It is understood that when using the "on" potential, all rectifiers are providing cathodic protection to pipeline **10**, such that the potential difference measured by voltmeter **42** is more negative than −0.85V when using a copper/copper sulfate reference electrode.

[**0059**] Referring now to **FIG. 4**, pipeline current measurement unit **50** may be used to measure the portion of current **34** flowing back to the rectifier in pipeline **10** at test station **40**. Each coating defect **16***a,b,c* permits current i_1, i_2, i_3 to reach the surface **38** of the metal pipes **12** of pipeline **10** and send current i_1, i_2 and i_3 down the pipeline **10**. For example, defect **16***a* allows a certain amount of current i_1 to enter the pipeline **10** while defects **16***b* and **16***c* add additional current flow i_2 and i_3 to the pipeline **10**. Pipeline current measuring unit **50** includes a volt meter **52** connected to terminals **61**, **62** inside test station **40**. First electrical conduit **54** extends from terminal **60** and is attached to pipeline **10** at connection point **58**. Second electrical conduit **56** extends from terminal **61** and is attached to the pipeline **10** at connection point **59**. Connection points **58**, **59** are some distance from each other so as to provide a span or distance between connection points **58**, **59**, such as 100 to 300 feet. The voltage drop between connection points **58**, **59** is therefore measured between terminals **60**, **61** and this voltage drop measures the portion of the total current **34** picked up by the section of pipeline **10** by virtue of the coating defects **16**.

[**0060**] The pipeline current measurement unit **50** is one method of measuring the current flow back towards a rectifier **24** along the pipeline **10**. Unit **50** measures the potential difference between connection points **58**, **59**, which are a distance apart, since a particular span along the pipeline **10** will provide a particular resistance to current flow. By measuring the voltage drop that occurs over that resistance, the current actually flowing at a particular point along the pipeline **10** can be measured assuming the resistance is known. The unit **50** determines what portion of current **34** is flowing back to a rectifier **24** at measurement point **58**. For example, the resistance along a particular pipe span may be approximately 0.5 milliohm and the voltage drop across this pipe span may be 0.75 mV, such that the portion of current **34** flowing in the pipeline **10** at this particular measurement point may be approximately 1.5 amps. The amount of current flowing back to the rectifier at any given point will change if a rectifier output is changed or if it goes out of service. The pipeline current measurement unit **50** measures this additional parameter as compared to the pipe-to-soil potential measurement unit **41** at a test station **40**.

[**0061**] Referring now to **FIG. 5**, there is shown a remote monitoring unit **62** installed at test station **40** which includes both a pipe-to-soil measurement unit **41** and a pipeline current measurement unit **50**. Pipe-to-soil measurement unit **41** measures the pipe-to-soil potential and this value is transmitted via the communications module **64** to a central location. The remote monitoring unit **62** also includes pipeline current measurement unit **50** which measures the portion of current **34** flowing back to rectifier **24** through steel pipe **12** of pipeline **10** at test station **40** where remote monitoring unit **62** is installed. This value is also transmitted via communication module **64** to a central location. Remote monitoring unit **62** may include both pipe-to-soil measurement unit **41** and pipeline current measurement unit **50** or it may include either pipe-to-soil measurement unit **41** or pipeline current measurement unit **50** only. Thus, remote monitoring unit **62** may only measure and transmit a pipe-to-soil value or a pipeline current value only, or it may measure and transmit both of these values.

[**0062**] Referring again to **FIG. 2**, there is shown a typical impressed current cathodic protection system **18** with a plurality of test stations **40** disposed along the length of pipeline **10**. Each of the test stations **40** is within the influence area of a cathodic protection circuit **20**, such as circuits **20***a,b,c,d*, with the test stations **40** typically being 1 mile apart. Each of the rectifiers **24***a,b,c,d* for the cathodic protection circuits **20***a,b,c,d* supply current **34** to a portion or section of pipeline **10**. The total amount of current being supplied to pipeline **10** by cathodic protection circuits **24***a,b,c,d* therefore determines the pipe-to-soil potential profile along pipeline **10** as measured at test stations **40** with all the cathodic protection circuits **24***a,b,c,d* on and in good operating condition. Any change in output from cathodic protection circuits **24***a,b,c,d*, such as one circuit going out of operation, will change the potential profile along pipeline **10**. Each cathodic protection circuit **20** thus has an influence on the pipe-to-soil potential of pipeline **10**. That influence can be measured at test stations **40** as a change in pipe-to-soil potential.

[**0063**] Referring now to **FIG. 6, a** voltage influence chart depicting the influence of a plurality of cathodic protection circuits CP_1, CP_2, CP_3, and CP_4 on a pipeline **10** is shown. The chart includes a graph plotting the data from conducting pipe-to-soil measurements while switching each of the plurality of cathodic protection circuits **20** along a length of the pipeline **10** off and back on again. The voltage influence curves of **FIG. 6** are developed by switching one of the rectifiers **24** at cathodic protection circuits **20** off, while the others remain on, and measuring the pipe-to-soil potential at each test station **40** with a portable pipe-to-soil measurement unit **41**. This cycle is repeated until each one of the rectifiers **24** at cathodic protection circuits **20** have been switched off and back on again, and the pipe-to-soil potential during this off and on event has been measured at each test station.

[**0064**] When any particular cathodic protection circuit **20** is turned off, there is a drop in current flow to the pipeline **10** causing an increase in the pipe-to-soil potential measured by pipe-to-soil measurement unit **41**. The current difference between a particular cathodic protection circuit **20** being on or off determines the influence that cathodic protection circuit **20** has on the pipe-to-soil potential at that particular point along pipeline **10**. The change in pipe-to-soil potential at every test station **40** resulting from cathodic protection circuit **20** being switched off and on again can be measured as a change in pipe-to-soil potential (voltage) at every test station **40** along pipeline **10**. **FIG. 6** shows this voltage change at every test station **40** as a voltage influence curve for each cathodic protection circuit **20** along pipeline **10**.

[**0065**] In **FIG. 6**, because there are four cathodic protection circuits, this measurement procedure will need to be done four times. Each rectifier **24** will provide a different current signature along the pipeline **10**. This is shown in **FIG. 6** by each of the cathodic protection circuits **20** providing a different voltage influence along the pipeline. The four peaks shown in **FIG. 6** correspond to the locations of the four cathodic protection circuits **20** along the pipeline