



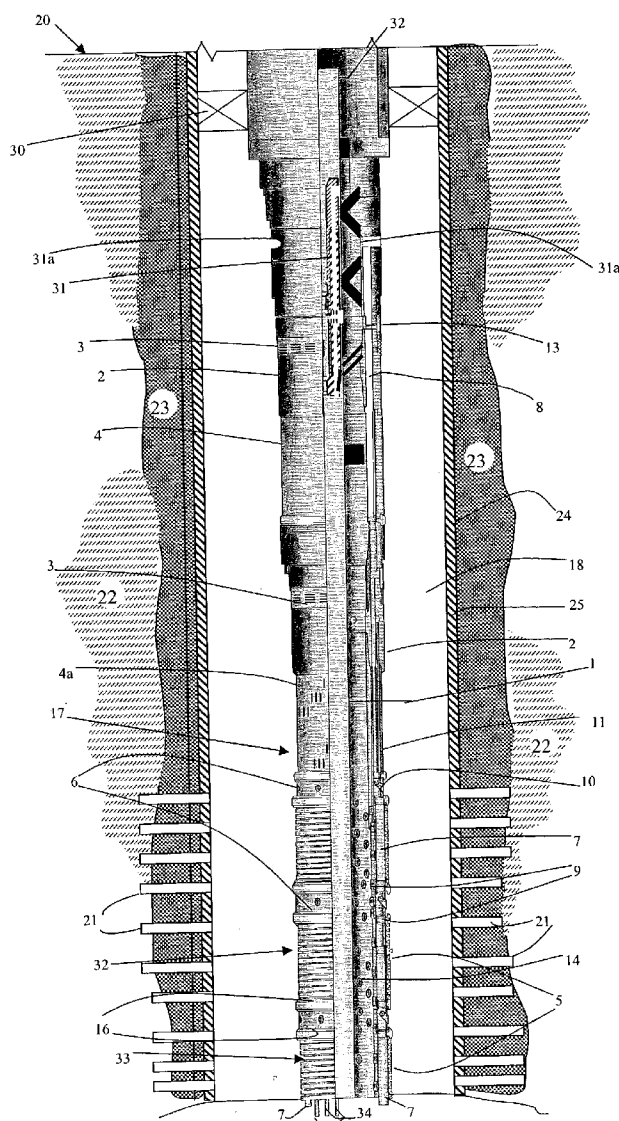
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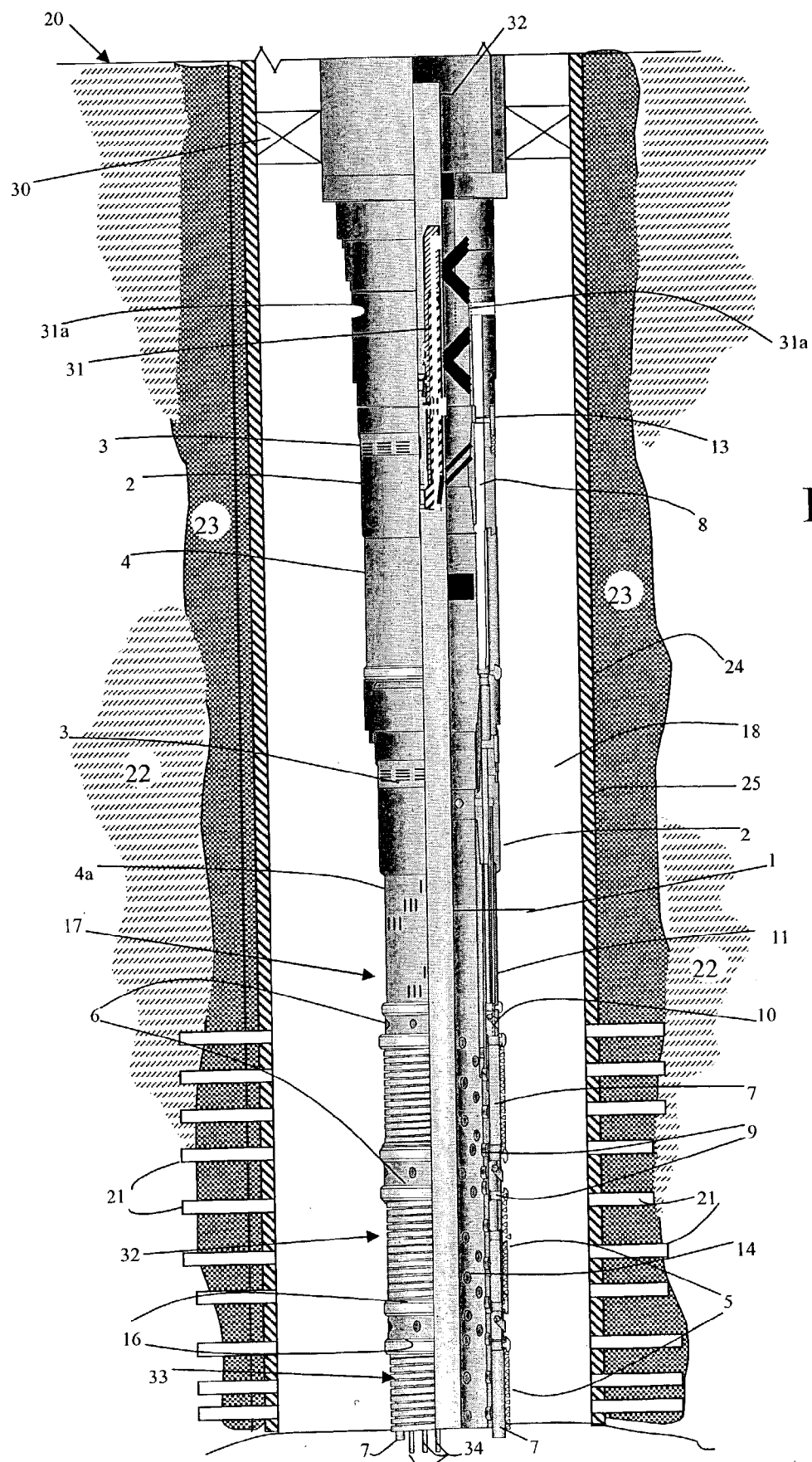
(19) **United States**(12) **Patent Application Publication**(10) **Pub. No.: US 2004/0140089 A1****Gunneroed**(43) **Pub. Date:****Jul. 22, 2004**(54) **WELL SCREEN WITH INTERNAL SHUNT TUBES, EXIT NOZZLES AND CONNECTORS WITH MANIFOLD**(52) **U.S. Cl.** 166/228; 166/236(76) **Inventor: Terje Gunneroed, Houston, TX (US)**

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1200 Smith Street, Suite 1400
Houston, TX 77002 (US)**(21) **Appl. No.: 10/347,973**(22) **Filed: Jan. 21, 2003****Publication Classification**(51) **Int. Cl.⁷ E21B 43/00**(57) **ABSTRACT**

A well screen for use in fracturing and/or gravel packing completions that produces a good distribution of gravel over the entire completion interval. The screen is comprised of a base pipe and an outer surface (e.g. wire wrap). A plurality of flow paths (e.g. shunt tubes) are positioned in the annulus formed by the base pipe and the outer surface of the screen, and connected to corresponding exit nozzle chambers positioned at different levels on the screen to supply gravel slurry throughout the well annulus. Thereby providing the necessary alternate flowpaths for the slurry without significantly increasing the overall effective outside diameter of the screen. The screen includes one or more joints each connected together via a special connector that incorporates a manifold area. Thereby making for simpler installation and faster make up of the joints, and eliminating the need for any special tools to run the screens in the well.





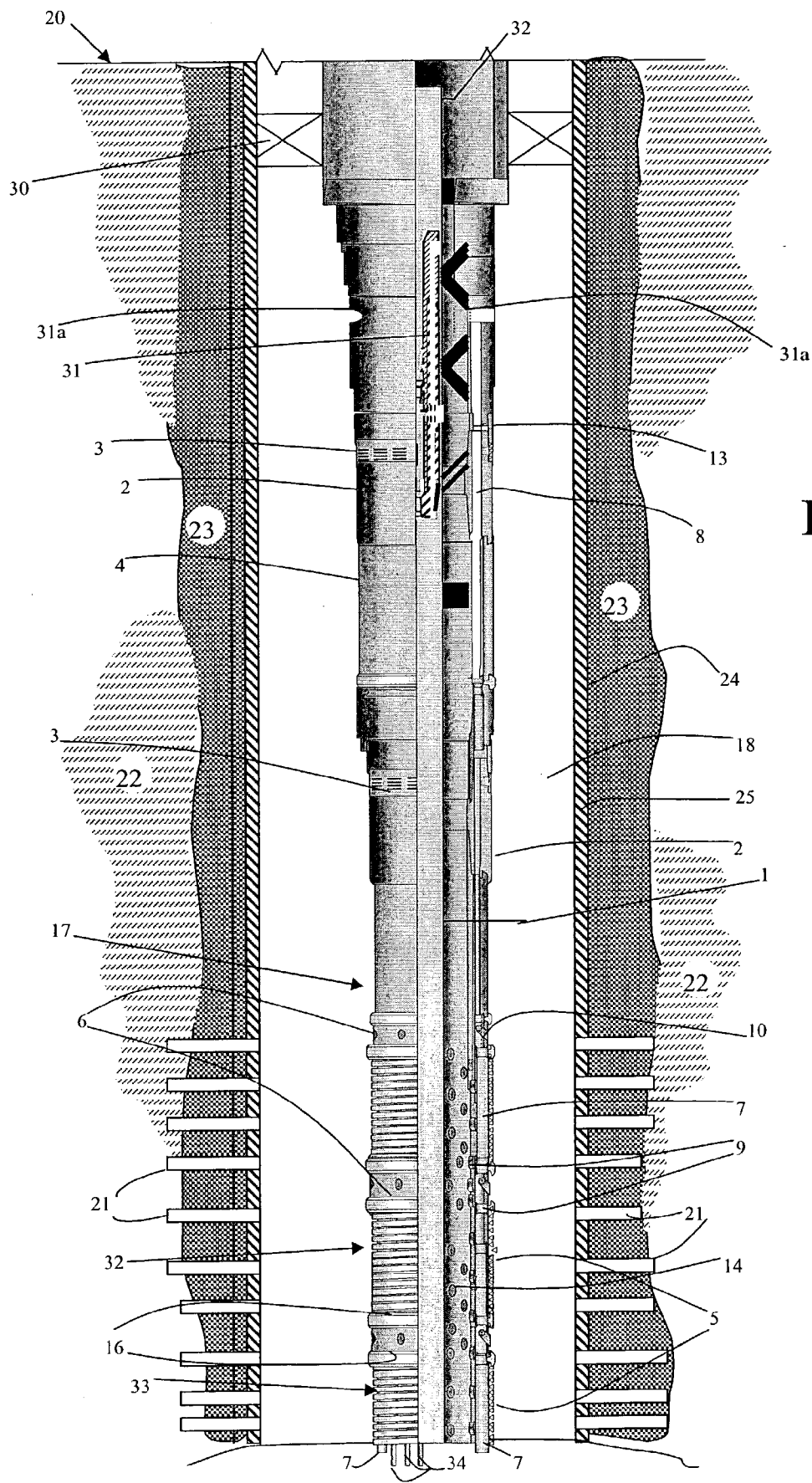


Fig. 1A

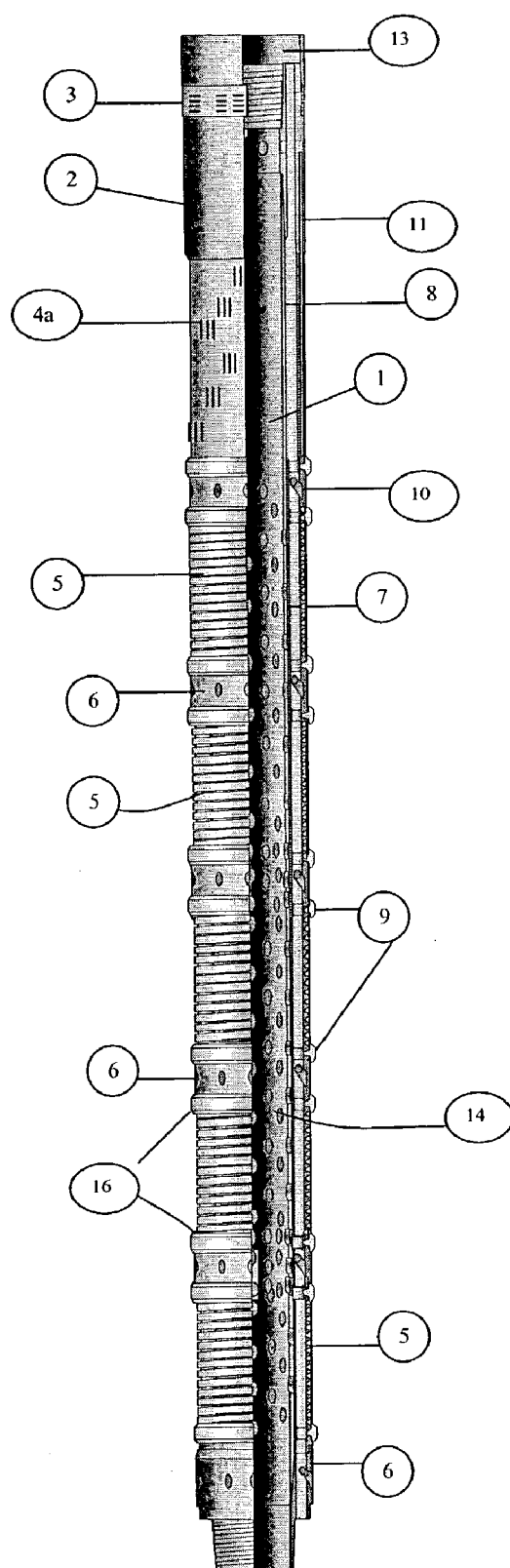


Fig. 2

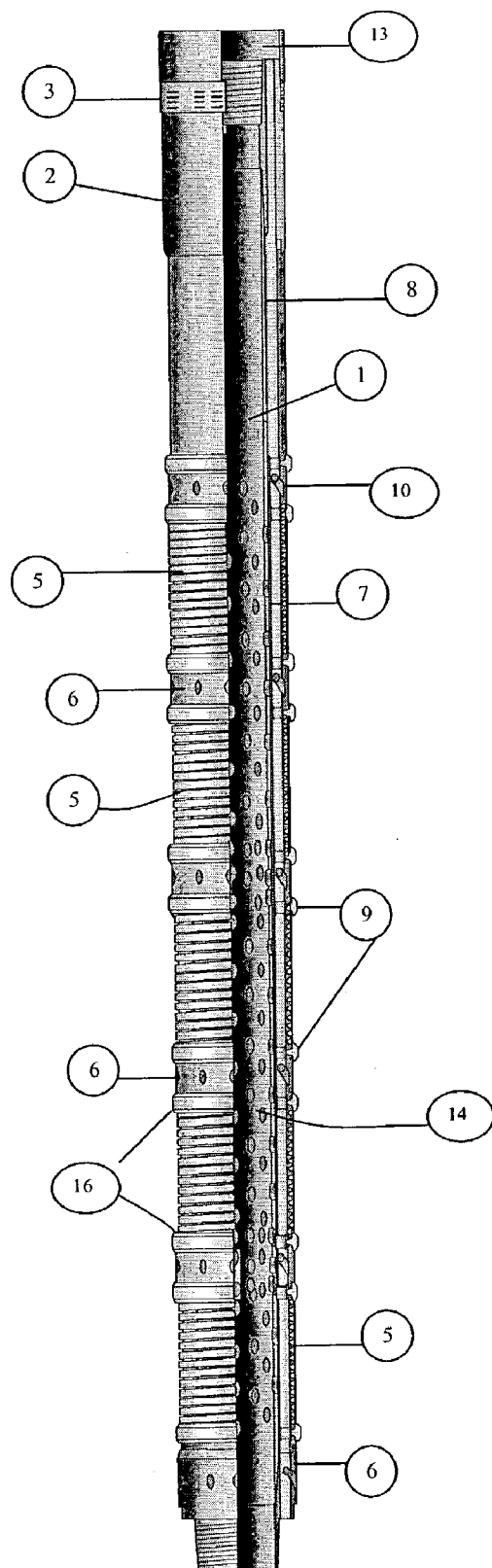


Fig. 2A

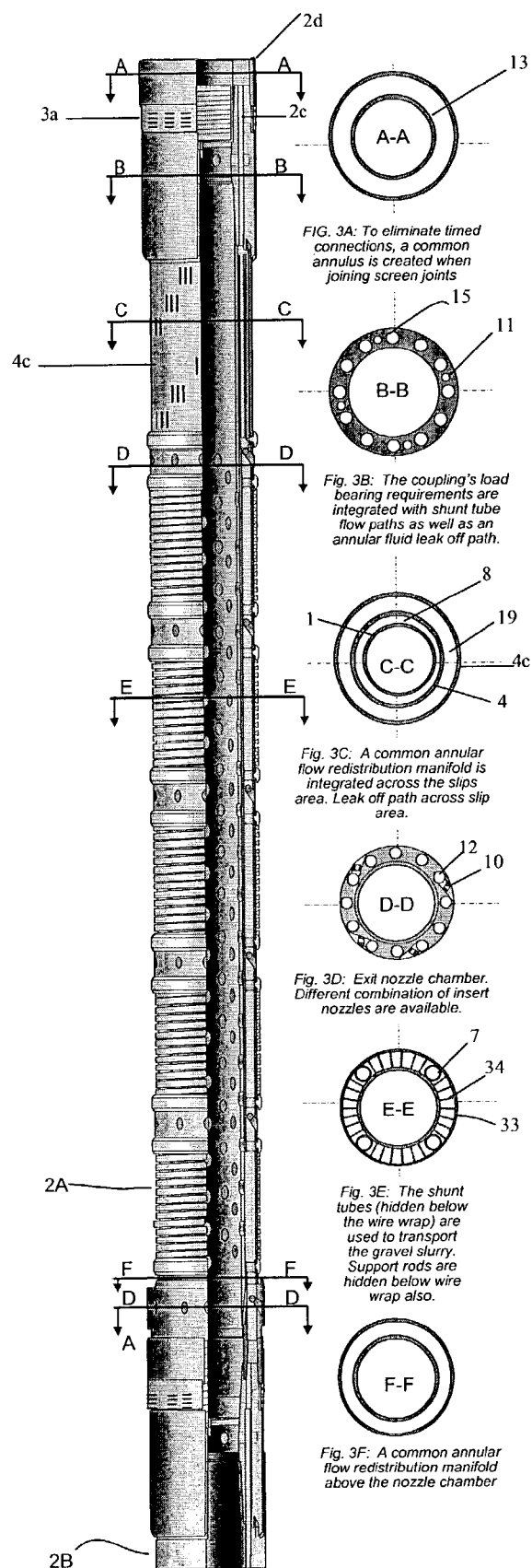


Fig. 3

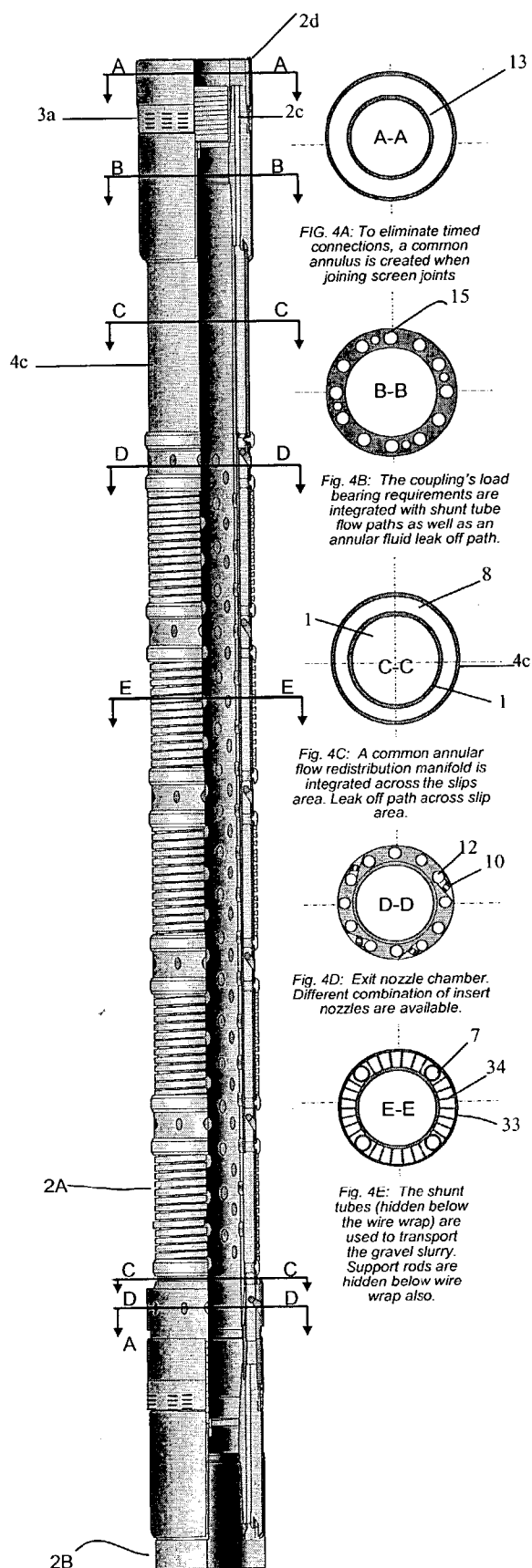
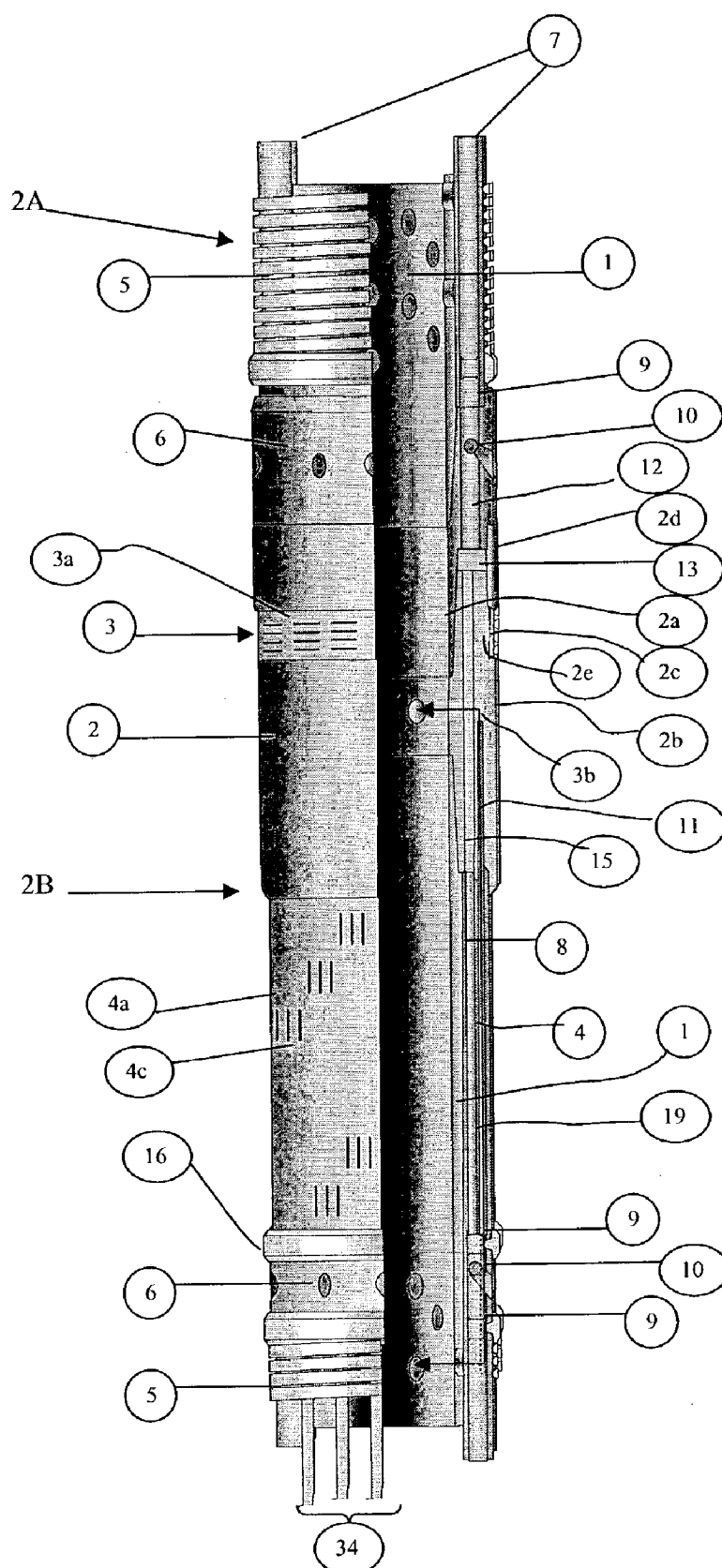


Fig. 4



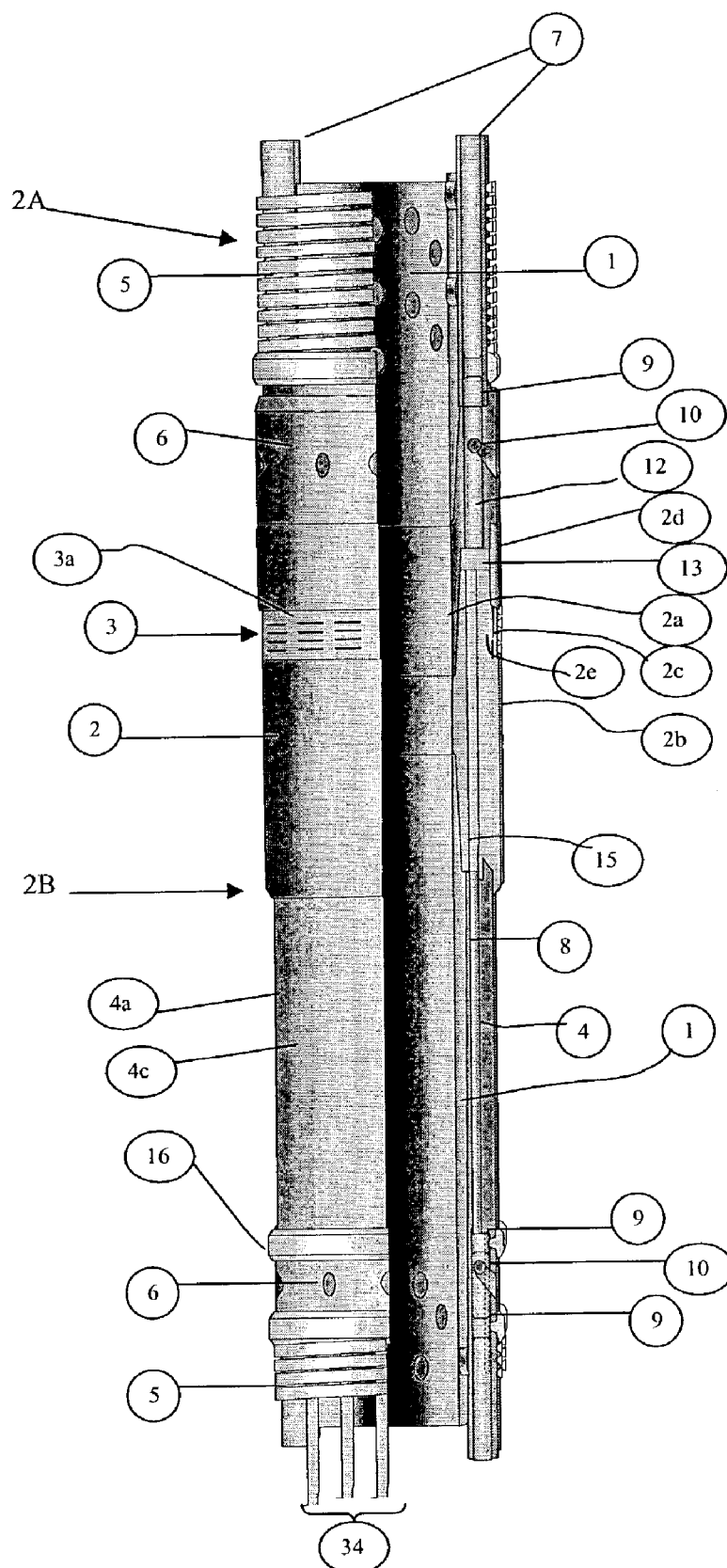


Fig. 5A

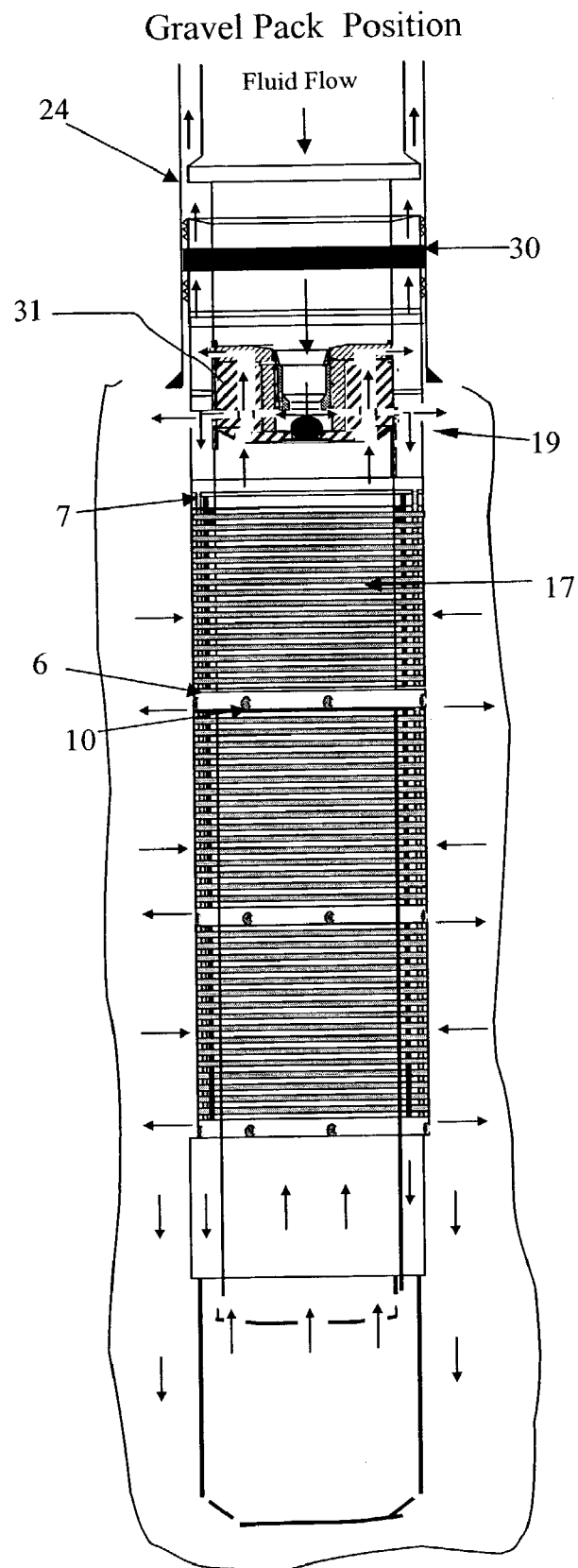


Fig. 6

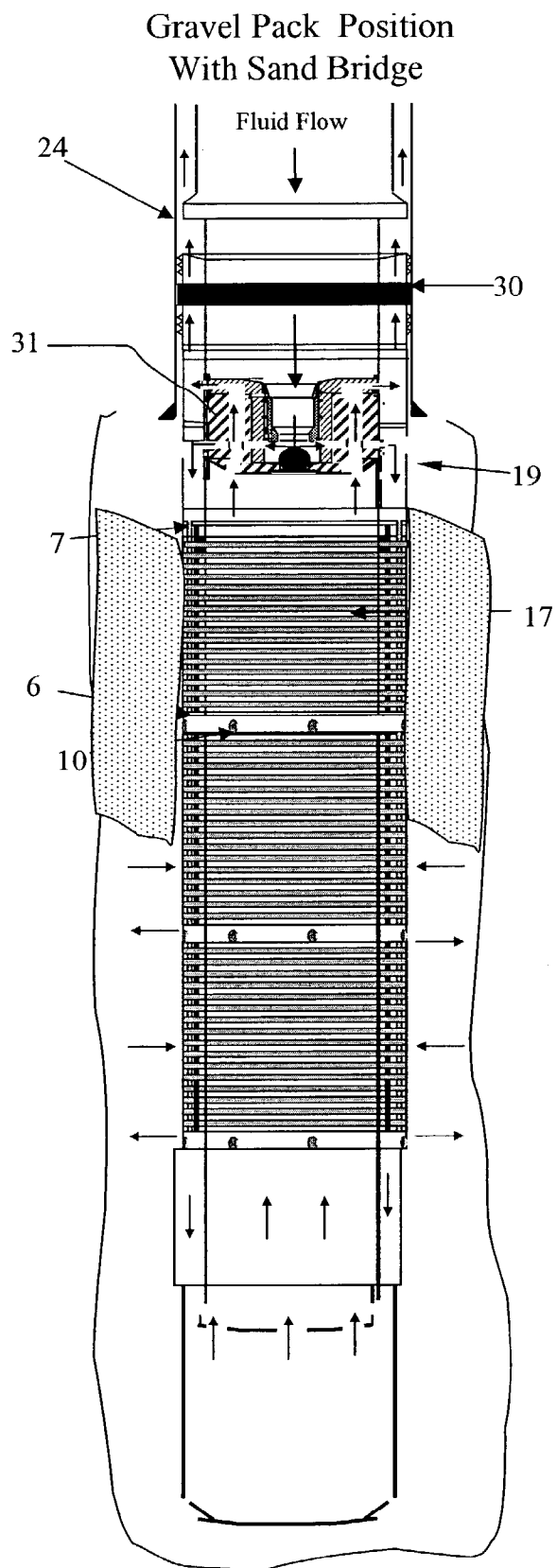


Fig. 7

WELL SCREEN WITH INTERNAL SHUNT TUBES, EXIT NOZZLES AND CONNECTORS WITH MANIFOLD

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

[0002] The present invention relates to a well screen for use in a wellbore and in one of its aspects relates to a well screen for fracturing and/or gravel packing a well that includes multiple shunt tubes (i.e. alternate flowpaths) axially extending along and positioned inside the annulus formed by the base pipe and outer surface (e.g. wire wrap) for delivering a particulate-laden fluid via exit nozzle chambers on the well screen and spaced at different levels within the wellbore annulus.

[0003] 2. Background

[0004] In producing hydrocarbons or the like from loosely or unconsolidated and/or fractured subterranean formations, it is not uncommon to produce large volumes of particulate matter (e.g. sand) in conjunction with the formation fluids. As is known in the art, these particles routinely cause a variety of problems that result in added expense- and increased downtime. Accordingly, it is extremely important to control the production of these particulates in most operations.

[0005] Probably the most common technique for controlling the production of particulates (e.g. sand) from a well is one that is known as "gravel packing". In a typical gravel pack completion, a well screen is lowered into the wellbore and positioned across the interval of the well that is to be completed. Particulate material, collectively referred to as gravel, is then pumped as a slurry down the tubing on which the screen is suspended. The slurry exits the tubing above the screen through a "crossover" tool or the like and flows downward in the annulus formed between the screen and the well casing or open hole, as the case may be.

[0006] The liquid in the slurry flows into the formation and/or the openings in the screen that are sized to prevent the gravel from flowing through them. This results in the gravel being bridged on or "screened out" on the screen and in the annulus around the screen where it collects to form the gravel pack. The gravel is sized so that it forms a permeable mass which blocks the flow of any particulates produced with the formation fluids.

[0007] One of the main problems with gravel packing, especially where long horizontal or inclined intervals are to be completed, is obtaining equal distribution of the gravel along the entire completion interval, i.e. completely packing the annulus between the screen and the casing in cased hole completions or between the screen and the wellbore in open hole completions. Poor distribution of the gravel (i.e. incomplete packing of the interval resulting in voids/unpacked areas in the gravel pack) is often caused by the dehydration of the gravel slurry into more permeable portions of the formation interval that, in turn, causes the formation of gravel "bridges" in the annulus before all of the gravel has been placed. These bridges block further flow of the slurry through the annulus causing insufficient placement of the gravel. Subsequently, the portion of the screen that is not covered or packed with gravel is thereby left exposed to erosion by the solids in the produced fluids or gas and/or that

portion of the screen is then easily blocked or "plugged" by formation particulates (i.e. sand).

[0008] U.S. Pat. No. 4,945,991, Jones, L. G., "Methods for Gravel Packing Wells" discloses a screen with rectangular perforated shunt tubes attached to the outside of a screen longitudinally over the entire length of the screen. In this method, the perforated shunts (i.e. flow conduits) extend along the length of the screen and are in fluid communication with the gravel slurry as it enters the annulus in the wellbore adjacent the screen.

[0009] If a sand bridge forms in the annulus formed by the screen and the wellbore prior to placing all of the gravel, the slurry will flow through the conduits past the sand bridge(s) and out into the annulus through the perforations spaced along the conduits to complete the filling of the annulus above and/or below the bridge(s). U.S. Pat. No. 5,113,935 is a further modification of this type of well screen. In some instances, valve-like devices are provided for the perforations in these conduits so that there is no flow of slurry through the conduits until a bridge is actually formed in the annulus; see also U.S. Pat. No. 5,082,052.

[0010] In many prior art, alternate path well screens, the individual perforated conduits or shunts are shown as being preferably carried externally on the outside surface of the screen; see U.S. Pat. Nos. 4,945,991; 5,082,052; 5,113,935; 5,417,284; and 5,419,394. This positioning of the shunt tubes has worked in a large number of applications, however these externally-mounted perforated shunts are not only exposed to possible damage during installation but, more importantly, effectively increase the overall diameter of the screen. The latter is extremely important when the screen is to be run in a small diameter wellbore where even fractions of an inch in the effective diameter of the screen may make the screen unusable or at least difficult to install in the well. Also, it is extremely difficult and time consuming to connect respective shunt tubes attached to the outside of the screen to shunt tubes attached to the outside of the following screen in the course of assembling the screen and lowering it into the wellbore.

[0011] In order to keep the effective diameter of a screen as small as possible, external perforated shunt tubes are typically formed from "flat" rectangular tubing even though it is well recognized that it is easier and substantially less expensive to manufacture a round tube and that a round tube has a substantially greater and more uniform burst strength than does a comparable rectangular tube.

[0012] An additional disadvantage to mounting the shunt tubes externally, whether they are round or rectangular, is that the shunt tubes are thereby exposed to damage during assembly and installation of the screen. If the shunt tube is crimped during installation or bursts under pressure during operation, it becomes ineffective in delivering the gravel to all levels of the completion interval and may result in the incomplete packing of the interval. One proposal for protecting these shunt tubes is to place them inside the outer surface of the screen; see U.S. Pat. Nos. 5,476,143 and 5,515,915. However, because these prior art, alternate path well screens incorporate the perforated shunts and require that holes be drilled in the wire wound portions of the screen and/or the shunt tubes, some additional form of seal between the drilled hole in the wire and shunt tube is needed to prevent slurry flow and possible erosion in the base pipe by

screen annulus. This substantially increases the cost of the screen without substantially decreasing the overall diameter of the screen. In addition, the connections between the joints of screen in these prior art well screens require either (1) a union type connection, which is understood by those skilled in the art to be incapable of withstanding torque being applied, (2) a timed connection to align all of the shunt tubes from screen joint to screen joint, (3) a jumper shunt tube between screen joints or (4) a cylindrical cover plate over the connection between screen joints that is either welded to the base pipe or held in place by metal bands. All of those are expensive, time consuming and/or very difficult to handle on the rig floor while making up and installing the well screens.

[0013] Other downhole well tools have been proposed for fracturing a formation (U.S. Pat. No. 5,161,618) or treating a formation (U.S. Pat. No. 5,161,613) whereby individual conduits or shunt tubes are positioned internally within a housing or the like to deliver a particulate treating or fracturing fluid to selective levels within the wellbore. However, the outlets through the housing of these tools remain open after the particular operation is completed which would be detrimental in gravel packing completions since the produced fluids could then carry particulates back into the housing through these openings after the gravel pack has been completed and the well has been placed on production.

[0014] U.S. Pat. No. 5,333,688 discloses a gravel pack screen having shunt tubes positioned within the base pipe of the screen where they do not increase the overall diameter of the screen. Gravel slurry carried by these shunt tubes is delivered to different levels in the well annulus around the screen through the spaced outlets through the housing. However, by placing the shunt tubes within the base pipe (i.e. ultimately part of the production flowpath), an intricate and sophisticated valve is required to each of the outlets after the gravel packing operation is completed, thereby adding substantially to the costs of the screen and of installation. As well, with the shunt tubes in the production flowpath any remedial or production data gathering work will be inhibited by the tubes and will cause such work to be expensive or incapable of being performed.

SUMMARY OF THE INVENTION

[0015] The present invention provides a well screen that is to be used for fracturing and/or gravel packing a completion in a wellbore wherein a good distribution of gravel is obtained over the entire completion interval even if a sand bridge or void or the like is formed in the well annulus before the placement of the gravel is completed. The present invention provides for distributing the gravel slurry to different points of the wellbore annulus from a multiplicity of unperforated flow conduits or shunt tubes positioned within the annulus formed between the base pipe and the outer surface of the screen, thereby providing the necessary alternate flowpaths for the slurry without substantially increasing the overall, outside diameter of the screen. The shunt tubes are connected to exit nozzle chambers placed at different points along the screen to allow for dispersion of the slurry around the complete circumference of the screen and along the entire length of the screen.

[0016] Also, by placing the unperforated shunt tubes within the annulus formed between the base pipe and the

outer surface of the screen, a) the shunt is protected from damage and abuse during handling and installation of the gravel pack screen; b) a more desirable "round" tube can be used to form the shunt tubes thereby providing shunts with greater burst strength and less chance of failure during operation than most external shunts; c) the ability is present to increase the number of shunts and thereby provide more flow area for delivery of the gravel slurry along the completion interval; and d) an externally smooth outside diameter on the outer surface of the screen is permitted to simplify the installation of the well screen

[0017] More specifically, the well screen of the present invention is comprised of a base pipe that has multiple openings through the wall thereof and an outer surface which is spaced from the base pipe to form an annulus between the base pipe and the outer surface. Typically, multiple alternate flow paths (e.g. shunt tubes) are spaced radially around the base pipe within the annulus and extended axially along the length of the base pipe and connected to exit nozzle chambers at designated intervals along the outer surface of the screen. Solid support members are interspersed between the shunt tubes to aid in supporting and spacing the outer surface away from the base pipe.

[0018] The outer surface of the screen is comprised of a continuous length of wire wrapped around the radially spaced shunt tubes and the support members and is welded at each point of contact with the tubes and support members. Each coil of the wrap wire is spaced slightly from the adjacent coils to form fluid passages between the respective coils of wire. End rings are used to align the tubes and support members and none of the tubes or support members are welded to the base pipe, thereby eliminating any problems associated with stress crack corrosion due to welding dissimilar metals. Multiple exit nozzle chambers are provided at designated intervals along the outer surface of the screen and the shunt tubes are connected to the exit nozzle chambers by a connector above and below. The present well screen may include only one section or it may include multiple sections that are connected together via a manifolded connector.

[0019] The manifolded connector allows for ease of make up of the joints of screen as it is run in the wellbore. The connector has multiple holes bored through the length of the box end and pin end. As the pin end is made up into the adjacent box end, there is a manifold area or space (e.g. common area) above the make up point that combines the flow from all of the shunt tubes. No other tie-in of the shunt tubes or additional cylindrical cover plates are required. Therefore the make up is similar to conventional pipe or tubing make up as performed in daily operations. The top of the manifold area is sealed with a seal ring above and below. The box end of the connector has a slotted plate that allows for return of the slurry fluid to aid dehydration across the manifolded connector. No special tools or timed connection or welding in the area of the connector are needed or required. The joints are made up end to end without any interruption in the flow between the joints. An additional concentric sleeve is provided below the box end of the connector to provide an area for hanging the screen on slips and/or latching the rig elevators to pick up the screen joint. The concentric sleeve can be slotted to provide additional area for return of the slurry fluid to aid dehydration across the concentric sleeve area. The purpose of the areas for

return of the slurry fluid is to achieve an even leak off rate across the entire well screen assembly.

[0020] In a typical gravel pack operation, the present screen is lowered into a wellbore and a gravel slurry is pumped down through the workstring to a cross-over tool that diverts the slurry flow to the well annulus surrounding the screen and the fluid returns to the surface via the workstring and wellbore annulus. The upper end of the shunt tubes within the screen may be open to the annulus to receive the gravel slurry or the tubes may be manifolded together to receive the slurry directly from the cross-over tool.

[0021] As the gravel slurry flows downward in the well annulus around the screen, it is likely to dehydrate on the formation and the screen as gravel is deposited around the screen to form the gravel pack. If enough fluid is lost from the slurry before the annulus is completely filled, a sand bridge is likely to form that will block further flow through the well annulus. The shunt tubes in the present well screen allow the slurry to by-pass this bridge in the well annulus and thereby complete the gravel pack.

BRIEF DESCRIPTION OF DRAWINGS

[0022] The apparent advantages and improvements of the present invention, as well as actual construction and operation will be better comprehended by referring to the drawings that are not necessarily to scale and in which like parts are identified with like numerals and in which:

[0023] **FIG. 1** is an elevational view, partly in cut away, of the well screen of the present invention in an operable position within a wellbore;

[0024] **FIG. 1A** is an elevational view, partly in cut away, of the well screen of the present invention in an operable position within a wellbore without the bleed off area across the connection;

[0025] **FIG. 2** is a partly cut away view of a single joint of the well screen of the present invention as set up to run in a wellbore;

[0026] **FIG. 2A** is a partly cut away view of a single joint of the well screen of the present invention as set up to run in a wellbore with out the bleed off area across the connection;

[0027] **FIG. 3** is a partly cut away view of a joint of the well screen of the present invention with several cross-sections taken along different lines of the well screen as indicated by the letters;

[0028] **FIG. 3A** is a cross-sectional view of **FIG. 3** taken along section lines AA of **FIG. 3**;

[0029] **FIG. 3B** is a cross-sectional view of **FIG. 3** taken along section lines BB of **FIG. 3**;

[0030] **FIG. 3C** is a cross-sectional view of **FIG. 3** taken along section lines CC of **FIG. 3**;

[0031] **FIG. 3D** is a cross-sectional view of **FIG. 3** taken along section lines DD of **FIG. 3**;

[0032] **FIG. 3E** is a cross-sectional view of **FIG. 3** taken along section lines EE of **FIG. 3**;

[0033] **FIG. 3F** is a cross-sectional view of **FIG. 3** taken along section lines FF of **FIG. 3**;

[0034] **FIG. 4** is a partly cut away view of a joint of the well screen of the present invention with several cross-sections taken along different lines of the well screen as indicated by the letters, but without the bleed off area across the connection;

[0035] **FIG. 4A** is a cross-sectional view of **FIG. 3** taken along section lines AA of **FIG. 4**;

[0036] **FIG. 4B** is a cross-sectional view of **FIG. 3** taken along section lines BB of **FIG. 4**;

[0037] **FIG. 4C** is a cross-sectional view of **FIG. 3** taken along section lines CC of **FIG. 4**;

[0038] **FIG. 4D** is a cross-sectional view of **FIG. 3** taken along section lines DD of **FIG. 4**;

[0039] **FIG. 4E** is a cross-sectional view of **FIG. 3** taken along section lines EE of **FIG. 4**;

[0040] **FIG. 5** is an enlarged partial view, partly cut away, of the manifolded connector end portions of two adjacent joints of the well screen of **FIG. 1**;

[0041] **FIG. 5A** is an enlarged partial view, partly cut away, of the manifolded connector end portions of two adjacent joints of the well screen of **FIG. 1A**;

[0042] **FIG. 6** is a side view of the entire screen assembly in place in the wellbore and indicating the fluid flow while in the gravel packing position; and

[0043] **FIG. 7** is a side view of the entire screen assembly in place in the wellbore and indicating the fluid flow while in the gravel packing position with a sand bridge formed in the annulus.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0044] **FIGS. 1 and 1A** illustrate the well screen **17** of the present invention in an operable position within the lower portion of a producing and/or injection well **20**. Well **20** has a wellbore **25** that extends from the surface (not shown) through an unconsolidated and/or fractured production and/or injection formation **22**. Even though well **20** is shown as a vertical, cased well, it should be noted that the present invention is equally applicable for use in open-hole wells and/or completions as well as horizontal and/or deviated (inclined) wellbores.

[0045] As shown, wellbore **25** is cased with casing **24** and cement **23** with perforations **21** within the interval of formation **22** that is to be gravel packed and/or fractured. Screen **17** is connected to the lower end of a cross-over tool **31** that is connected to the surface via a tubing or workstring (not shown) and is positioned across formation **22** forming an annulus **18** with casing **24**.

[0046] **FIGS. 1-4** illustrate screen **17** as comprised of a perforated base pipe **1**. However, because base pipe **1** is shown as having multiple perforations **14**, it should be recognized that other types of base pipes, e.g. slotted pipe, etc., can be used in place of the perforated base pipe without departing from the present invention. One or more unperforated shunt tubes **7** (two shown) are spaced around the circumference of base pipe **1** and extend longitudinally

along the length of the base pipe 1. Unperforated shunt tubes 7 (thereby flow conduits) are shown as being preferably circular in cross-section. It should be understood that conduits having other cross-sections (e.g. rectangular) can be incorporated without departing from the present invention.

[0047] As shown in FIG. 1, outer surface 32 of screen 17 is comprised of a continuous length of wrap wire 33 that, in turn, may be cut to provide a “keystone” shape (not shown). Solid support rods or longitudinal rod wire 34 (three shown in FIG. 1) or the like—which are commonly used in prior art screens of this general type—are interspersed with and/or between shunt tubes 7 to aid in supporting and spacing outer surface 32 (wire 33 is the preferred embodiment) of screen 17 away from base pipe 1. Shunt tubes 7 may be used as the only spacers between the base pipe 1 and the wire 33 without departing from the present invention.

[0048] Wire 33 is wrapped around the radially-spaced shunt tubes 7 and the longitudinal support rods 34 (Shown in FIG. 3E) on base pipe 1 and is normally welded at each point of contact with the shunt tubes 7 and wire longitudinal support rods 34. Each circumferential wrap of wire 33 is spaced slightly from the adjacent wraps to form passage-ways or slot openings 5 between the respective wraps of wire 33. The wire 33 is wrapped circumferentially in various lengths along the base pipe 1 and is shrink fit onto the base pipe 1 while covering the shunt tubes 7 and longitudinal support rods 34, forming the outer surface 32. Connector rings 16 are shrink fit onto the outer surface 32 of screen 17 and base pipe 1 to connect the outer surface 32 of screen 17 to the base pipe 1. This is basically the same process commonly used in the manufacture of wire-wrap screens that are commercially available, such as LINESLOT Screens, manufactured by Reslink, Inc. Houston, Tex.

[0049] As shown in FIGS. 1, 2 and 5, a part of the outer surface 32 of screen 17 incorporates multiple exit nozzle chambers 6 spaced along the length of each screen joint 17, shrink fitted onto base pipe 1 and comprised of several nozzles 10 (FIGS. 1-5) that are connected to the unperforated shunt tubes 7 via connectors 9. The outer surface 32 of screen 17 is connected to the exit nozzle chambers 6 via the connector rings 16 that are shrink fitted onto the screen 17 and exit nozzle chambers 6.

[0050] The preceding description of screen 17 indicates that it is constructed of a perforated base pipe with a wire 33 or the like that is wrapped in closely spaced wraps to form a permeable liner. It will also be recognized by those skilled in the art that outer surface 32 may be formed from a slotted pipe, screen material, or the like, as long as it is permeable to fluids and impermeable to particulates. Accordingly, the “screen” as used throughout the present specification and claims, including screen 17, is meant to be generic and to include and cover all types of those structures commonly used by the industry in gravel pack and frac pack operations which permit the flow of fluids through them while abating the flow of particulates (e.g. commercially available screens, slotted or perforated liners or pipes, screened pipes, pre-packed or dual prepacked screens and/or liners or combinations thereof) into which shunt tubes 7 can be incorporated inside the outer surface of the screen 17 as disclosed in the present invention.

[0051] Additionally, screen 17 may comprise only one joint (e.g. 30 foot section) or it may comprise a multiple number of joints connected together. As an example, FIG. 5 illustrates a coupling 2 for joining two screen joints 2A and 2B together. Coupling 2 is comprised of a standard threaded

box 2b and a threaded pin 2a. After the two joints have been joined and properly torqued a manifold area 13 is formed above the threaded connection by the extension 2d that is threaded onto box 2b. Manifold area 13 is connected to the shunt tubes 7 from joint 2A via the channels 12 bored through exit nozzle chamber 6 above the threaded pin 2a, and is in turn connected to the shunt tubes 7 from joint 2B via channels 15 bored in the threaded box 2b. Incorporation of this manifold area 13 allows for make up of the joints 2A and 2B without having to align the shunt tubes on the adjoining joints. The bored channels 15 in the threaded box 2a connect or align with the concentric annulus 8 formed by the base pipe 1 and inner concentric pipe 19' that is positioned between the top exit nozzle chamber 6 and the threaded box 2b (FIG. 5).

[0052] As known by those skilled in the art, the inability to bleed off the fluid from the slurry across the coupling 2 and the elevator/slip area 4a may cause insufficient dehydration of the fluid from the gravel slurry to occur in this area and thereby an incomplete pack is performed. The present invention incorporates two areas 3, 4a for bleed off of the fluid from the slurry (FIG. 3). The bleed off area 3 in coupling 2 is formed by milling a groove 2c radially around the exterior of the threaded box 2b, then covering the groove 2c by a thin slotted cover plate 3a that is held in place by the extension 2d, made up to the outside of threaded box 2b (FIG. 5). Bored hole 2e connects to bored channel 15 to allow bleed off of the fluid to the shunt tubes 7 (FIG. 5). The bleed off area 4a is comprised of a slotted external concentric pipe 4c that forms an annulus 19 with the inner concentric pipe 4. This annulus is connected to a bored channel 11 in threaded box 2b that has a hole bored to connect to the base pipe flow stream. The external slotted concentric pipe 4c and the inner concentric pipe 4 are positioned between the top exit nozzle chamber 6 and the threaded box 2c.

[0053] In a typical gravel pack operation, screen 17 is lowered into wellbore 20 (FIG. 1) on workstring 32 and is positioned across the formation 22. Packer 30 is set as is understood by those skilled in the art. A gravel slurry is then pumped down the workstring into cross-over 31 and out of outlet ports 31a into annulus 18 of the wellbore. All of the shunt tubes 7 are manifolded together by concentric annulus 8 that is formed by base pipe 1 and inner concentric pipe 4 to receive the gravel slurry either via the wellbore annulus 18 or directly from the outlet ports 31a in the cross-over tool 31.

[0054] As the gravel slurry flows downward in annulus 18 around the screen 17, it will likely dehydrate due to fluid loss to formation 22 and/or through the screen 17. The fluid entering screen 17 will return to the surface through pipe 31b in cross-over tool 31 (FIG. 6). As the fluid from the gravel slurry dehydrates on the screen 17 and/or the formation 22, the gravel carried in the slurry is deposited and collects in the annulus 18 to form the gravel pack. As is known in the art, if enough fluid is lost from the slurry before the annulus 18 is filled, a sand bridge (FIG. 7) will form and block flow through the annulus 18 and prevent further filling below the bridge. If this occurs while using the present invention, the gravel slurry can continue to be pumped downward through the shunt tubes 7 and out the respective exit nozzles 10 by-passing the bridge and completing the gravel pack.

[0055] Because many varying and different embodiments may be made within the scope of the invention concept taught herein which may involve many modifications in the embodiments herein detailed in accordance with the descrip-

tive requirements of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

What is claimed:

1. A well screen comprising:
 - a base pipe having openings through the wall thereof;
 - an outer surface having a section mounted over said base pipe, some of said surface of said section being permeable to fluids and abating the flow of particulate material, said outer surface having standoff from said base pipe, to form an annulus between the said base pipe and said outer surface;
 - at least one section of exit nozzle chambers, said section placed over said base pipe and adjacent to said permeable outer surface section;
 - at least one shunt tube positioned inside said annulus and secured to the inside of said outer surface and extending axially along said base pipe adjacent to said permeable section of said outer surface;
 - said section of exit nozzle chambers secured to said outer surface, said nozzle chamber section having multiple exit ports circumferentially spaced around said nozzle chamber section, said exit nozzle chambers being connected to said shunt tube for communicating with the outside of said outer surface of said screen.
2. The well screen of claim 1, wherein there are several permeable sections of said outer surface.
3. The well screen of claim 2, wherein there are further included longitudinal support rods secured to the inside of said outer surface, thereby causing said outer surface to stand off from said base pipe.
4. The well screen of claim 3, wherein said support rods are welded to the inside of said outer surface.
5. The well screen of claim 4, wherein said shunt tube is interspersed with said longitudinal support rods.
6. The well screen of claim 5, wherein said shunt tube is welded to the inside of said outer surface.
7. The well screen of claim 3, wherein said outer surface includes multiple sections of a wire wrapped around said shunt tube and said longitudinal support rods, each wrap of said wire being spaced from the adjacent wraps to create openings between said wraps of wire.
8. The well screen of claim 2, wherein said section of exit nozzle chambers is placed over said base pipe and alternates with sections of said outer surface.
9. The well screen of claim 1, wherein said exit ports of nozzle inserts includes material used for erosion abatement.
10. The well screen of claim 2 where there is included:
 - a multiple number of said shunt tubes radially spaced around said base pipe within said annulus and extending along said base pipe in said permeable sections of said outer surface and connected to said exit nozzle chamber sections of said outer surface, thereby at least one flow path is established.
11. A well screen for use with fluid in slurry in a flow stream, comprising:
 - a plurality of joints, each of said joints having—
 - a base pipe having openings through the wall thereof;
 - an outer surface having a section mounted over said base pipe, some of said surface of said section being per-

meable to fluids and abating the flow of particulate material, said outer surface having standoff from said base pipe, to form an annulus between the said base pipe and said outer surface;

- at least one section of exit nozzle chambers, said section placed over said base pipe and adjacent to said permeable outer surface section;

- at least one shunt tube positioned inside said annulus and secured to the inside of said outer surface and extending axially along said base pipe adjacent to said permeable section of said outer surface;

- said section of exit nozzle chambers secured to said outer surface, said nozzle chamber section having multiple exit ports circumferentially spaced around said nozzle chamber section, said exit nozzle chambers being connected to said shunt tube for communicating with the outside of said outer surface of said screen;

- a mechanism means for joining adjacent ones of said joints together forming a common manifold area, whereby said mechanism permitting said at least one shunt tube in one each of said joints being in fluid connection is connected to said a common manifold area and thereby are in communication with said exit nozzle chambers and at least one shunt tube of the adjoining joints of said joint.

12. The well screen of claim 11 where said mechanism joining said joints includes:

- a fluid means for fluid in slurry to return to the flow stream in the said shunt tubes.

13. The well screen of claim 12 wherein said fluid means includes a box end at one end of said base pipe, said box end having threads for attachment to an adjacent one of said plurality of joints;

- an external circumferential groove above said threads; and

- a slotted plate covering said external circumferential groove.

14. The well screen of claim 11 where said mechanism includes connection means for joining adjacent ones of said joints, and the flow stream is in said base pipe and further including:

- a fluid means for the fluid in slurry to return to the flow stream in said base pipe;

- a slotted external concentric pipe positioned between said exit nozzle chamber that is the highest mounted and said threaded box, said slotted external concentric pipe forming an annulus with said inner concentric pipe and said threaded box and having a bored channel therein, said bored channel being in fluid connection with said annulus and in further fluid communication with the flow stream in said base pipe.

15. The well screen of claim 11 where there are a multiple number of said shunt tubes radially spaced around said base pipe within said annulus and extending along said base pipe in said permeable section of said outer surface and connected to said exit nozzle chamber sections of said outer surface.

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