WELL SCREEN

FIELD OF THE INVENTION

[0001] The present invention relates to screens used in subsurface well completions, and particularly to screens using mesh media.

BACKGROUND

[0002] Screens are commonly used in well completions in which the producing formation is poorly or loosely consolidated. Abrasive particulates generally referred to as "sand" or "fines", can cause problems if produced. For example, the formation surrounding the wellbore can erode and wash out, potentially leading to collapse of the well. Sand can damage equipment such as pumps or seals as the sand travels at high speed through the pump or past the seals. Produced sand must be disposed of, and this imposes an additional cost to the well operator. Fines can clog flow passages, disrupting production.

[0003] Often, to enhance filtration, a layer of particles of presorted size, commonly referred to as "gravel", is injected between the formation (or casing) and the screen. In those cases, the screen is sized to prevent passage of the gravel. The gravel in turn prevents the passage of fines.

[0004] Various screen types are used to prevent the production of sand. For example, a perforated base pipe can have wire wrapped around it such that the spacing between the wire wraps limits the size of sand that can pass. Mesh material can also be used. However, well screens can be expensive. Therefore, there is a continuing need for improved designs and manufacturing methods for screens.

SUMMARY OF THE INVENTION

[0005] In view of the foregoing and other considerations, the present invention relates to wellbore completions and more particularly to sand control well screens.

[0006] Accordingly, premium mesh-type well screens are provided. In one example, a well screen includes a base pipe having perforations and a screen assembly connected about a portion of the base pipe, wherein an outer shroud is not disposed over the screen assembly.

[0007] Another example of a well screen used in a wellbore includes a base pipe having perforations and a screen assembly having at least three layers interconnected by diffusion bonding, the screen assembly positioned about a portion of the base pipe and connected thereto.

[0008] In another example, a screen assembly connected about a perforated base pipe includes a filter layer constructed of layers of woven metal cloth sintered together; a drainage layer positioned between the base pipe and the filter layer, the drainage layer sintered to the filter layer; and a support layer constructed of woven metal rods and metal cable disposed about the filter layer, the support layer sintered to the filter layer.

[0009] The foregoing has outlined the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The foregoing and other features and aspects of the present invention will be best understood with reference to the following detailed description of a specific embodiment of the invention, when read in conjunction with the accompanying drawings, wherein:

[0011] **Figure 1** is an exploded view of a well screen of the present invention; and

[0012] **Figure 2** is a partially cut-away view of a well screen of the present invention.

DETAILED DESCRIPTION

[0013] Refer now to the drawings wherein depicted elements are not necessarily shown to scale and wherein like or similar elements are designated by the same reference numeral through the several views.

[0014] As used herein, the terms "up" and "down"; "upper" and "lower"; and other like terms indicating relative positions to a given point or element are utilized to more clearly describe some elements of the embodiments of the invention. Commonly, these terms relate to a reference point as the surface from which drilling operations are initiated as being the top point and the total depth of the well being the lowest point.

[0015] Figure 1 is an exploded view of a well screen of the present invention, generally denoted by the numeral 10. Well screen 10 includes a base pipe 12 and a screen assembly 14. Screen assembly 14 is positioned over a portion of base pipe 12 to facilitate filtered fluid flow into well screen 10 and into base pipe 12. Base pipe 12 may be a perforated, slotted, or include one or more inflow control devices ("ICD") to facilitate the radial flow of fluid into base pipe 12. It is noted that an ICD may limit flow, or prevent flow into base pipe 12 in selected circumstances. In

an example, base pipe 12 may be a non-perforated pipe having a ICD connected along base pipe 12, for example at the top, and then base pipe 12 is covered by screen assembly 14.

[0016] As is known in the industry, mesh-type well screens include an outer shroud surrounding the various mesh layers atop the base pipe. The outer shroud serves multiple purposes including protecting the mesh layer when running into the wellbore and during transportation and provides burst resistance to the mesh layer. Well screen 10 of the present invention eliminates the outer shroud thereby reducing costs of the well screen and reducing the outside diameter of well screen 10 relative to other premium mesh-type screens. Well screen 10 of the present invention is believed to address the long felt and yet unfulfilled need for a reduced outside diameter well screen capable of operating in a wellbore.

[0017] Screen assembly 14 includes a drainage layer 16, filter layer 18, and support layer 20 further described with reference to Figure 2. In an embodiment of the present invention screen assembly 14 is of a fully sintered construction, wherein the three-layers are diffusion bonded together. It is noted that multiple layers, for example more than one filter layer 18, may be utilized.

[0018] Referring now to Figure 2 wherein a partial cut away view of well screen 10 is provided. Drainage layer 16 is positioned about and against base pipe 12. In the illustrated embodiment, drainage layer 16 is connected to base pipe 12 by welds 22 thereby eliminating retainer ring type connectors. A rail 24, shown by hidden lines, may be connected across the top to provide a safety edge to the assembly to avoid damage to well screen 10 during transport and installation. For example, weld 22 seals filter layer 18 to base pipe 12 to for ma seal to a similar level of filtration

layer 18. The sealing may be accomplished by welding rail 24 to base pipe 12 and to filter layer 18.

[0019] Drainage layer 16 is provided between base pipe 12 and mesh or filter layer 18 to facilitate the flow of fluid into base pipe 12 when a perforation 13 in base pipe 12 or a portion of filter layer 18 is plugged. Drainage layer 16 of the present example is constructed of woven metal members shown as metal rods 26 and metal cable 28. Layer 16 may be constructed of woven cable as both the warp and the weft or with rods as the warp and the weft. In the illustrated embodiment, layer 16 is bonded together and to layers 18 and 20. In particular, layer 16 is sintered to the inside diameter of mesh filter layer 18.

[0020] Filter layer 18 is constructed of sintered mesh type material. For example, filter layer 18 is made of multiple layers of woven wire cloth sintered together. Filter layer 18 forms a porous medium sized to provide accurate particle size control while maximizing the desired fluid flow.

[0021] Support layer 20 is provided about mesh filter layer 18 and drainage layer 16. In the illustrated embodiment, support layer 20 is sintered, diffusion bonded, to the outside diameter of filter layer 18. Support layer 20 is constructed of woven metal members shown as metal rods 26 and metal cable 28. Layer 20 may be constructed of woven cable as both the warp and the weft or with rods as the warp and the weft. In some examples, screen assembly 14 may not include support layer 20.

[0022] It is understood that layers 16, 18, and 20 may be interconnected by means other than sintering. For example, filter layer 18 may be sandwiched between drainage layer 16 and support layer 20. Layers 16 and 18 may each be connected to base pipe 12 by welds 22 or may be interconnected along rail 24 and connected to base pipe 12 by welds 22.

[0023] From the foregoing detailed description of specific embodiments of the invention, it should be apparent that a well screen that is novel has been disclosed. Although specific embodiments of the invention have been disclosed herein in some detail, this has been done solely for the purposes of describing various features and aspects of the invention, and is not intended to be limiting with respect to the scope of the invention. It is contemplated that various substitutions, alterations, and/or modifications, including but not limited to those implementation variations which may have been suggested herein, may be made to the disclosed embodiments without departing from the spirit and scope of the invention as defined by the appended claims which follow.

WHAT IS CLAIMED IS:

1. A well screen comprising:

a base pipe having means for allowing fluid flow into the base pipe; and

a screen assembly connected about a portion of the base pipe, wherein an outer shroud is not disposed over the screen assembly.

2. The well screen of claim 1, wherein the means for allowing fluid flow into the base pipe includes an inflow control device.

3. The well screen of claim 1, wherein the screen assembly includes:

a drainage layer positioned about the base pipe; and

a filter layer positioned over the drainage layer.

4. The well screen of claim 3, wherein the drainage layer is connected to the base pipe by welding and the filter layer and the drainage layer are interconnected.

5. The well screen of claim 3, wherein the filter layer and the drainage layer are interconnected by diffusion bonding.

6. The well screen of claim 4, wherein the filter layer and the drainage layer are interconnected by diffusion bonding.

7. The well screen of claim 3, wherein the drainage layer is constructed of woven metal rod and metal cable.

8. The well screen of claim 7, wherein the metal rod and metal cable are interconnected by diffusion bonding.

9. The well screen of claim 8, wherein the drainage layer is connected to the base pipe by welding and the filter layer and the drainage layer are interconnected.

10. The well screen of claim 3, wherein the drainage layer is constructed of metal rods woven together as the warp and weft.

11. The well screen of claim 10, wherein the warp and weft are interconnected by diffusion bonding.

12. The well screen of claim 11, wherein the drainage layer is connected to the base pipe by a weld and the filter layer and the drainage layer are interconnected.

13. The well screen of claim 3, wherein the drainage layer is constructed of metal cable woven together as the warp and weft.

14. The well screen of claim 13, wherein the warp and weft are interconnected by diffusion bonding.

15. The well screen of claim 14, wherein the drainage layer is connected to the base pipe by a weld and the filter layer and the drainage layer are interconnected.

16. A well screen apparatus used in a wellbore, the apparatus comprising:
a base pipe having a means for allowing radial fluid entry; and
a screen assembly having at least three layers interconnected by diffusion bonding, the screen assembly positioned about a portion of the base pipe and connected thereto.

17. The apparatus of claim 16, wherein the screen assembly includes a drainage layer, a filter layer, and a support layer.

18. The apparatus of claim 17, wherein the filter layer is constructed of sintered metal fabric.

19. The apparatus of claim 16, wherein the screen assembly includes:
a drainage layer constructed of woven metal members;
a filter layer constructed of sintered metal fabric; and
a support layer constructed of woven metal members, wherein the drainage layer is positioned between the filter layer and the base pipe.

20. The apparatus of claim 16, wherein the screen assembly is connected to the base pipe by welding and without being surrounded by a shroud member.

21. A screen assembly connected about a base pipe, the screen assembly comprising:

a filter layer constructed of layers of woven metal cloth sintered together;

a drainage layer positioned between the base pipe and the filter layer, the drainage layer sintered to the filter layer; and

a support layer constructed of woven metal rods and metal cable disposed about the filter layer, the support layer sintered to the filter layer.