CLAIMS

What is claimed is:

1. A pipe inspecting robot (10) for traveling along the surface of a pipeline (42), the robot (10) characterized by:

a body (12);

first and second independently articulating legs (16a, 16b) attached to the body (12);

first and second leg motors (18a, 18b) in controlling communication with the first and second articulating legs (16a, 16b), respectively; and

first and second pairs of wheels (24a, 24b) attached to the first and second articulating legs (16a, 16b), respectively, at an opposite end of the legs (16a, 16b) from the body (12);

the first and second leg motors (18a, 18b) configured so that when the first pair of wheels (24a) encounters an obstacle, the second leg motor (18b) rotates the second leg (16b) upward away from the surface of the pipeline (42) and radially around the body (12) until the second pair of wheels (24b) contacts the surface of the pipeline (42) on an opposite side of the obstacle, after which the first leg motor (18a) rotates the first leg (16a) upward away from the surface of the pipeline (42) and radially around the body (12) until the first pair of wheels (24a) contacts the surface of the pipeline (42), thereby causing the robot (10) to pass over the obstacle.

2. The pipe inspecting robot (10) of claim 1, wherein the first and second pairs of wheels (24a, 24b) are attached to the first and second articulating legs (16a, 16b) by first and second wheel hubs (20), respectively, and wherein the wheel hubs (20) contain at least one wheel motor (22) to power the wheels (24a, 24b).

3. The pipe inspecting robot (10) of claim 2, wherein each wheel (24a, 24b) is powered by a separate wheel motor (22), and wherein the course of the robot (10) can be adjusted by increasing or decreasing the speed of each wheel (24a, 24b) with its corresponding wheel motor (22).

4. The pipe inspecting robot (10) of claim 1, wherein the body (12) contains at least one device selected from the group consisting of a control circuit (26), a communication circuit (28), a global positioning system (GPS) circuit (30), a GPS antenna (34), a camera (56, 58), a camera circuit (38), and a battery pack (40).

5. The pipe inspecting robot (10) of claim 1, further characterized by:

a downward facing camera (56, 58) attached to the body (12) for collecting data about the surface condition of the pipeline (42) and for guiding the robot (10).

6. The pipe inspecting robot (10) of claim 1, wherein the robot (10) is autonomous.

7. The pipe inspecting robot (10) of claim 1, wherein the robot (10) is remote controlled.

8. The pipe inspecting robot (10) of claim 1, further characterized by:

pins (44) attached to the body (12) and having an extended and a retracted position, wherein when in the extended position the pins (44) lock the position of the legs (16a, 16b) relative to the body (12), and when in the retracted position the pins (44) allow the legs (16a, 16b) to articulate relative to the body (12).

9. The pipe inspecting robot (10) of claim 1, further characterized by:

a radial arm (50) attached to the body (12) and extending outward from the body (12) around a portion of the circumference of the pipe, the radial arm (50) having a camera (56, 58) for inspecting the surface of the pipe.

10. The pipe inspecting robot (10) of claim 9, further characterized by:

a radial arm extension (52) slidably attached to the radial arm (50) and configured to extend still further around the circumference of the pipe.

11. A pipeline inspection robot (10), characterized by:

a body (12);

first and second legs (16a, 16b) attached to the body (12);

first and second wheels (24a, 24b) attached to the first and second legs (16a, 16b), respectively, at an opposite end of the legs (16a, 16b) from the body (12); and

a radial arm (50) attached to the body (12) and extending outward from the body (12) around a portion of the circumference of the pipeline (42), the radial arm (50) having a camera (56, 58) for inspecting the surface of the pipeline (42).

12. The pipeline inspection robot (10) of claim 11, further characterized by:

a radial arm extension (52) slidably attached to the radial arm (50) and configured to extend further around the circumference of the pipeline (42) than the radial arm (50).

13. The pipeline inspection robot (10) of claim 11, further characterized by:

first and second leg motors (18a, 18b) in controlling communication with the first and second legs (16a, 16b), respectively, the first and second leg motors (18a, 18b) configured so that when the first wheels (24a) encounters an obstacle the second leg motor (18b) rotates the second leg (16b) upward away from the surface of the pipeline (42) and radially around the body (12) until the second wheels (24b) contacts the surface of the pipeline (42) on an opposite side of the obstacle, after which the first leg motor (18a) rotates the first leg (16a) upward away from the surface of the pipeline (42) and radially around the body (12) until the first pair of wheels (24a) contacts the surface of the pipeline (42), thereby causing the robot (10) to pass over the obstacle.

14. The pipeline inspection robot (10) of claim 11, wherein the first and second wheels (24a, 24b) are attached to the first and second legs (16a, 16b) by first and second wheel hubs (20), respectively, wherein the wheel hubs (20) contain a separate wheel motor (22) for each wheel (24a, 24b), and wherein the course of the robot (10) can be adjusted by increasing or decreasing the speed of each wheel (24a, 24b) with its corresponding wheel motor (22).

15. The pipeline inspection robot (10) of claim 11, further characterized by:

a downward facing camera (56, 58) attached to the body (12) for collecting data about the surface condition of the pipeline (42) and for guiding the robot (10).

16. The pipeline inspection robot (10) of claim 11, wherein the robot (10) is autonomous.

17. The pipeline inspection robot (10) of claim 11, wherein the robot (10) is remote controlled.

18. The pipeline inspection robot (10) of claim 11, further characterized by:

pins (44) attached to the body (12) and having an extended and a retracted position, wherein when in the extended position the pins (44) lock the position of the legs (16a, 16b) relative to the body (12), and when in the retracted position the pins (44) allow the legs (16a, 16b) to articulate relative to the body (12).

19. A method of inspecting a pipeline (42), the method characterized by:

providing a robot inspection device (10) characterized by:

a body (12);

first and second wheel assemblies that articulate fully around a circumference of the body (12) and have wheels (24a, 24b) on an end distal from the body (12);

urging the device (10) along the pipeline (42) and adjacent to an obstacle on the pipeline (42) so that one of the wheel assemblies is proximate the obstacle;

articulating the body (12) with respect to the proximate wheel assembly and articulating a wheel assembly distal from the obstacle with respect to the body (12) so that wheels (24a, 24b) on the distal wheel assembly orbit over the pipeline (42) and land onto the pipeline (42) on a side of the obstacle opposite the proximate wheel assembly; and

articulating the body (12) with respect to the distal wheel assembly and articulating the proximate when assembly with respect to the body (12) so that wheels (24a, 24b) on the proximate wheel assembly land on the pipeline (42) on a side of the distal wheel assembly distal from the obstacle.

20. The method of claim 19, further characterized by:

detecting the obstacle using a device (10) attached to the robot body (12) and selected from the group consisting of a camera (56, 58), a global positioning system (GPS) (30), and a proximity sensor.

CLAIMS:

1. A pipe inspecting robot for traveling along the surface of a pipeline, the robot comprising:

a body;

first and second articulable legs that articulate independently of one another and are attached to the body, the legs articulable around the body around a common central body axis;

first and second leg motors controlling the first and second articulating legs, respectively; and

first and second pairs of wheels attached to the first and second articulating legs, respectively, at an opposite end of the legs from the body, the first leg articulable around the first pair of wheels around a first wheel axis, and the second leg articulable around the second pair of wheels around a second wheel axis, the first wheel axis and the second wheel axis parallel to the central body axis, and the first and second wheels configured to move along the pipeline with the body;

the first and second leg motors configured so that when the first pair of wheels encounters an obstacle in front of the first pair of wheels in the direction of movement of the body, the second leg motor rotates the second leg upward away from the surface of the pipeline and radially around the body until the second pair of wheels contacts the surface of the pipeline on an opposite side of the obstacle, after which the first leg motor rotates the first leg upward away from the surface of the pipeline and radially around the body until the first pair of wheels contacts the surface of the pipeline, thereby causing the robot to pass over the obstacle.

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2. The pipe inspecting robot of claim 1, wherein the first and second pairs of wheels are attached to the first and second articulating legs by first and second wheel hubs, respectively, and wherein the wheel hubs contain at least one wheel motor to power the wheels.

3. The pipe inspecting robot of claim 2, wherein each wheel is powered by a separate wheel motor, and wherein the course of the robot can be adjusted by increasing or decreasing the speed of each wheel with its corresponding wheel motor.

4. The pipe inspecting robot of claim 1, wherein the body contains at least one device selected from the group consisting of a control circuit, a communication circuit, a global positioning system (GPS) circuit, a GPS antenna, a camera, a camera circuit, and a battery pack.

5. The pipe inspecting robot of claim 1, further comprising:

a downward facing camera attached to the body for collecting data about the surface condition of the pipeline and for guiding the robot.

6. The pipe inspecting robot of claim 1, wherein the robot is autonomous.

7. The pipe inspecting robot of claim 1, wherein the robot is remote controlled.

8. The pipe inspecting robot of claim 1, further comprising:

pins attached to the body and having an extended and a retracted position, wherein when in the extended position the pins lock the position of the legs relative to the body, and when in the retracted position the pins allow the legs to articulate relative to the body.

9. The pipe inspecting robot of claim 1, further comprising:

a radial arm attached to the body and extending outward from the body around a portion of the circumference of the pipe, the radial arm having a camera for inspecting the surface of the pipe.

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10. The pipe inspecting robot of claim 9, further comprising:

a radial arm extension slidably attached to the radial arm and configured to extend still further around the circumference of the pipe.

11. A pipeline inspection robot, comprising:

a body;

first and second legs that articulate independently of one another, that are attached to the body, and that are articulable around a common central body axis;

first and second wheels attached to the first and second legs, respectively, at an opposite end of the legs from the body, the first leg articulable around the first wheel around a first wheel axis, and the second leg articulable around the second wheel around a second wheel axis, the first wheel axis and the second wheel axis oriented parallel to the central body axis, and the first and second wheels configured to move along the pipeline with the body;

the first and second legs and first and second wheels configured so that when the first wheel encounters an obstacle in front of the first wheel in the direction of movement of the body, the second leg rotates upward away from the surface of the pipeline and radially around the body until the second wheel contacts the surface of the pipeline on an opposite side of the obstacle, after which the first leg rotates upward away from the surface of the pipeline and radially around the body until the first wheel contacts the surface of the pipeline, thereby causing the robot to pass over the obstacle; and

a radial arm attached to the body and extending outward from the body around a portion of the circumference of the pipeline, the radial arm having a camera for inspecting the surface of the pipeline.

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12. The pipeline inspection robot of claim 11, further comprising:

a radial arm extension slidably attached to the radial arm and configured to extend further around the circumference of the pipeline than the radial arm.

13. The pipeline inspection robot of claim 11, further comprising:

first and second leg motors controlling the first and second legs, respectively, the first and second leg motors configured so that when the first wheel encounters an obstacle in front of the first wheel in the direction of movement of the body, the second leg motor rotates the second leg upward away from the surface of the pipeline and radially around the body until the second wheels contacts the surface of the pipeline on an opposite side of the obstacle, after which the first leg motor rotates the first leg upward away from the surface of the pipeline and radially around the body until the first pair of wheels contacts the surface of the pipeline, thereby causing the robot to pass over the obstacle.

14. The pipeline inspection robot of claim 11, wherein the first and second wheels are attached to the first and second legs by first and second wheel hubs, respectively, wherein the wheel hubs contain a separate wheel motor for each wheel, and wherein the course of the robot can be adjusted by increasing or decreasing the speed of each wheel with its corresponding wheel motor.

15. The pipeline inspection robot of claim 11, further comprising:

a downward facing camera attached to the body for collecting data about the surface condition of the pipeline and for guiding the robot.

16. The pipeline inspection robot of claim 11, wherein the robot is autonomous.

17. The pipeline inspection robot of claim 11, wherein the robot is remote controlled.

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18. The pipeline inspection robot of claim 11, further comprising:

pins attached to the body and having an extended and a retracted position, wherein when in the extended position the pins lock the position of the legs relative to the body, and when in the retracted position the pins allow the legs to articulate relative to the body.

19. A method of inspecting a pipeline, the method comprising:

providing a robot inspection device comprising:

a body having a central body axis;

first and second wheel assemblies having first and second wheel axes, respectively, the first and second wheel axes oriented parallel to the central body axis, the first and second wheel assemblies configured to articulate fully around a circumference of the body around the central body axis, and also to articulate around the first and second wheel axes, and having wheels on an end distal from the body, and the first and second wheel assemblies configured to move along the pipeline with the body;

urging the device along the pipeline and adjacent to an obstacle in front of the first wheel assembly in the direction of movement of the body on the pipeline so that the first wheel assembly is proximate the obstacle;

articulating the body with respect to the first wheel assembly around the first wheel axis, and articulating the second wheel assembly distal from the obstacle with respect to the body around the central body axis so that wheels on the second wheel assembly orbit over the pipeline and land on the pipeline on a side of the obstacle opposite the first wheel assembly; and

articulating the body with respect to the second wheel assembly around the second wheel axis, and articulating the first wheel assembly with respect to the body around the central body

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axis so that wheels on the first wheel assembly land on the pipeline on a side of the second wheel assembly, and at a position distal from the obstacle.

20. The method of claim 19, further comprising:

detecting the obstacle using a device attached to the robot body and selected from the group consisting of a camera, a global positioning system (GPS), and a proximity sensor.

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