INDICATING AND PLUGGING APPARATUS FOR OIL WELLS

Richard J. Stiegemier and George P. Maly, Fullerton, Calif., assignors to Union Oil Company of California, Los Angeles, Calif., a corporation of California

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This invention relates to a novel indicating and plugging apparatus for use in oil wells, and in particular concerns a device or tool adapted to being positioned within a well bore for the purpose of determining the location of fluid-producing strata traversed by the bore and/or for plugging off such strata to prevent the flow of fluids into the bore hole.

In many of the oil-producing areas of the world the production of crude oil from wells is accompanied by the production of water or brine. Well effluents comprising as much as 90 percent of water or brine and only 10 percent of petroleum are by no means uncommon. The cost of raising such water or brine to the earth's surface and of separating it from the oil represents an economic loss, and in many instances the problem of disposing of the waste water or brine is more than one of mere economics. In some instances the water-bearing strata lie a considerable distance above or below the oil-bearing strata, and in such cases the flow of water into the well can be shut off by isolating the water-bearing strata and plugging them with Portland cement or the like without similarly plugging the oil-bearing strata. Such procedure, however, requires accurate information as to the exact point or points of water intrusion into the bore. In other instances the oil- and water-bearing strata lie so close together that conventional methods for locating the two types of strata are incapable of distinguishing between the two, and ordinary cementing procedures result in plugging the oil- and water-bearing strata alike. It is also occasionally desired to locate and/or plug off gas-bearing strata, and the same problems arise in connection therewith.

It is accordingly an object of the present invention to provide improved means for the variously locating fluid-bearing strata traversed by a well bore.

Another object is to provide a device adapted to being positioned within a well bore for the purpose of determining accurately the location of water-bearing strata which are closely associated with oil-bearing strata.

A further object is to provide a device for selectively plugging off subterranean water-bearing strata which are located closely adjacent to oil-bearing strata.

A still further object is to provide a device for indicating the aqueous, oleaginous or gaseous nature of the fluids produced from strata traversed by a well bore.

Other and related objects will be apparent from the following detailed description of the invention, and various advantages not specifically referred to herein will be apparent to those skilled in the art upon employment of the invention in practice.

We have found that the above objects and attendant advantages may be realized by means of a device or tool which operates on a principle of laterally dividing a selected portion of the well bore into a plurality of isolated increments or sections of relatively short length, each of which sections contains a foraminous material which is sensitive with respect to the variously fluids produced by the well and/or is capable of forming an impermeable plug when contacted therewith. The term "foraminous fluid-sensitive material" is herein employed to designate a porous solid which undergoes an observable physical or chemical change when contacted with a well fluid. As is hereinafter more fully pointed out such a material may take various forms. In employing the apparatus of the invention to determine the location of fluid-bearing strata it is positioned within the well bore opposite the portion of the formation which is to be investigated, and the well is thereafter allowed to produce until conditions of natural flow are attained. The apparatus is then removed from the well and examination of the fluid-sensitive material in each of the isolated sections will establish the aqueous, oleaginous, or gaseous nature of the well fluid which has entered each of said sections. Since the position which each of said sections previously occupied within the well bore is accurately known, the location of the fluid-bearing strata along the length of the portion of the bore subjected to investigation can accurately be determined. When the device is employed as a plugging tool it may be allowed to remain permanently in the bore, the fluid-sensitive material employed in each section being one which forms an impermeable plug in those sections into which the undesirable fluid has intruded but which remains foraminous in those sections into which only oil has entered. Other means of employing the device of the invention are set forth hereinafter.

In the accompanying drawing which forms a part of this specification: Figure 1 schematically illustrates the operating principle of the device provided by the invention; Figure 2 is a cross-sectional view of one form which the apparatus may take; Figure 3 is a fragmentary view illustrating how the apparatus of Figure 2 is positioned within the well casing; Figures 4 and 5 are partial cross-sectional views of another form of apparatus within the scope of the invention; and Figures 6 and 7 are partial cross-sectional views of still a third form of the device.

Referring now to Figure 1, and with particular reference to use of the device to determine the location of water-bearing strata. Bore hole 10 is shown extending through subterranean formation 11 and traversing water-bearing stratum 12, oil-bearing stratum 13, water-bearing stratum 14 and oil-bearing stratum 15. Well casing 16 is cemented within the bore by means of cement plug 18, and perforations 17 (formed, for example, by conventional gun perforation) extend through the walls of casing 16 and plug 18. The indicating and plugging tool of the invention rests within casing 16 on tool support 16a affixed to the inner wall of casing 16, and consists essentially of a central vertical conduit 19 carrying a plurality of spaced horizontal separators 20 which engage the inner wall of casing 16 at their peripheries forming fluid-tight seals therewith. Central conduit 19 is provided with perforations 21 located between each of separators 20, and the spaces between said separators is filled with a water-sensitive material 22. As will readily be seen, positioning the device within the casing effects division of the bore hole into a series of isolated vertically stacked chambers or cells, each of which is defined by two of the separators 20, a portion of the inner wall of casing 16, and a portion of the outer wall of central conduit 19. Each of said cells is filled with water-sensitive material 22 and communicates with the formation traversed by the bore via at least one of the perforations 17 and with the interior of conduit 19 via at least one of the perforations 21.

In employing the tool illustrated by Figure 1 as an instrument for determining the location of water-bearing strata 13 and 14, the well is pumped dry or, alternatively, is filled with oil or other non-aqueous liquid. If neces-
sary, superimposed pressure may be applied to prevent well fluids from entering the bore hole while the device is being positioned within the bore. The device is then lowered into the casing and positioned opposite the formation to be invaded. The tool support may be further adjusted by suitable positioning of tool support 16a which may be attached to the inside of the casing either before or after the latter is set. The tool support may take the form of a casing packer set by means of a wire line device, or, when the bottommost portion of the hole is to be investigated, the bottom of the hole itself may constitute the support for the tool. After the tool has been set, the well is allowed to produce until conditions of natural flow have been attained, said flow being from the various strata traversed by the bore through the particular cell or cells which communicate with such strata via one or more perforations 17, and into conduit 19 via one of perforations 21. The water-sensitive material within each cell is thus contacted with the effluent from the particular stratum with which the cell is in communication. Upon subsequent withdrawal of the tool from the bore, examination of the material in each cell will determine whether any fluid at all has entered the cell and if so whether it is water or oil. Since the distance of each cell above tool support 16a and the location of the tool support with respect to the portion of the formation over which the tool extended are both known, the location of the oil- and water-bearing strata within that portion of the formation can readily be determined. Thus, with reference to Figure 1, let it be assumed that supporting ring 16b is positioned at a depth of 1600' and that each of the seven cells illustrated is 1' high. When the tool is removed from the bore and the contents of each cell are examined, it will be found that the water has entered the first, fifth and sixth cells (numbering from the top), oil has entered the third and seventh cells, and the second and fourth cells will be dry. Accordingly, it is determined that water-bearing strata occur at 1593-1594 feet and at 1597-1599 feet and that oil-bearing strata occur at 1595-1596 feet and at 1599-1600 feet. It must be understood that the foregoing considerations are illustrative only, and do not necessarily represent the conditions in an actual producing formation; usually the producing interval extends over a much greater length of the well bore and the tool employed will provide for considerably more than seven cells. Also, it will be understood that the apparatus may be adapted to indicate oil- or gas-bearing strata by employing an oil- or gas-sensitive indicating material in the spaces between separators 20, i.e., a material which undergoes an observable physical or chemical change when contacted with oil or gas.

The apparatus of the present invention may be employed as a plugging tool in several ways. For example, after the location of the water-bearing strata has been determined as described in the preceding paragraph, the water-sensitive material is removed from between the separators, and in those cells which were opposite the oil-bearing strata it is replaced by an impermeable material such as cement. The tool is then run back in the bore to its former position, and a liquid plugging agent, e.g., cement slurry, a resin-forming liquid, etc., is pumped down conduit 19. The liquid plugging agent will pass through those spaces which are opposite the water-bearing strata and will not pass through such strata, thereby preventing flow between the blocks of cement and forming a plug within the water-bearing strata, after which the pressure is released and the tool is removed from the bore leaving the water-bearing strata completely plugged and the oil-bearing strata in free communication with the bore hole. The well is then placed in production in the conventional manner.

According to an alternative mode of operation, the tool is positioned in the bore hole as above described and the well is allowed to produce until equilibrium conditions are established. The tool is then withdrawn from the bore and the water-sensitive material is removed from between the separators and examined. Those spaces through which water has passed, as indicated by the condition of the water-sensitive material contained therein, are then plugged off with a water-impermeable solid such as cement or a resinous plugging agent, and the remaining spaces are left open. The tool is then relocated in the bore and the well is placed in production. As will readily be apparent, the fluids from the oil-bearing strata pass freely through the open cells into the central conduit of the tool whereas the fluids from the water-bearing strata are excluded by the impermeable plug in the cells which lie opposite such strata. According to this mode of operation, the tool remains permanently within the bore and forms a permanent part of the tubing string.

According to a third mode of operation, the water-sensitive material which fills the spaces between separators 20 is of a type which is unaffected by oil but which swells or otherwise changes upon contact with water to form a water-impermeable plug. The tool is run into the bore and positioned opposite the formation to be treated as described above, and the well is placed in production. In those cells into which water passes from water-bearing strata, the water-sensitive material will form the afore-mentioned swellable plug, thereby shutting off the flow of water into the central conduit, whereas the flow of oil from the oil-bearing strata into the central conduit is unimpeded. As in the mode of operation described in the preceding paragraph, the tool remains in the well as a permanent part of the tubing string.

Referring now to Figure 2, which illustrates one specific embodiment of the invention, the device therein shown consists of a central longitudinal conduit 30 which may be provided with means, not shown, for coupling to a well tubing string. Separators 31 are spaced along the length of conduit in spaced pairs, the uppermost separator being welded or otherwise affixed to conduit 30, as at 32, but the remaining separators being free to slide along conduit 30. The lowermost of separators 31 is retained on conduit 30 by a pin or other clamping means 33 which holds the entire assembly together while the device is being lowered into the well casing. Each separator 31 conveniently takes the form of a flat disc having a center hole corresponding closely to the outside diameter of conduit 30 and having a diameter somewhat, say ¼", less than that of the internal diameter of the well casing in which the tool is to be employed. The latter is designated by dotted line 34. Resilient sealing means 35, in the form of a flat disc having a center hole closely corresponding to the outside diameter of conduit 30 and a diameter corresponding closely to the inside diameter of casing 34, occupies the space between each two separators 31 which constitute a pair. Said means are conveniently formed of oil-resistant rubber or the like, and upon being compressed expand in a lateral direction. Each pair of separators 31 is separated, one pair from the other, by a cylindrical shell or tube 36 which is of substantially the same outside diameter as that of separators 31 and which engages opposed separators 31. Preferably the edges of shells 36 and the faces of separators 31 are machined so that a fluid-tight seal is formed upon mere frictional engagement, thereby simplifying the assembly and disassembly of the apparatus, but if desired shells 36 may be positively sealed to separators 31, as by welding. Shells 36 are provided with a central perforated conduit 30 provided with similar perforations 38 between each pair of separators 31. A formless fluid-sensitive material 39 substantially fills the spaces between the pairs of separators 31. As will readily be seen, the tool illustrated by Figure 2 in essence consists of a longitudinal stack of isolated cells or chambers, each of which is defined by imperforate end walls constituting by opposed separators 31, a perforate outside wall constituted by shell 36, and a perforate inner wall constituted...
by a portion of conduit 30, each substantially filled with a fluid-sensitive material 39, and each separated from its adjacent cell or chamber by resilient sealing means in the form of a septum.

Figure 5 illustrates the device of Figure 2 positioned within a well bore, tool support 40 is welded or otherwise affixed to the inside of well casing 34 which has been perforated as at 41, and the device of Figure 2 has been run down the casing until the lowermost of separators 31 rests on support 40. When the full weight of the device and/or the well tubing to which it is coupled rests on support 40, resilient sealing means 35 are compressed and expand laterally to form fluid-tight seals with the well casing as at 42. Thus, the well bore is divided laterally into a plurality of isolated cylindrical chambers of relatively short length, and the total volume of fluid into the bore is subdivided into separate streams, each of which passes via perforations 41 and 37 through a body of fluid-sensitive material 39 and into conduit 30 via perforations 38.

As has been previously explained, subsequent examination of the fluid-sensitive material in each of the chambers will establish the aqueous, oleaginous or gaseous nature of the stream of fluid which has passed therethrough, and the location of each stream with respect to the location of tool support 40 is readily determined from the dimensions of the particular device employed.

Figure 4, to which reference is now made, represents another view of the apparatus of the invention may take. Central longitudinal conduit 50 carries conical wedges or cams 51 having their apices directed downwardly spaced at intervals along its length. Said wedges may be integral with conduit 56, as shown, or may take the form of conical collars affixed to conduit 50, as by welding. Resilient sealing means 52 take the form of relatively thick circular discs having a diameter slightly less than the inside diameter of the well casing in which the device is to be employed (indicated by dotted lines 53) and being provided with a center hole having a diameter slightly larger than the outside diameter of conduit 50. Each of sealing means 52 is mounted on conduit 50 immediately below each of wedges 51 so that the apex of the latter is in register with the center hole of sealing means 52. Cylindrical shells 54 having a diameter slightly less than that of sealing means 52 and having perforations 55 extending laterally through their walls extend between the opposed faces of adjacent sealing means 52, and register in peripheral grooves 56 cut in the faces of sealing means 52. Bottom plate 57 is affixed at the lower end of conduit 50, as by welding. Plate 57 serves as clamping means to hold the assembly together. Perforations 59 extend laterally through the walls of conduit 50 between wedges 51. The device of Figure 4 thus takes the form of a series of isolated fluid-tight cylindrical chambers strung along the length of conduit 50, each of said chambers being defined by the opposed faces of adjacent sealing means 52, the inner wall of a perforated cylindrical shell 54, and the outer wall of perforate conduit 50. Each of said chambers is filled with a fluid-sensitive material 60 which is packed loosely enough to permit longitudinal movement of conduit 50 and attached wedges 51.

Figure 6 illustrates the device of Figure 4 in operating position within well bore casing 53. The lowermost of sealing means 52 rests on tool support 40 affixed inside casing 53. Conduit 50 has been moved downwardly with respect to sealing means 52 and shells 54, said movement being effected either by the force of gravity acting on conduit 50 and/or the tubing string to which it is attached, at its upper end, or by a positively applied pressure. Said downward movement forces wedges 51 into the center holes of sealing means 52, thereby causing the latter to expand laterally and contact well casing 53 at their peripheries to form fluid-tight seals therewith. The well bore is thus divided vertically into a series of chambers, each of which is in communication with conduit 50 via perforations 59 and with the subterranean formation opposite which the tool extends via perforations 55 in shells 54 and the perforations in casing 53. The flow of fluids from said formation is thus caused to be subdivided by horizontal planes into a number of streams, each of which flows into conduit 50 through one or more of the chambers formed by the tool and affecting (or not affecting) the fluid-sensitive material 60 contained in each of said chambers. As has been previously explained, subsequent inspection of the sensitive material in each of said chambers establishes the aqueous or oleaginous nature of the fluid which has flowed therethrough, and the location of the source of said fluid can accurately be determined. As will readily be apparent wedges 51 may be tapered upwardly and the central holes of sealing means 52 so in register therewith that lateral expansion of the sealing means is effected by raising conduit 50 and attached wedges 51 with respect thereto.

Referring now to Figures 6 and 7, there is shown a form of device in which hydraulic or pneumatic means are employed to seal off the bore hole into a plurality of chambers containing a fluid-sensitive material. Longitudinal conduit 70 has separators 71 rigidly affixed along its length in spaced pairs. A cylindrical shell 72 having perforations 73 extending through its walls extends between adjacent pairs of separators 71 and forms fluid-tight seals therewith at its upper and lower edges. Seals 74 occupies the space between each two separators 71 which together constitute one of said spaced pairs, and takes the form of a flat inflatable hollow disc having relatively thin walls constructed of a resilient material such as rubber. The outer diameter of sealing means 74 in a deflated condition is somewhat less than the inside diameter of the well casing 75 in which the tool is to be employed. Each of said sealing means has a center hole through which conduit 70 extends and is sealed to conduit 70 at the edges of said holes. Each of sealing means thus resembles a tubeless automotive pneumatic tire mounted on conduit 70 between each two separators 71 which form a pair. Hydraulic or pneumatic line 76, which is connected with a source of gas or liquid pressure, not shown, runs substantially parallel to conduit 70 and communicates via ports 77 to the hollow interior of each of said sealing means 74. Conduit 70 is provided with lateral perforations 78 between each pair of separators 71, and the spaces bounded by adjacent pairs of separators 71, shells 72, and conduit 70 are filled with a fluid-sensitive material 79. The device is pressurized in casing 75 as previously described and gas or fluid pressure is applied to line 76, thereby inflating sealing means 74 and causing them to expand laterally to meet and form fluid-tight seals with the inside wall of casing 75 at their peripheries. The device is thereafter operated as an indicating and/or plugging tool as hereinbefore explained.

As will be apparent to those skilled in the mechanical arts, many modifications other than those explained above may be made without departing from the scope of the invention. For example, each of the devices described above comprises perforate shells coaxial with the longitudinal conduit and extending between the spaced sealing means or between spaced pairs of separators which contain the sealing means. Since the purpose of such shells is in some instances merely one of containing a particular non-self-supporting fluid-sensitive material within the confines of the device, such shells may in those instances be dispensed with where the fluid-sensitive material is sufficiently rigid as to be self-supporting. In other cases, as in the device of Figures 2 and 3, such shells serve the further purpose of effecting operation of the sealing means and cannot be dispensed with. In essence, the device of the invention comprises a perforate longitudinal conduit, a plurality of disc-like sealing means coaxially spaced along the length of said conduit and
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sealed thereto in substantially fluid-tight relationship, said sealing means being capable of being extended laterally to contact at their peripheries the inner wall of a well casing and form fluid-tight seals therewith, means for effecting said extension of said sealing means, and a foraminous fluid-sensitive material positioned in the spaces between said sealing means and exterior of said conduit.

The fluid-sensitive material which is referred to herein may take a wide variety of forms, it being necessary only that such material be at least initially permeable to water, and gas and undergoes some observable physical or chemical change upon being contacted with water, oil, or gas. In most instances, the device of the invention will be employed for locating and plugging water or brine strata, and the material in question need be sensitive only to water. For example, it may consist simply of silica sand which will absorb or adsorb sufficient water or brine to change its electrical conductivity, or it may be a porous mineral or cellulose material which is impregnated with a chemical salt or dye which changes color upon becoming wet with water. Certain cobalt salts, for example, are blue when dry and pink when wet. Organic dyes, fatty acids, soaps and other oil-soluble materials may be employed to indicate the presence of oil. Highly absorptive materials such as silica gel or activated charcoal may be employed since the fluids adsorbed thereon, be they water, oil, or gas may be driven off by heating and their quantity and nature determined by conventional means of chemical analysis. According to one embodiment of the invention, the material in question is one which is permeable to oil but which swells upon contact with water or brine to form a water-impenetrable plug. Colloidal clays have this property, as do certain cellulose derivatives, and either may be employed.

A particularly suitable material of this nature consists of a mixture of white pine sawdust and carboxymethylcellulose. For example, a loosely packed 50-50 mixture of 20-mesh white pine sawdust and carboxymethylcellulose is highly permeable to oil but upon being contacted with water or brine swells to form a soft semi-solid which has a permeability with respect to water of substantially zero. Other materials of this nature include wood fiber and combinations thereof with bentonite or the like, ethylcellulose, methylcellulose, peat moss, foaming cement (such as a mixture of Portland cement and aluminum powder), paper pulp, aerosol-treated wood fiber, etc. As previously noted, the sensitive material may be particulate and non-self-supporting, or it may take the form of a porous integral solid.

Other modes of applying the principle of our invention may be employed instead of those explained, change being made as regards the means or elements employed, provided the apparatus stated by any of the following claims, or the equivalent of such stated apparatus, be produced.

We, therefore, particularly point out and distinctly claim as our invention:

1. An indicating and plugging device for use in well bores comprising, in combination, an elongated body member having a continuous passage extending therethrough and vertically spaced lateral ports communicating between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said bore; a plurality of resilient fluid-tight sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, each of said sealing members having a normal diameter less than that of the well bore in which the device is employed but capable of lateral expansion to form a substantially fluid-tight seal at its periphery with the walls of said bore to partition said formation into a plurality of isolated sections communicating with said passage in said body member via at least one of said ports; means for so expanding said sealing members; and a foraminous fluid-sensitive material contained exterior of said body member in the spaces between said sealing members.

2. A device as defined in claim 1 wherein said foraminous fluid-sensitive material is a material which undergoes an observable physical or chemical change upon being contacted with aqueous media.

3. A device as defined in claim 1 wherein said foraminous fluid-sensitive material is a material whose permeability with respect to aqueous media is substantially decreased upon being contacted with such media but its permeability with respect to mineral oil is substantially unaffected upon being contacted with mineral oil.

4. A device as defined in claim 1 wherein the said foraminous fluid-sensitive material is a mixture of sawdust and carboxymethylcellulose.

5. An indicating and plugging device for use in well bores comprising, in combination, an elongated body member having a continuous passage extending therethrough and vertically spaced lateral ports communicating between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said bore; a plurality of resilient fluid-tight sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, each of said sealing members having a normal diameter less than that of the well bore in which the device is employed but capable of lateral expansion to form a substantially fluid-tight seal at its periphery with the walls of said bore to partition said formation into a plurality of isolated sections communicating with said passage in said body member via at least one of said ports; means for so expanding said sealing members; and a foraminous fluid-sensitive material contained exterior of said body member in the spaces between said sealing members.

6. A device as defined in claim 5 wherein the said foraminous fluid-sensitive material is a material which undergoes an observable physical or chemical change upon being contacted with aqueous media.

7. A device as defined in claim 5 wherein the said foraminous fluid-sensitive material is a material whose permeability with respect to aqueous media is substantially decreased upon being contacted with such media but whose permeability with respect to mineral oil is substantially unaffected upon being contacted with mineral oil.

8. An indicating and plugging device for use in well bores comprising, in combination, an elongated body member having a continuous passage extending therethrough and vertically spaced lateral ports communicating between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said bore; a plurality of resilient fluid-tight sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, each of said sealing members having a normal diameter less than that of the well bore in which the device is employed but capable of lateral expansion to form a substantially fluid-tight seal at its periphery with the walls of the bore to partition said formation into a plurality of isolated sections communicating with said passage in said body member via at least one of said ports; means for so expanding said sealing members; and a foraminous fluid-sensitive material contained exterior of said body member in the spaces between said sealing members.

9. An indicating and plugging device for use in well bores comprising, in combination, an elongated body member having a continuous passage extending therethrough and vertically spaced lateral ports communicating between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said bore; a plurality of resilient fluid-tight sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, each of said sealing members having a normal diameter less than that of the well bore in which the device is employed but capable of lateral expansion to form a substantially fluid-tight seal at its periphery with the walls of said bore to partition said formation into a plurality of isolated sections communicating with said passage in said body member via at least one of said ports; means for so expanding said sealing members; and a foraminous fluid-sensitive material contained exterior of said body member in the spaces between said sealing members.

10. A device as defined in claim 9 wherein the said foraminous fluid-sensitive material is a mixture of sawdust and carboxymethylcellulose.
ing between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said bore; a plurality of resilient fluid-tight sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, each of said sealing members having a normal diameter less than that of the well bore in which the device is employed but capable of lateral expansion to form a substantially fluid-tight seal at its periphery with the walls of the bore to partition said formation into a plurality of isolated sections communicating with said passage in said well bore via at least one of said ports, and each of said sealing members having a center opening larger than the outside diameter of said body member and in register with the narrow ends of said tapered wedges; perforate tubular members mounted coaxially with and spaced away from said body member and extending between adjacent sealing members; clamping means for retaining said sealing members on said body member; and a foraminous fluid-sensitive material contained between said tubular members and said body member in the spaces between said sealing members.

10. An indicating and plugging device for use in well bores comprising, in combination, an elongated body member having a continuous passage extending therethrough and vertically spaced lateral ports communicating between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said well bore; a plurality of hollow inflatable sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, the diameter of said sealing members when deflated being less than that of the wall bore in which the device is employed but such that upon inflation said sealing members engage the walls of said well bore and form substantially fluid-tight seals therewith and thereby partition said formation into a plurality of isolated sections communicating with said passage in said body member via at least one of said ports; relatively rigid means for restricting longitudinal expansion of said sealing members upon being inflated; means for inflating said sealing members; and a foraminous fluid-sensitive material contained exterior of said body member in the spaces between said sealing members.

13. An indicating and plugging device for use in well bores comprising, in combination, an elongated body member having a continuous passage extending therethrough and vertically spaced lateral ports communicating between said passage and the exterior of said member, said body member being adapted to be positioned within a well bore opposite a fluid-producing formation traversed by said well bore; a plurality of hollow inflatable sealing members coaxially spaced along the length of said body member in fluid-tight relationship therewith, the diameter of said sealing members when deflated being less than that of the wall bore in which the device is employed but such that upon inflation said sealing members engage the walls of said well bore and form substantially fluid-tight seals therewith and thereby partition said formation into a plurality of isolated sections communicating with said passage in said body member via at least one of said ports; relatively rigid means for restricting longitudinal expansion of said sealing members upon being inflated; perforate tubular members mounted coaxially with and spaced away from said body member and extending between adjacent sealing members; clamping means for retaining said sealing members; and a foraminous fluid-sensitive material contained between said tubular member and said body member in the spaces between said sealing members.

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