

SPECIFICATION

Method and apparatus for making well screen

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This invention is concerned with rod-based screen with a pipe base.

- Welded rod-based screen, sometimes referred to as "bar-weld" screen, is formed by wrapping wire in spaced helical turns around a plurality of rods. The rods are parallel to each other and equally spaced around a circular path of predetermined diameter. The conventional way of making this screen is to move the rods longitudinally past stationary wire feeding apparatus and welding electrodes. The rods are rotated as well as moved longitudinally to wrap the wire around the rods in spaced helical turns. The welding electrode engages the wire as it contacts each rod and welds the wire to the rods, sequentially. The welding current travels from the welding electrode to the wire and into the rod then from the rod to a ground electrode positioned internally of the rods. The tension in the wire that is needed to cause the wire to wrap around the rods acts to hold the rods in good electrical contact with the internal ground electrode. See U.S. Patent No. 3,275,785, entitled "Method and Apparatus for Manufacturing Well Screens", which issued to Hill D. Wilson on September 27, 1966.

- The screen thus formed is either used with or without a pipe base. If a pipe base is desired, the welded rod-based screen is slipped over the perforated pipe and its ends are welded to the pipe. To slip the screen over the pipe base, there must be clearance between the screen and the pipe. Differential pressure usually exists across the screen when in service. This pressure, if sufficient, will cause the wires and the rods to be bent inwardly into contact with the pipe base. Such a collapse will result in a shifting of the turns of wire forming the screen and reduce or destroy the ability of the screen to serve its intended purpose.

- Apparatus for making a rod-based screen in place on a perforated pipe base is disclosed in United States Letters Patent No. 3,469,609, which issued September 30, 1969 to Howard L. Smith, III. In this patent it is proposed to wrap the wire directly on the rods lying along the outside of the perforated pipe base. One disc shaped electrode contacts the wire as it engages the rods to weld the wire to the rods as it is being wrapped around the rods and the pipe base. A second electrode, which is also disc shaped, rolls along the coils that have already been welded to the rods to provide a ground for the welding circuit. In this arrangement, the electrical current flows through the wire being welded into the rod directly below it then along the rod to the

- portion of the previously wrapped wire that is in contact with the ground electrode then through this portion of the wire into the ground electrode. At the same time, the current can flow directly to the ground electrode through the wire. The amount of current taking this path will depend on the resistance of the wire alone as opposed to the resistance of the circuit through the wire to the rods and back to the wire. Unless there is sufficient resistance and current at the point of contact between the wire and rod to heat the metal to fusion temperature then no weld will occur. This necessary high resistance will tend to cause the current to flow to ground through the wire.

- The arrangement described in this patent may have another disadvantage. It may be difficult to maintain good electrical contact between the rolling ground electrode and the wire already wrapped and welded to the rods on the pipe base. It is very important that the portion of the circuit from the rod to ground have a substantially lower resistance to the flow of current than the resistance provided between the rod and the wire that is being welded to it.

- In other words, to get a good fusion weld between the rod and the wire the principal resistance in the circuit should occur at that point in order to heat the rod and wire sufficiently to obtain fusion between the two. This means that between the rod and ground there must be a minimum of resistance in the circuit. This requires a very good low resistance contact between the ground electrode and the portion of the screen that it contacts, which may be difficult to obtain with the rolling ground electrode described in the Smith Patent.

- According to one aspect of the present invention there is provided a method of making a rod-based screen in place on a perforated pipe base comprising the steps of mounting a perforated pipe for rotation around its longitudinal axis, positioning a plurality of rods along the outer surface of the pipe, rotating the pipe and the rods to wrap a wire in spaced helical turns around the pipe and the rods, grounding each rod ahead of the wrapped wire through a respective contact that engages the rod on the outside surface of the rod adjacent the wire, and resistance welding the wire to the rods as the wire engages each successive rod.

- In another aspect of the invention there is provided a rod-based screen with a perforated pipe base made by mounting a perforated pipe for rotation around its longitudinal axis, positioning a plurality of rods along the outer surface of the pipe, rotating the pipe and the rods to wrap a wire in spaced helical turns around the pipe and the rods, grounding each rod ahead of the wrapped wire through a respective contact that engages each rod on

the outside surface of the rod adjacent the point of engagement of the wire and the rod, exerting a separate resilient force on each contact to hold the contact in good electrical contact with the rod it engages at all times, and resistance welding the wire to the rods as the wire engages each successive rod.

In yet another aspect of the invention, there is provided apparatus for making a rod-based wire screen in place on a perforated pipe base comprising means for mounting a perforated pipe for rotation around its longitudinal axis said pipe having a plurality of rods extending along the outside surface of the pipe for rotation therewith, a wire feeding means, means for causing relative rotation between the pipe and the wire feeding means to wrap the wire around the outside of the pipe and the rods, means for causing relative movement longitudinally of the pipe between the pipe and rods and the wire feeding means to wrap the wire around the pipe and rods in spaced helical turns, a first electrode positioned to engage the wire and weld the wire to each rod as the wire is wrapped around the rods, a plurality of second electrodes, means mounting the second electrodes for each second electrode to engage only one rod a short distance ahead of the wire as the wire is wrapped around the pipe and rods and resilient means urging each second electrode toward the rod it engages to hold that electrode in good electrical contact with the rod at all times to provide a separate welding circuit between the first electrode through the wire and the rod to which it is being welded and the second electrode in electrical contact with the rod.

In the apparatus set forth in the preceding paragraph it is preferred that the second electrodes contact the rods not more than $2\frac{1}{2}$ cms. ahead of the wire. In a preferred form each second electrode comprises a groove in which seats the rod engaged by that electrode. The second electrodes are preferably mounted to a support through which the pipe base is relatively movable and which has a plurality of wheels for engaging the pipe base at circumferentially spaced locations, e.g. four wheels mutually located at 90° , to locate the axis of the pipe base relative to the support structure.

There will be described hereinafter how the invention may be put into practice using a ground electrode arrangement as set forth above to assist in maintaining the generally desired minimum electrical resistance between the point of weld and the wire. Furthermore the rods are pulled into firm contact with the pipe base as the wire is wrapped around the rods and pipe base so there will be no clearance between the rods and the pipe base. Thus, the wire is pulled tightly around the rods which are firmly supported by the pipe base and is firmly supported against the dif-

ferential pressure that may develop across the screen in service.

The invention and its preferred practice will now be described further with reference to the accompanying drawings, in which:—

Figure 1 is a view partly in elevation and partly in section of the preferred embodiment of the welding and ground electrodes in position in accordance with this invention forming a welded rod-based screen in place on a pipe base.

Figure 2 is a cross sectional view taken along line 2-2 of Fig. 1.

Figure 3 is an isometric view of one of the contact assemblies of the ground electrode.

Pipe base 10 is provided with a plurality of perforations 11. A plurality of rods 12 extend along the outside surface of the pipe base, generally parallel to its longitudinal axis. The rods are usually equally spaced around the outside of the pipe base. Wire 14 is shown being wrapped around the pipe base and rods to form a screen. The wire feeding means is not shown but is of conventional construction usually comprising a drum from which the wire is fed. Usually, some sort of braking arrangement is used to holding the wire in tension to cause it to bend around the pipe and the rods. For examples of wire feeding means, see the above identified Smith and Wilson Patents.

To wrap the wire on the pipe and rods, relative rotation between the pipe and rods and the wire feeding means is necessary.

Usually, the wire feeding means is fixed and the pipe and rods are rotated. At the same time the pipe and rods are moved longitudinally at a speed which along with the speed of rotation provides the desired spacing between the adjacent turns of wire. Alternatively, as shown in the Smith Patent, the wire feeding means can be moved longitudinally of the pipe and rods while the pipe and rods are rotated.

The first (welding) electrode 16 is positioned to engage the wire as it is wrapped on the pipe and provide a welding current that causes the wire and the rod it engages to fuse together. The electrode is disc-shaped and rolls along the wire. To complete the circuit, means are provided to connect the rods to ground a short distance ahead of the wrapped wire.

In the embodiment shown in Fig. 1, such means comprise second or ground electrode arrangement 18. The ground electrode includes a plurality of contact assemblies 20. Each assembly includes contact 22 and contact housing 24, as shown in Fig. 3. The contact is generally L-shaped having leg 22a which extends outwardly from housing 24 and leg 22b, which is generally located within U shaped housing 24, leg 22a has elongated contact surface 22c for engaging one of the rods that extends along the surface of the

pipe base. Preferably, contact surface 22c is provided with groove 26 extending parallel to the rod to receive the rod and to guide the rod as it moves from under the contact to a position under the wire and the welding electrode. Each individual contact assembly is attached to plate 28 as shown in Figs. 1 and 2 along a line extending radially from the center of the pipe base. Each contact engages one of the rods located on the outside of the pipe base.

Means are provided to resiliently urge the contact surface of each contact toward the rod it engages to hold the rod in contact with the pipe base. In the embodiment shown, coil spring 30 is positioned between the back of U-shaped housing 24 and engages leg 22b adjacent its upper end. The spring urges the contact to pivot around pin 32, which mounts the contact in the housing. This in turn urges contact surface 22c of the contact into firm engagement with the rod it engages and, in turn, holds the rod in groove 26 and against the outside surface of pipe base 10. As the pipe and rods are rotated, the rods tend to move and flop around. So the contacts, each separately urged through the resilient force of respective spring 30, and grooves 26 also serve to hold the rods from lateral movement and guide the rods as they move under the wire and welding electrode 16 so that they will have the proper spacing under the wire.

Electrode arrangement 18 including contacts 22 should be made of a material having good electrical conductivity, such as brass. This reduces the tendency for any welding to occur between the contacts and the rods. The rods are generally of steel, often stainless steel. Housing 24 for the rod assembly as well as mounting plate 28 should also be made of a material having good electrical conductivity. The ground electrode assembly is mounted on rotating head 31 for rotation with the pipe and the rods. A commutator or the like (not shown) connects the electrode arrangement to ground.

As explained above the best welds are obtained between the wire and the rod by providing an electrical welding circuit wherein the major resistance in the circuit is the contact between the wire and the rod to which it is to be welded. The circuit between there and ground should be substantially lower in resistance. Therefore, preferably ground electrode arrangement 18 is positioned so that contact surface 22c on each individual contact 22 is positioned as close to the welding electrode as possible to reduce the distance the electrical current has to flow down the rod to the ground contact. Also, the contacts can do a better job of guiding the rods, the closer the contacts are to the point of welding the wire to the rods. Preferably, the contacts are spaced less than one inch (2.54cm) from the welding electrode.

Mounted on the back of plate 28 of the ground electrode arrangement are means for engaging the outside surface of the pipe to hold the contacts of the ground electrode equally spaced from the longitudinal axis of the pipe. In the embodiment shown, four wheels 36 are positioned at 90° angles from each other to extend between the rods and engage the surface of the pipe base. These wheels serve to hold the individual contacts of the ground electrode equally spaced from the pipe, i.e. the electrode is centered relative to the pipe base.

Thus there has been described a method to make a rod-based screen in place on a perforated pipe base. To this end the pipe is mounted for rotation around its longitudinal axis. A plurality of rods are positioned along the outer surface of the pipe. By rotating the pipe and the rods, a wire is wrapped in spaced helical turns around the pipe. The wire is welded to the rods as the wire engages the rods. The welding circuit is grounded to the rods ahead of the wrapped wire through contacts that engage the rods on the outside surface of the rods adjacent to the point of weld.

CLAIMS

1. A method of making a rod-based screen in place on a perforated pipe base comprising the steps of mounting a perforated pipe for rotation around its longitudinal axis, positioning a plurality of rods along the outer surface of the pipe, rotating the pipe and the rods to wrap a wire in spaced helical turns around the pipe and the rods, grounding each rod ahead of the wrapped wire through a respective contact that engages the rod on the outside surface of the rod adjacent the wire, and resistance welding the wire to the rods as the wire engages each successive rod.

2. A rod-based screen with a perforated pipe base made by mounting a perforated pipe for rotation around its longitudinal axis, positioning a plurality of rods along the outer surface of the pipe, rotating the pipe and the rods to wrap a wire in spaced helical turns around the pipe and the rods, grounding each rod ahead of the wrapped wire through a respective contact that engages each rod on the outside surface of the rod adjacent the point of engagement of the wire and the rod, exerting a separate resilient force on each contact to hold the contact in good electrical contact with the rod it engages at all times, and resistance welding the wire to the rods as the wire engages each successive rod.

3. Apparatus for making a rod-based wire screen in place on a perforated pipe base comprising means for mounting a perforated pipe for rotation around its longitudinal axis said pipe having a plurality of rods extending along the outside surface of the pipe for rotation therewith, a wire feeding means,



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pipe base. Preferably, contact surface 22c is provided with groove 26 extending parallel to the rod to receive the rod and to guide the rod as it moves from under the contact to a position under the wire and the welding electrode. Each individual contact assembly is attached to plate 28 as shown in Figs. 1 and 2 along a line extending radially from the center of the pipe base. Each contact engages one of the rods located on the outside of the pipe base.

Means are provided to resiliently urge the contact surface of each contact toward the rod it engages to hold the rod in contact with the pipe base. In the embodiment shown, coil spring 30 is positioned between the back of U-shaped housing 24 and engages leg 22b adjacent its upper end. The spring urges the contact to pivot around pin 32, which mounts the contact in the housing. This in turn urges contact surface 22c of the contact into firm engagement with the rod it engages and, in turn, holds the rod in groove 26 and against the outside surface of pipe base 10. As the pipe and rods are rotated, the rods tend to move and flop around. So the contacts, each separately urged through the resilient force of respective spring 30, and grooves 26 also serve to hold the rods from lateral movement and guide the rods as they move under the wire and welding electrode 16 so that they will have the proper spacing under the wire.

Electrode arrangement 18 including contacts 22 should be made of a material having good electrical conductivity, such as brass. This reduces the tendency for any welding to occur between the contacts and the rods. The rods are generally of steel, often stainless steel. Housing 24 for the rod assembly as well as mounting plate 28 should also be made of a material having good electrical conductivity. The ground electrode assembly is mounted on rotating head 31 for rotation with the pipe and the rods. A commutator or the like (not shown) connects the electrode arrangement to ground.

As explained above the best welds are obtained between the wire and the rod by providing an electrical welding circuit wherein the major resistance in the circuit is the contact between the wire and the rod to which it is to be welded. The circuit between there and ground should be substantially lower in resistance. Therefore, preferably ground electrode arrangement 18 is positioned so that contact surface 22c on each individual contact 22 is positioned as close to the welding electrode as possible to reduce the distance the electrical current has to flow down the rod to the ground contact. Also, the contacts can do a better job of guiding the rods, the closer the contacts are to the point of welding the wire to the rods. Preferably, the contacts are spaced less than one inch (2.54cm) from the welding electrode.

Mounted on the back of plate 28 of the ground electrode arrangement are means for engaging the outside surface of the pipe to hold the contacts of the ground electrode equally spaced from the longitudinal axis of the pipe. In the embodiment shown, four wheels 36 are positioned at 90° angles from each other to extend between the rods and engage the surface of the pipe base. These wheels serve to hold the individual contacts of the ground electrode equally spaced from the pipe, i.e. the electrode is centered relative to the pipe base.

Thus there has been described a method to make a rod-based screen in place on a perforated pipe base. To this end the pipe is mounted for rotation around its longitudinal axis. A plurality of rods are positioned along the outer surface of the pipe. By rotating the pipe and the rods, a wire is wrapped in spaced helical turns around the pipe. The wire is welded to the rods as the wire engages the rods. The welding circuit is grounded to the rods ahead of the wrapped wire through contacts that engage the rods on the outside surface of the rods adjacent to the point of weld.

CLAIMS

1. A method of making a rod-based screen in place on a perforated pipe base comprising the steps of mounting a perforated pipe for rotation around its longitudinal axis, positioning a plurality of rods along the outer surface of the pipe, rotating the pipe and the rods to wrap a wire in spaced helical turns around the pipe and the rods, grounding each rod ahead of the wrapped wire through a respective contact that engages the rod on the outside surface of the rod adjacent the wire, and resistance welding the wire to the rods as the wire engages each successive rod.

2. A rod-based screen with a perforated pipe base made by mounting a perforated pipe for rotation around its longitudinal axis, positioning a plurality of rods along the outer surface of the pipe, rotating the pipe and the rods to wrap a wire in spaced helical turns around the pipe and the rods, grounding each rod ahead of the wrapped wire through a respective contact that engages each rod on the outside surface of the rod adjacent the point of engagement of the wire and the rod, exerting a separate resilient force on each contact to hold the contact in good electrical contact with the rod it engages at all times, and resistance welding the wire to the rods as the wire engages each successive rod.

3. Apparatus for making a rod-based wire screen in place on a perforated pipe base comprising means for mounting a perforated pipe for rotation around its longitudinal axis said pipe having a plurality of rods extending along the outside surface of the pipe for rotation therewith, a wire feeding means,

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means for causing relative rotation between the pipe and the wire feeding means to wrap the wire around the outside of the pipe and the rods, means for causing relative move-

- 5 ment longitudinally of the pipe between the pipe and rods and the wire feeding means to wrap the wire around the pipe and rods in spaced helical turns, a first electrode positioned to engage the wire and weld the wire
- 10 to each rod as the wire is wrapped around the rods, a plurality of second electrodes, means mounting the second electrodes for each second electrode to engage only one rod a short distance ahead of the wire as the wire is
- 15 wrapped around the pipe and rods and resilient means urging each second electrode toward the rod it engages to hold that electrode in good electrical contact with the rod at all times to provide a separate welding circuit
- 20 between the first electrode through the wire and the rod to which it is being welded and the second electrode in electrical contact with the rod.

4. Apparatus as claimed in Claim 3 in

25 which said second electrodes contact the rods not more than $2\frac{1}{2}$ cms. ahead of said first electrode.

5. Apparatus as claimed in Claim 3 or 4 in which each second electrode comprises a

30 groove in which seats the rod engaged by that electrode.

6. Apparatus as claimed in Claim 3, 4 or 5 comprising a support structure to which said second electrodes are mounted and

35 through which the pipe base is relatively movable, said support structure having a plurality of wheels for engaging said pipe base at circumferentially spaced locations to locate the axis of the pipe base relative to the support

40 structure.

7. The method of making a rod-based screen in place on a perforated pipe base substantially as hereinbefore described with reference to the accompanying drawings.

45 8. The rod-based screen with a perforated pipe base made substantially as hereinbefore described with reference to the accompanying drawings.

9. The apparatus for making a rod-based

50 wire screen in place on a perforated pipe base substantially as hereinbefore described with reference to the accompanying drawings.