

United States Patent [19]**Thomeer**[11] **3,830,299**[45] **Aug. 20, 1974****[54] SHALLOW PLUGGING SELECTIVE
RE-ENTRY WELL TREATMENT****[75] Inventor:** Johannes H. Thomeer, Houston,
Tex.**[73] Assignee:** Shell Oil Company, Houston, Tex.**[22] Filed:** May 21, 1973**[21] Appl. No.:** 362,624**[52] U.S. Cl.:** 166/250, 166/269, 166/281,
166/297**[51] Int. Cl.:** E21b 33/138, E21b 43/25**[58] Field of Search** 166/250, 281, 269, 285,
166/252, 297**[56] References Cited****UNITED STATES PATENTS**

2,019,418	10/1935	Lang	166/269
2,107,007	2/1938	Lang	166/269

2,223,804	12/1940	Kennedy	166/281
2,799,341	7/1957	Maly	166/288
3,451,264	6/1969	Kastor	166/250 X
3,593,798	7/1971	Darley	166/269 X
3,677,343	7/1972	Showalter	166/252

Primary Examiner—David H. Brown**[57] ABSTRACT**

The pattern of fluid flow between a well and one or more subterranean reservoirs having different characteristics and/or fluid content is adjusted by determining the flow pattern, plugging all of the reservoirs with plugging material deposited internally within a few inches from the well borehole, and then perforating some or all of the plugged portions with openings that are arranged in relation to the determined flow pattern to provide selected rates of flow at selected depths.

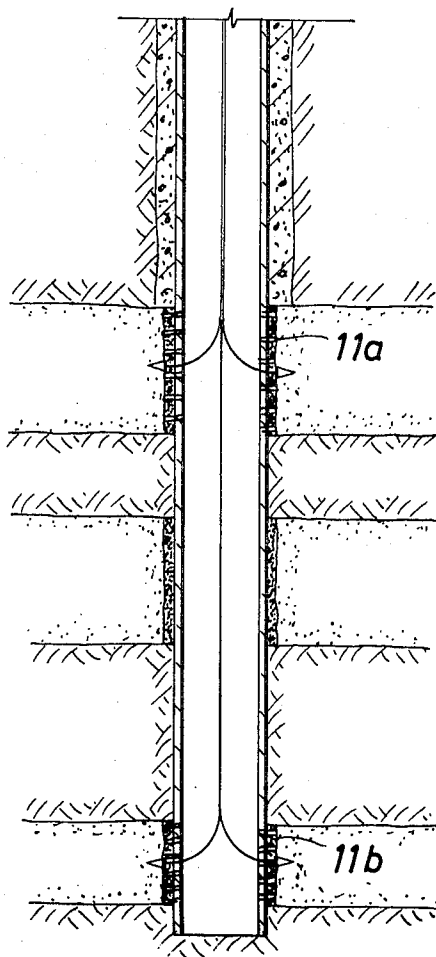
12 Claims, 15 Drawing Figures

FIG. 1A

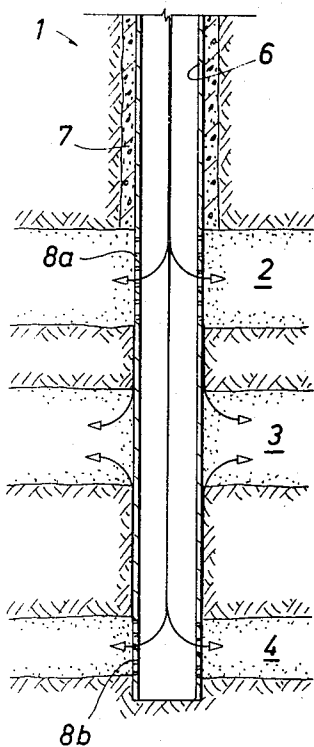


FIG. 1B

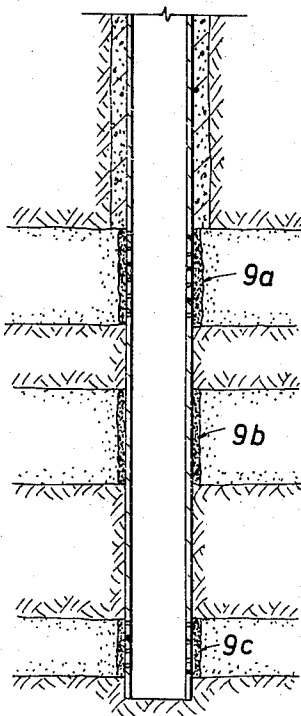


FIG. 1C

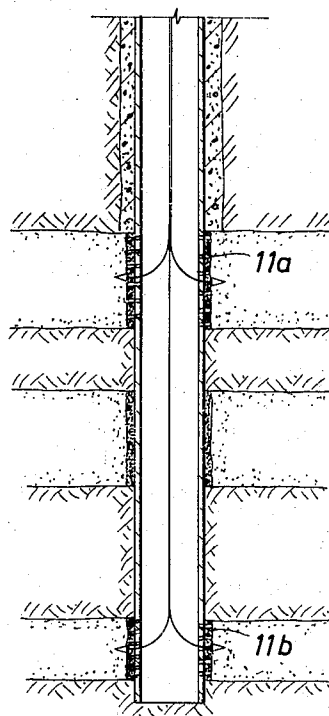


FIG. 2A

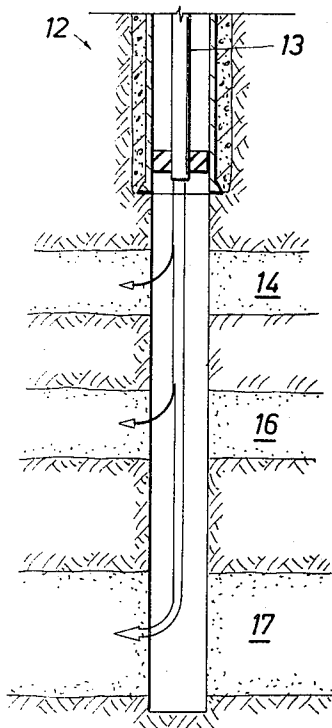


FIG. 2B

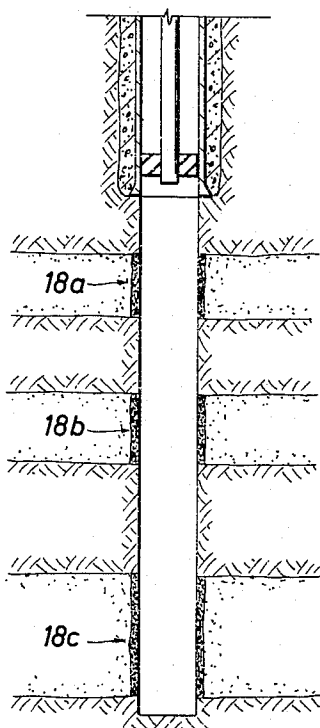


FIG. 2C

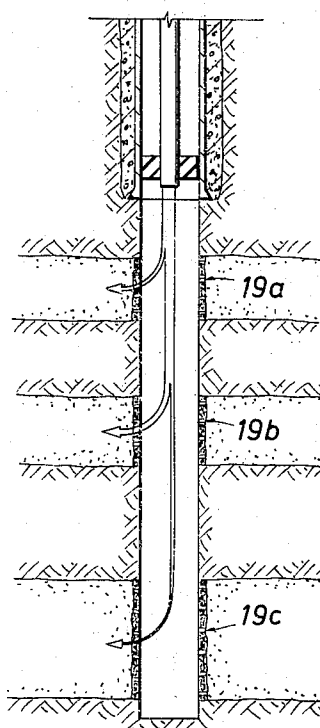


FIG. 3A

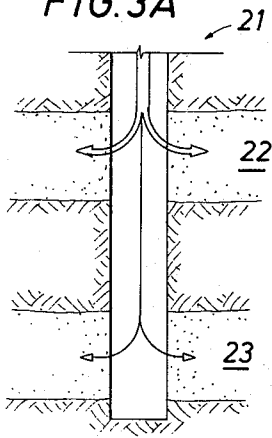


FIG. 3B

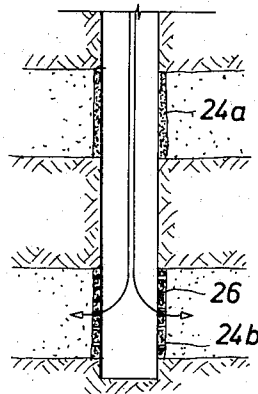


FIG. 3C

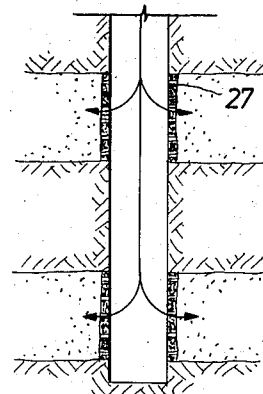


FIG. 4A

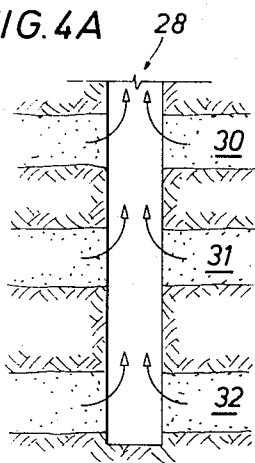


FIG. 4B

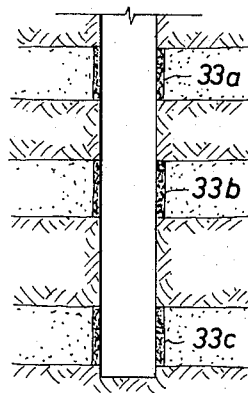


FIG. 4C

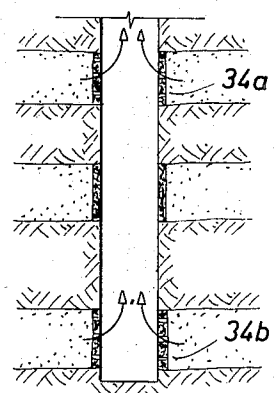


FIG. 5A

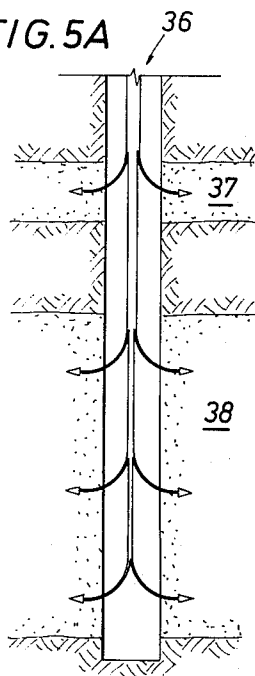


FIG. 5B

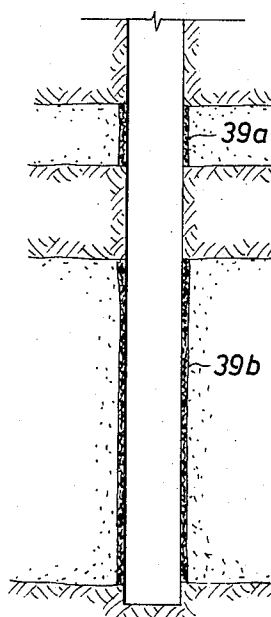
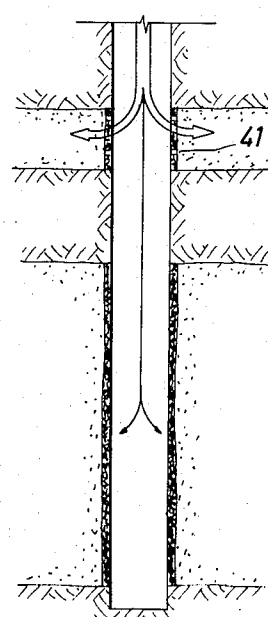


FIG. 5C



SHALLOW PLUGGING SELECTIVE RE-ENTRY WELL TREATMENT

BACKGROUND OF THE INVENTION

The invention relates to a well-treating process for use in boreholes (which are open, cased, cemented, or uncemented) of injection or production wells. It provides a method for utilizing a combination of known materials and techniques to improve the injectivity profile of a well by either reducing or increasing the receptivity of selected subterranean reservoirs, and to improve the production profile of a well by reducing production of unwanted fluids by plugging all or part of the source reservoirs of these fluids.

Numerous materials and techniques are known for use in increasing or decreasing the permeability of earth formations and/or for improving the injection profile of a well. Over thirty years ago, U.S. Pat. No. 2,223,804 described injecting a formation-penetrating plugging agent that forms extensive plugged regions within the more permeable zones and shallow plugged regions in the less permeable zones, then underreaming, blasting-off, or rubbing the walls of the borehole to remove or shatter the shallowly plugged portions while leaving the plugging material in the extensively plugged portions. U.S. Pat. No. 2,779,341 suggests injecting hot fluid to selectively heat the more permeable zones and then injecting molten material that would enter and plug the heated zones but not the cooler less permeable zones. U.S. Pat. No. 2,800,184 suggests water flooding to a substantially residual oil saturation, and temporarily plugging the less permeable zones at the well bore surface while a permanent plugging material is injected into the more permeable zones. U.S. Pat. No. 3,159,976 suggests injecting separate slugs of an asphalt emulsion and an emulsion breaker through separate conduits to deposit asphalt in and adjacent to a permeable subterranean formation. U.S. Pat. No. 3,310,125 describes asphalt emulsion drilling fluids and how such fluids are adapted to form impermeable filter cakes on permeable subterranean formations while permitting substantially no penetration of the asphalt into the pores of the subterranean formations. U.S. Pat. No. 3,455,390 describes fluid-loss preventing dispersions of oil-soluble particles suitable for plugging permeable subterranean formations until they are contacted by oil. U.S. Pat. No. 3,677,343, describes improving a water flood injectivity profile by establishing a constant flow of the flood-water into a reservoir interval, then suspending in the inflowing water a selected amount of small particles that partially plug the most permeable subterranean formations.

Substantially, twenty years ago U.S. Pat. No. 2,766,010 suggested pressurizing a low-fluid-loss cement slurry against a reservoir interval to form a thin sheath of cement on all portions of the interval, then perforating selected portions to permit a flow of fluid into the reservoir. The steps of forming and subsequently perforating a cement sheath are commonly used in the installation and perforation of well casings. Such a sheath formation and perforation is generally ineffective for improving an injectivity profile. Little or none of the cement enters the permeable subterranean formations and its flow-preventative effect is easily destroyed since cement tends to shatter when perforated, even when supported between a casing and the subterranean formation. In addition, fluid flow channels tend

to be dissolved along the interface between the cement and the subterranean reservoirs whenever an acid is injected through the perforations that pierce the cement sheath.

Such prior techniques have commonly depended upon a significant difference in effective permeability to cause a treating fluid to enter one subterranean formation rather than another. Such differences may not and often do not, occur. Even where the lack of a good injection profile is due to one zone that receives most of the injected fluid, that zone may not be the zone having the highest effective permeability. For example, in a well that communicates with 500 feet of 5 millidarcy permeability water sand and 10 feet of 25 millidarcy permeability oil sand, most of an injected fluid will enter the 500 feet of less permeable water sand.

SUMMARY OF THE INVENTION

The present invention relates to adjusting the fluid flow profile of a well that communicates with subterranean reservoirs or reservoir zones. Determinations are made of the variations in the flow-capability with depth within the well. Each reservoir zone that communicates with the well is plugged by depositing a plugging material within its pores within a few inches of the borehole well. Plugged portions of the reservoirs are then selectively pierced to provide openings that are arranged (by their location, number and size) in relation to the determined variations in flow capability to provide selected rates of flow at selected depths within the well.

As used herein, the term "flow profile" between a well and one or more reservoirs or reservoir zones in communication with the well relates to the fluid injection or production profile or pattern of the amount of flow into or out of series of permeable subterranean formations or reservoirs or zones within a reservoir where the flow is in response to a given pressure differential involving pressures less than a reservoir fracturing pressure. The "flow capability" with depth within a well refers to the amounts and/or kinds of fluid that flow or can be caused to flow into or out of the surrounding reservoir zones at different depths within the well (where such flows are induced by pressures that do not fracture the reservoirs; and where the reservoirs that receive or produce the fluid may be at depths other than those at which the flow occurs within the borehole, e.g. due to channeling behind a perforated casing).

Flow profile problems may occur in injection or production wells that are completed (i.e. opened) into single or multiple reservoirs. Generally, the permeable zones encountered by a well have different characteristics and/or fluid contents that result in different receptivities to injected fluids or productions of wanted or unwanted fluids. In addition, the extent of the reservoir formation damage or impairment may vary from zone to zone. This also affects injection and production profiles. Consequently, for example in injecting water, the individual zones or reservoirs may take the water at different rates. Those rates may not be the desired ones with respect to a process such as a water flood.

DESCRIPTION OF THE DRAWINGS

FIGS. 1 to 5 are each schematic illustrations of portions of wells and subterranean reservoirs at different stages of treatments with the present process.

DESCRIPTION OF THE INVENTION

As will be apparent to those skilled in the art, the type of treatment used to improve the flow profile of a given well must be suited to the geological make-up of the reservoirs encountered by that well. Whether or not any profile adjustment effected by treatments near the wellbore may have a chance of success in terms of improved reservoir performance will depend upon the adequacy of zonal isolation away from the wellbore, the specific objective of such a profile control treatment, and the overall profitability involved. For example, where extensive communication between different zones or different reservoirs away from the wellbore is known to exist, or to be likely, treatments near a well bore are not apt to be effective in improving a flood performance.

In determining the variations with depth within the well of the flow capability (which involves the fluid receptivity of the reservoirs and/or the types and/or rates of fluid produced from the reservoirs), numerous suitable procedures and techniques are commercially available. Contingent on the well, field, and reservoir conditions, the means for determining such variations may include one or a combination of techniques such as: production logging surveys utilizing temperature logs, spinner logs, radioactive tracer logs, differential density logs, or the like; the injection and/or production performance of nearby wells; drill stem tests or open hole logs; core data; geologic interpretations; reservoir performances; or the like.

The present invention is, at least in part, premised on a discovery that (a) a ring of internally plugged reservoir rock can provide a uniquely advantageous flow-preventing sheath around a bore hole, (b) substantially all of the reservoirs in communication with the wellbore can be plugged internally within a region near enough to the borehole to be perforated by economically feasible perforating tools or techniques (even if relatively wide variations exist in reservoir properties, such as pore sizes, wettability, etc.) without the need for a mechanical isolation of each reservoir for selective placement of the plugging material, and (c) by correlating the size, number and location of perforations that pierce the plugged portions of the reservoirs with determinations of the pre-treatment pattern of flow capability with depth, the perforations can be arranged to permit selected rates of flow and/or selected fluid production at selected depths.

A ring of internally plugged subterranean reservoir formations is adapted to form a particularly damage-resistant seal around a well. The sealing should cause a significant reduction in the pre-treatment flow rates, but need not be fluid tight. The sealing effects of the internally deposited plugging materials are preferably supplemented by flow-impairing filter-cakes on the faces of the reservoirs. But, the internal seals in each reservoir should, by themselves, provide significant reductions in the effective permeability of the reservoir and should do so within a zone extending not more than about 6 (and preferably not more than about 2) inches away from the borehole. The resultant internally plugged annular ring of reservoir rock is uniquely adapted to remain undisturbed when bumped or scraped by well equipment or tools that are moved in the well bore opposite the plugged and/or plugged and perforated reservoirs.

Such a ring of internally plugged reservoirs can be formed around the borehole of a well that has been completed in substantially any way that provides fluid communication between the borehole and the surrounding reservoirs. Thus, the present invention can be used to treat substantially any type of a fluid profile problem. For example, wells containing poorly cemented casings, or cased wells in which the cement has deteriorated, often exhibit communication between reservoirs intended to be isolated. The unwanted communication may take place through channels in the cement and/or the casing/open hole annulus and can result in severe profile problems. In such situations, since the reservoirs intended to be sealed (for example by cement and casing) are in effect in communication with the wellbore, in the present process, an internally plugged annular ring will be formed in those reservoirs, during the placement of the plugging material. This will prevent such reservoirs from receiving or yielding any substantial volumes of fluids, unless their plugged portions are subsequently perforated.

Materials and techniques for forming internally plugged regions within permeable subterranean formations and for perforating such regions, are known and available to those skilled in the art. The perforations can be formed by means of explosive jets and/or bullets or by means of abrasion, or the like.

When a relatively impermeable sheath of plugged reservoir rock surrounds a borehole and isolates all reservoirs, perforations through the sheath can be arranged to permit only selected rates of flow and/or selected fluid production at selected depths. Such a plugging and perforating can comprise or provide the selected adjustment in the pretreatment flow profile or can provide an initial one of a series of steps for producing the selected profile adjustment. For example, where the reservoirs around a wellbore have an overall fluid receptivity that is relatively low, the perforations through the plugging materials can be opened only into those that were initially least receptive and used for selectively injecting a permeability-improving material, such as an acidizing fluid. Later, additional perforations can be opened into the initially more permeable reservoirs or zones. This provides both a normalization of the flow profile and an increase in the overall injectivity of the interval. Alternatively, in an interval containing some zones having fluid receptivities that are too high (relative to other reservoirs in communication with the wellbore), the plugged zone can be selectively perforated into the initially too receptive zones and used to selectively inject an amount of permeability-impairing material that is controlled to effect a selected reduction in permeability. When perforations are opened in the remainder of the reservoir, the flow profile is more uniform.

Plugging fluids and techniques suitable for use in the present invention can be substantially any individual fluids or mixtures involving solutions or systems adapted to penetrate into and deposit plugging materials within the first few inches of a permeable subterranean formation. Such fluids can be oil-phase or aqueous liquids and/or gases that contain or comprise resin-forming components, precipitate-forming components, electroless (i.e. chemically-deposited) metal plating components, gel-forming materials, suspensions or emulsions of solid or substantially solid organic or inorganic materials, molten or thermally liquidifiable mate-

rials that can be injected while they are molten, and solidified within the earth formations, or the like. Examples of suitable materials include the precipitate-forming or gel-forming solutions of a polyvalent metal and a pH-increasing reactant that precipitate a hydrated metal oxide such as those described in the E. A. Richardson U.S. Pat. No. 3,614,985; the heat-guided plugging formulations and techniques of the R. D. Coles, E. A. Richardson, U.S. Pat. No. 3,669,188; the electroless metal plating solutions and techniques of the E. A. Richardson, R. C. Ueber U.S. Pat. No. 3,672,449; or the like. Particularly suitable plugging fluids comprise suspensions or emulsions containing particles that have composition, concentrations and sizes, that cause an invasion into permeable earth formations, and a deposition of plugging material within a few inches of the point of entry.

In using a plugging fluid containing reactive components (such as resin-forming, metalplating, or precipitate-forming materials) having a rate of reaction that is affected by temperature, the time and temperature exposure of each portion of the fluid (between its mixing at a surface location and its arrival at the reservoirs to be treated) can advantageously be normalized. This can be done as follows. The fluid initially present in the borehole is circulated out, e.g., by pumping fluid in through an injection tubing string while allowing an outflow of fluid through the annulus between the tubing string and the borehole wall or casing. The plugging fluid is pumped from a surface location to and into the zone to be treated at a rate and pressure providing a selected rate of flow. Initially, little or no outflow is allowed through the annulus outlet, so that substantially all of the plugging solution is injected into the reservoir interval at the rate and pressure established by the

pump. As portions of the reservoir interval become plugged, increasing portions of fluid are diverted away from the reservoir interval by allowing increasing amounts of fluid to return through the annulus of the well. As will be apparent to those skilled in the art, the progressively bypassing fluid injection tends to ensure that substantially each increment of the plugging fluid that enters the reservoir interval has been subject to substantially the same temperature for the same length of time. Each increment flows from the pump to the reservoir interval at substantially the same rate — although the rate of inflow into the reservoir interval decreased as additional portions of that interval are plugged.

A suspension of relatively insoluble inorganic particles having compositions, sizes, and concentration adapting them to invade and impede the effective per-

meability of earth formations, provides a plugging fluid that is advantageous in being substantially inert with respect to the commonly employed well treatment fluids as well as the fluids usually produced from a reservoir. Such a plugging fluid is formulated by suspending in a liquid (a) reservoir-invading particles that have effective diameters generally less than one-third the mean pore size of the reservoir, (b) bridging-size particles having effective diameters generally larger than one-third the mean pore size of the reservoir formations, and (c) using a concentration of particles that tends to cause an invasion and internal plugging before a filter cake is formed by the bridging effect. As known to those skilled in the art, sizes of the pores of a reservoir can be estimated by means of petrophysical data, such as capillary pressure curves, or the like.

A plugging fluid that is particularly suitable for dolomite reservoirs—having a permeability of about 50 millidarcies and a mean pore size of about 20 microns in diameter, contains invading-size bentonite particles of generally less than about 12 microns with a significant portion of less than 1 micron in size, and bridging-size particles of Imsil A-10 (a siliceous granular material available from Illinois Mineral Company) primarily in the 1–10 micron size range.

Table 1 shows the results of flow tests with dolomite cores, using and 0.1% wt. concentration of the above bentonite and Imsil particles in a 2% aqueous sodium chloride brine; with a ratio of 5 parts bentonite per part of Imsil. The bentonite particles were the particles that, predominantly, penetrated the cores. The data taken during solids injection reflect the contribution of internal impairment, plus that, due to an external filter cake. The data following the brine exposure reflect only the internal permeability impairment.

TABLE 1

RESULTS OF PARTICLE IMPAIRMENT TESTS

Sample k_{ic} , md	Permeability, md*				Face*** Removed	
	With "mud"	After "mud"	Reversed			
40**	0.07	6.7–3.8 1.9–0.53	8.5–5.9	(0.38 inch)	37	
13	0.09	1.1–0.78	3.3–1.4	(0.16 inch)	6	
6.4	0.04	0.96–0.3–0.46	2.3–0.6	(0.26 inch)	6.2	
5.6	0.05	0.4–0.14	2.9–1.3	(0.32 inch)	4.2	

*Range indicates change in k_{ic} with flow.

**Mean pore diameter=16 microns; not available for other samples.

*** Internally plugged portion essentially removed.

Upon exposure to brine and/or backflush, permeabilities were increased to values of about 20% of the original permeabilities for the two higher permeability cores, and to values of about 30–40% of the original permeabilities for the tighter cores.

In a suspension of earth-formation-invading particles, the use of a swelling clay, such as bentonite, in an aqueous salt solution, such as a sodium chloride brine, can be particularly advantageous. The suspended clay can be injected into the formation at a salinity at which the clay sizes are a minimum. The sizes of the so-deposited clay particles can then be increased by either decreasing or increasing the salinity of the aqueous liquid that contacts the particles.

In a dolomite earth formation, the sizes of deposited clay particles can be increased by either an increase or decrease in salinity. For sandstone formations, however, where a decreasing salinity might create problems

due to the swelling of the matrix clay and a disruption of the natural intergranular bonding materials, the particles sizes can be increased by an increase in salt concentration. For example, the salt concentration can be increased by injecting a slug of a more concentrated solution, such as one containing sixty thousand parts per million sodium chloride; etc.

Laboratory tests with a dolomite core having a permeability of 18 millidarcies, indicated that an inflow of an 0.1% mixture of bentonite and Imsil A-10 in a ratio of 5:1, reduced the core permeability to 0.8% of the pretreatment permeability. An inflow of a 2% sodium chloride solution restored the permeability to 22.4% of the initial. An inflow of fresh water reduced the permeability to 12.8%. The re-introduction of 2% brine raised the permeability to 19.2% and a 4% brine (40,000 parts per million), lowered it to 15.2% of the pretreatment value.

Alternatively or additionally, plugging fluids containing suspensions of similarly sized particles of organic materials that are rock-surface-attracted and at least somewhat deformable at the reservoir temperature, are advantageous. Such fluids are preferably emulsions or suspensions of positively charged asphalt, wax, or polymer, particles having a pH adjusted to a value above the zero point of charge of the earth formation being treated. This ensures that the mineral surfaces are charged negatively (relative to the suspended particles) and tend to attract and hold the suspended material. Thus, various amine hydrochloride cationic emulsifiers (which depend on pH values of 6.5 or less for their cationic surfactant character) cannot be used successfully with certain minerals such as dolomite, limestone or calcite, in which the zero point of charge is in a pH range of from about 8 to 9.5. Such emulsifiers would be suitable for reservoirs predominating in quartz — on which the zero point of charge is a pH of about 2.2.

In suspensions of asphalts, the degree of plugging is responsive to numerous factors such as pH, rock-type, emulsifier concentration, adhesion agent concentration, asphalt hardness, temperature, and the like. Particularly suitable adhesion agents comprise water-insoluble salts formed by mixing a diamine hydrochloride with tallow acid. The asphalt suspensions can advantageously be mixed with suspensions of inorganic particles.

FIG. 1 shows a portion of a well 1 that encounters reservoirs 2, 3 and 4. The well contains a casing 6 surrounded by a sheath of cement 7, through which perforations 8a and 8b have been opened, with the intention of causing an injected fluid to enter the reservoirs 2 and 4, while isolating the reservoir 3. However, as indicated by the arrows in FIG. 1a, due to a poor quality of the cement, flow channels exist behind the casing and permit the injected fluids to enter reservoir 3. In treating the well in accordance with the present invention, determinations are made of the variations in flow capability with depth within the well. For example, by conducting a flow-meter survey during injection, the substantially equal rates of flow through the perforation 8a and 8b, are discernable, and by logging the radioactivity profile near the well during and after injecting a slug of tagged fluid, the channeling behind the casing to enter the reservoir 3 is detectable. All three reservoirs are plugged by injecting a plugging fluid, a suspension of the type such as listed in Table 1, so that (as shown in FIG. 1b) the plugged zones 9a, 9b and 9c are formed

within the first few inches of the reservoirs, and cause a significant reduction in the rate of flow into those reservoirs. Then (as shown in FIG. 1c) the plugged portions of the reservoirs are selectively penetrated by perforation 11a and 11b at the depths of the reservoirs 2 and 4, to cause the injected fluid to be selectively directed into those reservoirs.

FIG. 2 shows a portion of a well 12 equipped with casing cemented above a depth interval of interest. Tubing string 13 (surrounded by a packer) is arranged to inject fluid into a lower section (which could be an open hole, or lined hole, or perforated cased hole) that communicates with reservoirs 14, 16 and 17. An initial determination of the flow capability with depth within the well, indicates that, during an injection of fluid, about 10% enters reservoir 14, 15% enters reservoir 16, and 75% enters reservoir 17. In contrast, a desirable flow profile would permit only a small proportion of flow into reservoir 17, with a majority of the fluid going into the reservoirs 14 and 16. The well is treated as follows: a plugging fluid is injected to form shallow internal plugs 18a, 18b and 18c, in the respective reservoirs (as shown in FIG. 2b). The plugged zones are then selectively perforated (as shown in FIG. 2c) to form perforations 19a, 19b, and 19c. The perforations 19a and 19b penetrating reservoirs 14 and 16 are relatively numerous and/or large-sized and those, 19c, penetrating reservoir 17, are relatively few and small. As indicated by the sizing of the arrows, the fluid entry then becomes 35% entering reservoir 14, 50% entering reservoir 16, and only 15% entering reservoir 17.

FIG. 3 shows a portion of a well 21 that communicates with reservoirs 22 and 23 that both have relatively low effective permeabilities but have combinations of permeabilities, pressures and thicknesses such that (as indicated by the arrows in FIG. 3a) an undesirably large proportion of injected fluid enters reservoir 22. The well is treated by plugging both reservoirs in zones 24a and 24b (as shown in FIG. 3b). Perforations 26 are extended through the plugged zone 24b, and an acidizing fluid is injected. Subsequently perforations 27 are opened into reservoir 22 and the injection profile is improved (as indicated by the equal-sized inflow arrows in FIG. 3c).

FIG. 4 shows a portion of a production well 28 in communication with oil and gas reservoir 30, water reservoir 31 and oil reservoir 32. In this well the determination of variations in flow capability indicates a production of oil and gas from the depth of reservoir 30, water from the depth of reservoir 31, and oil from the depth of reservoir 32. Such a profile may cause higher than necessary lifting costs, the creation of unnecessarily high back pressures on reservoirs 30 and 32, due to the hydrostatic head of a column of water, and unnecessary costs in the disposal of produced water at a surface location, etc. In treating the well, plugged zones 33a, 33b and 33c are formed in the respective reservoirs (as shown in FIG. 4b). The plugging materials are preferably a surface-wetting asphaltic material in the form of an emulsion or suspension that deposits a plugging material that is resistant to removal by a production of aqueous fluid. The plugged zones are selectively penetrated by perforations 34a and 34b, so that the water production is substantially eliminated (as indicated in FIG. 4c).

FIG. 5 shows a portion of a well 36 in fluid communication with reservoirs 37 and 38. A determination of

the variations in flow capability with depth within the well indicates that about one-third of the injected fluid enters reservoir 37. That reservoir is ten-feet thick, has an effective permeability of 60 millidarcies and thus exposes to the wellbore 600 millidarcy feet of reservoir. About two-thirds of the injected fluid enters reservoir 38, which is 60-feet thick, has an effective permeability of only 20 millidarcies, and thus exposes to the wellbore 1,200 millidarcy feet of reservoir. It is desirable to change the flow profile so that little or none of the injected fluid will enter the less permeable but thicker reservoir 38. Shallow plugs 39a and 39b are deposited within the reservoirs (as shown in FIG. 5b). The plugged portions are then penetrated by perforations 41 so that (as shown in FIG. 5c) the rate of flow is relatively high at the depth of reservoir 37, but is only negligible at the depth of reservoir 38.

What is claimed is:

1. A process for adjusting the fluid flow profile of a well that communicates with subterranean zones or reservoirs, which process comprises:
 - determining the variation in flow capability with depth within the well;
 - plugging each of the zones or reservoirs internally with plugging materials that are deposited within a few inches of the well borehole; and
 - selectively perforating the plugged portions by forming openings through them that are arranged in relation to the determined variations in flow capability to permit selected rates of flow at selected depths.
2. The process of claim 1 in which said openings are arranged to permit a relatively greater flow rates at depths of determined relatively low flow capabilities.

3. The process of claim 1 in which said openings are arranged to permit relatively lower flow rates at depths of determined relatively high flow capabilities.

4. The process of claim 1 in which:

said openings are first formed only at depths of relatively low determined flow capabilities;

at least one stimulating fluid is injected through the openings, and

openings are subsequently formed at other depths.

5. The process of claim 1 in which:

said openings are first formed only at depths of relatively high determined flow capability;

at least one permeability reducing material is injected; and

openings are subsequently formed at other depths.

6. The process of claim 1 in which the well is an injection well.

7. The process of claim 1 in which the well is a production well.

8. The process of claim 1 in which the well contains an uncased borehole along said zones or reservoirs.

9. The process of claim 1 in which one well contains a cased borehole along said zones or reservoirs.

10. The process of claim 1 in which the well is a production well and said openings are arranged to permit substantially no flow at depths at which the fluid that can be produced has an undesired composition.

11. The process of claim 1 in which said openings are arranged to permit relatively greater rates of flow at depths of determined relatively high flow capability.

12. The process of claim 1 in which said openings are arranged to permit relatively greater rates of flow at depths of determined relatively low flow capability.

* * * * *