one current return electrode positioned between the tool body and the wall of the bore hole, an electrical measurement device configured to monitor a voltage or a current signal indicative of an impedance imbalance, a regulator connected to the electrical measurement device, whereby the regulator is configured to receive the voltage or the current signal indicative of the impedance imbalance and is configured to generate an adjustment signal based on the voltage or the current signal indicative of the impedance imbalance. The apparatus also includes an adjustable electrical device connected to the regulator, whereby the adjustable electrical device is configured to receive the adjustment signal from the regulator.

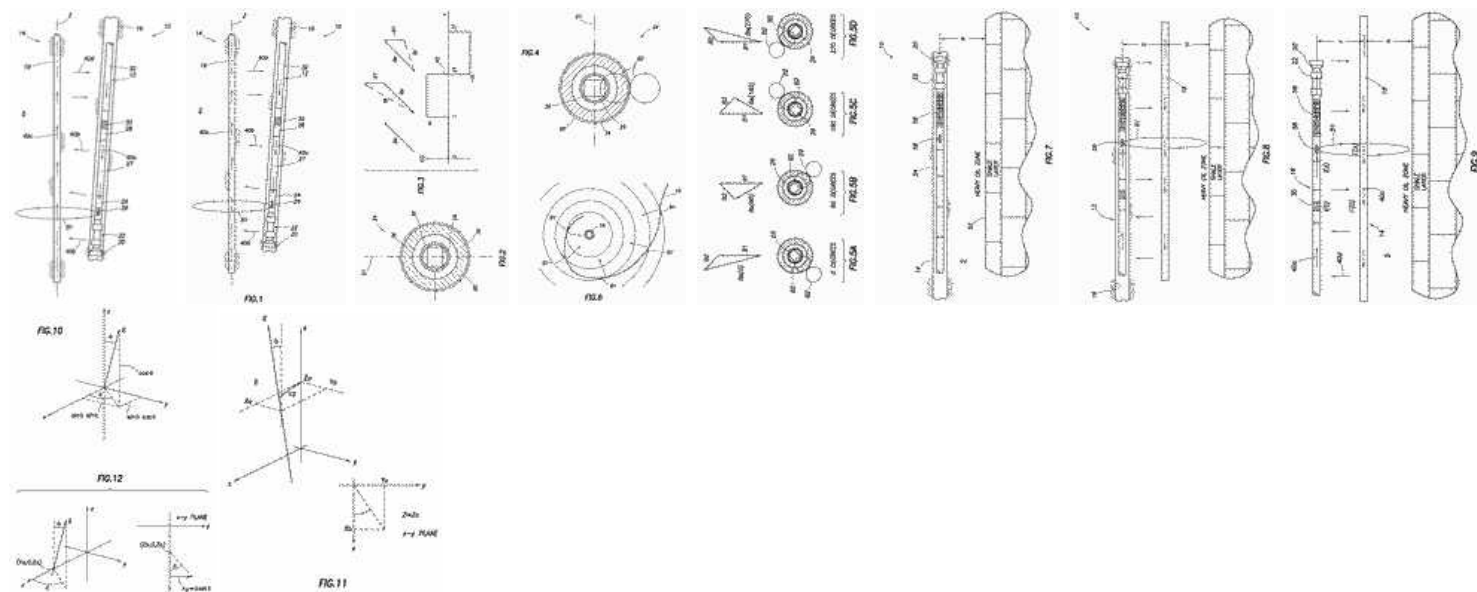
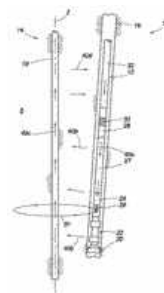


2.	Electromagnetically determining the relative location of a drill bit using a solenoid source installed on a steel casing	US20070278008	2006-12-04	HALLIBURTON ENERGY SERVICES* VECTOR MAGNETICS ITHACA NY*	2007-12-06	2007-12-06
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Electrically powered electromagnetic field source beacons installed in a reference well in combination with a down-hole measurement while drilling (MWD) electronic survey instrument near the drill bit in the borehole being drilled permit distance and direction measurements for drilling guidance. Each magnetic field source beacon consists of a coil of wire wound on a steel coupling between two lengths of steel tubing in the reference well, and powered by an electronic package. Control circuitry in the electronic package continuously "listens" for, and recognizes, a "start" signal that is initiated by the driller. After a "start" signal has been received, the beacon is energized for a short time interval during which an electromagnetic field is generated, which is measured by the MWD apparatus. The generated magnetic field may be an AC field, or switching circuitry can periodically reverse the direction of a generated DC electromagnetic field, and the measured vector components of the electromagnetic field are used to determine the relative location coordinates of the drilling bit and the beacon using well-known mathematical methods. The magnetic field source and powering electronic packages may be integral parts of the reference well casing or may be part of a temporary work string installed therein. Generally, numerous beacons will be installed along the length of the reference well, particularly in the important oil field application of drilling steam assisted gravity drainage (SAGD) well pairs.



A wellbore tool for locating a target wellbore containing a conductive member from a second wellbore and directing the trajectory of the second wellbore relative to the target wellbore includes an electric current driver having an insulated gap; a three-axis magnetometer positioned within a non-magnetic housing that is disposed within a non-magnetic tubular, the three-axis magnetometer positioned below the electric current driver; a drill bit positioned below the three-axis magnetometer; a hollow tubular connected between the electric current driver and the three-axis magnetometer; and a measurement-while-drilling tool. The current driver generates an electric current across the gap to the portion of the tool below the insulated gap. In a method a current is generated across the insulated gap to the portion of the tool below the insulated gap to the conductive material in the target wellbore returning to a portion of the bottom hole assembly above the insulated gap thereby producing a target magnetic field. Measuring the target magnetic field at the bottom hole assembly and the earth's magnetic field; and determining the position of the second wellbore relative to the target wellbore. Then steering the bottom hole assembly to drill the second wellbore along a trajectory relative to the target wellbore.



4. Electromagnetic homing system using mwd and current having a fundamental wave component and an even harmonic wave component being injected at a target well

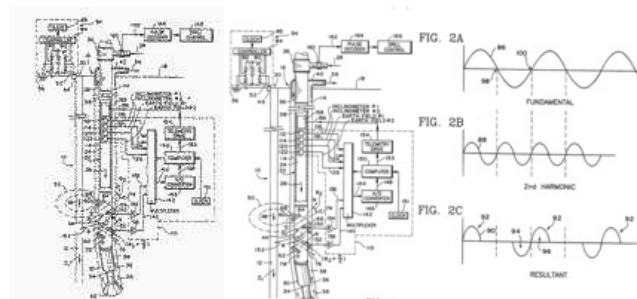
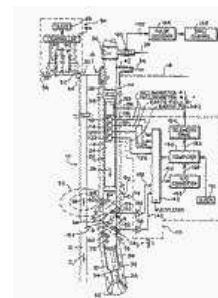
US5343152

1992-11-02

HALLIBURTON ENERGY SERVICES*

1994-08-30 1994-08-30

Apparatus for measuring magnetic fields while drilling includes an electrode located adjacent or in contact with a target well casing to produce an electrical current. The current including a fundamental wave component having two opposite zero crossings per cycle and an even harmonic wave component having two opposite zero crossings per cycle produces an alternating current magnetic field in the earth surrounding the target well. The target well is to be intercepted by, or to be avoided by, a relief well being drilled. A sensitive magnetometer is located within a nonmagnetic portion of the drill string within the relief well to detect the alternating magnetic field generated by the current flow in the target and to produce unambiguous output signals corresponding to the detected field and determining the distance and direction of the target well from the relief well the determination being made in synchronization with the fundamental wave component to eliminate phase ambiguity in the determination of the direction.



A method and apparatus for determining the distance from a relief borehole to a target well utilizes measurements of an electric field at the target well. The electric field is produced by injecting current into the earth near the wellhead of the target well, this current producing a target current in conductive material in the target well. The electric field corresponding to the target current is measured by means of sensors in the relief borehole, and this field measurement, together with a measurement of the alternating magnetic field at the relief well due to the target current, permits determination of the distance to the target well from the relief borehole.

