

[72] Inventor **C P Lanmon, II**
Friendswood, Tex.
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 [73] Assignee **Schlumberger Technology Corporation**
New York, N.Y.

3,347,315 10/1967 Lanmon 166/100 X
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Primary Examiner—David H. Brown

Attorneys—Ernest R. Archambeau, Jr., David L. Moseley,
 Edward M. Roney and William R. Sherman

[54] **METHODS AND APPARATUS FOR PERFORATING
 EARTH FORMATIONS**
 25 Claims, 4 Drawing Figs.

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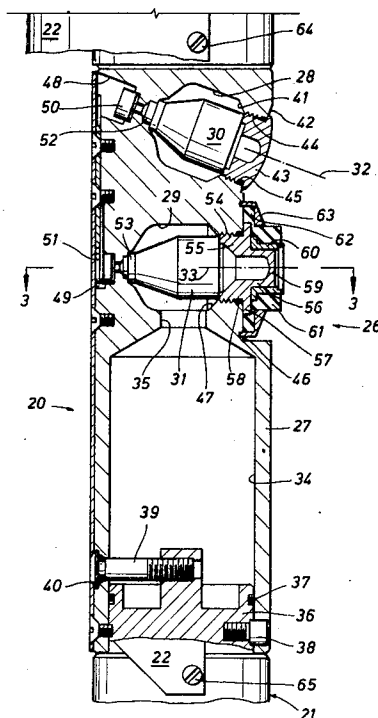
[50] Field of Search 166/297,
 100, 55.1; 175/4.52, 4.6

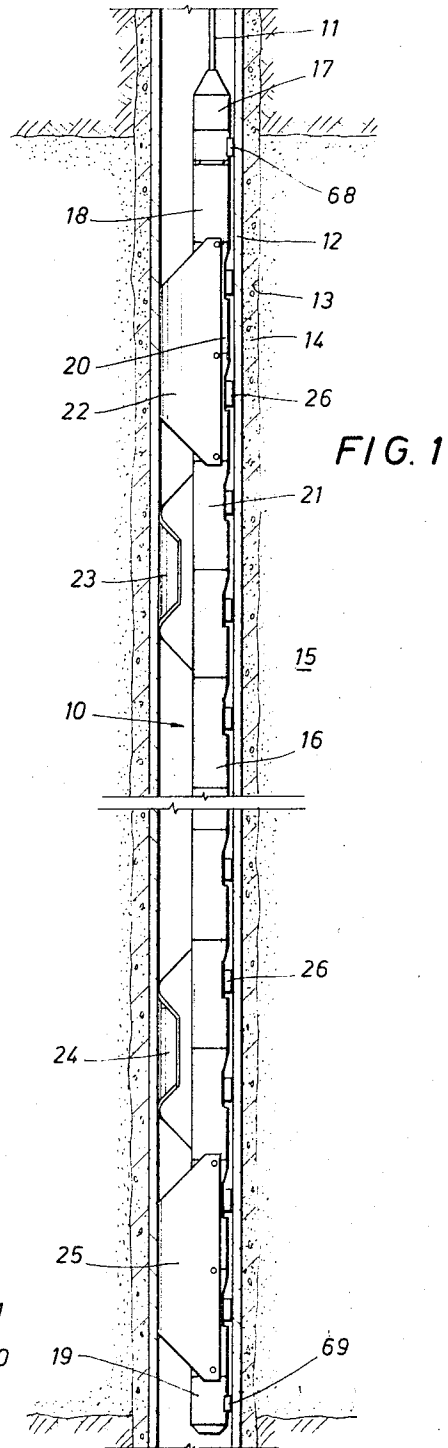
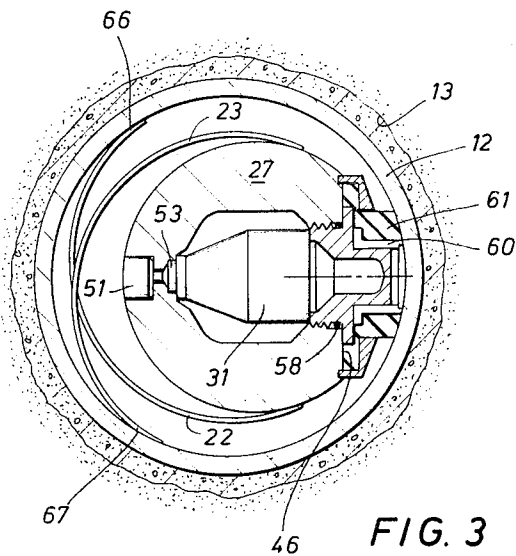
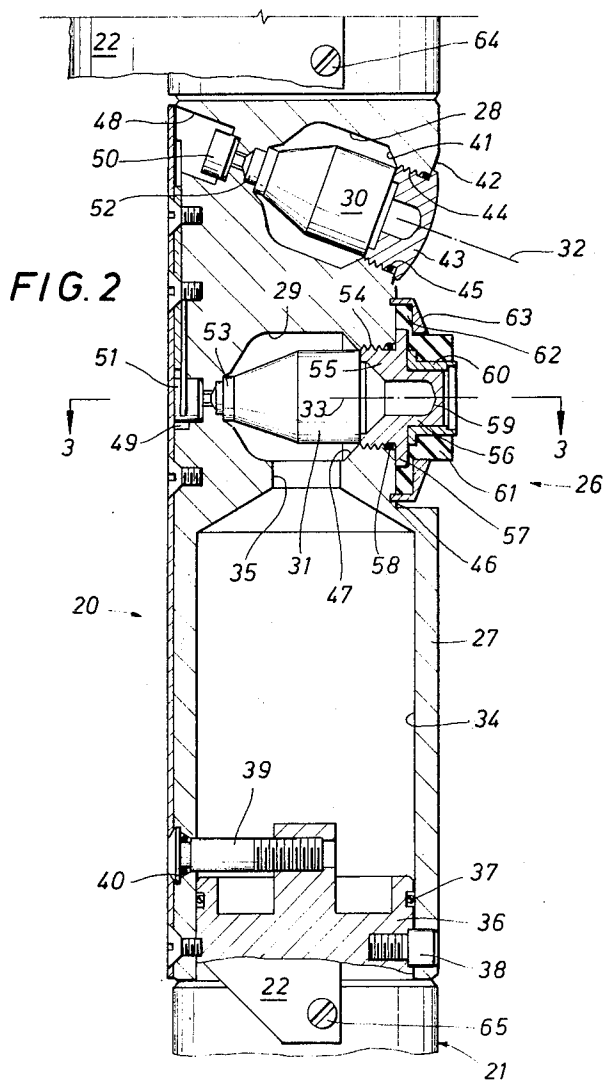
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ABSTRACT: This application discloses new and improved methods for perforating earth formations and then cleaning debris and the like from such perforations. To practice the present invention, a new and improved perforator is provided with one or more pairs of like or similar perforating devices operatively arranged for producing perforations in an earth formation which are selectively directed so that each pair of perforations will be in fluid communication with each other. An enclosed low-pressure chamber is coupled to one of the perforating devices in each set and a seal is arranged around the perforating axis of this perforating device for at least limiting the direct entrance of well bore fluids into the perforation produced thereby. In this manner, upon operation of each pair of the perforating devices, well bore fluids will be drawn into the perforation produced by the other perforating device and be swept through the intercommunicating perforations into the low-pressure chamber for cleaning debris and loose formation materials from the perforations.





C P Lanmon, II
INVENTOR

BY *Ed Archambault Jr*
ATTORNEY

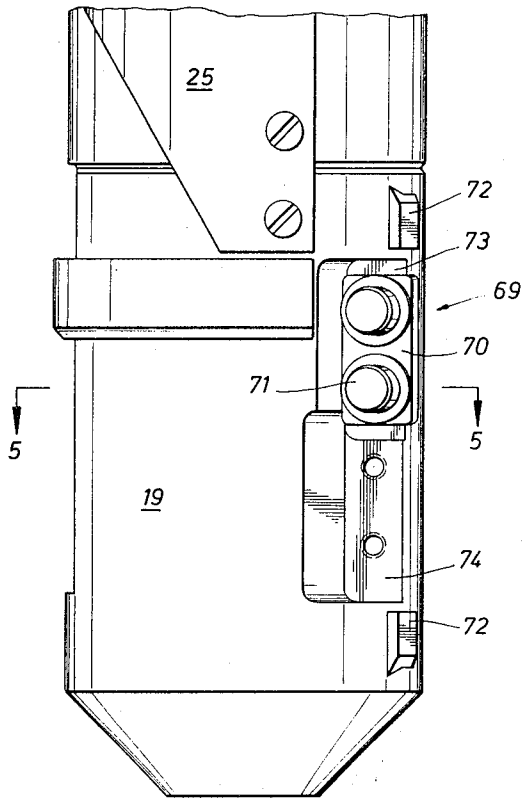


FIG. 4

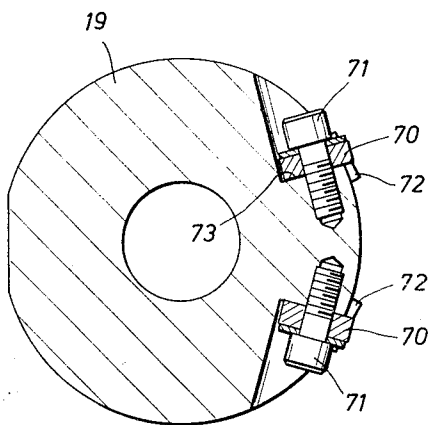


FIG. 5

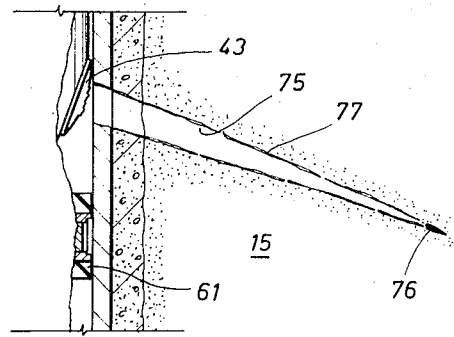


FIG. 6

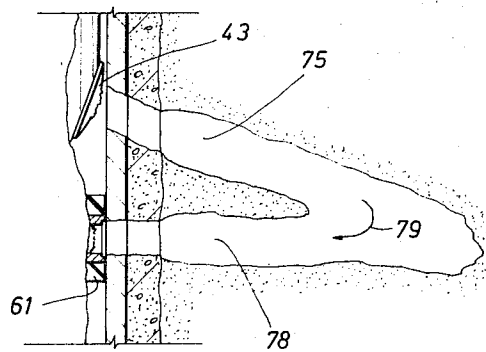


FIG. 7

C P Lanmon, II
INVENTOR

BY *W. H. Archambeau Jr.*
ATTORNEY

METHODS AND APPARATUS FOR PERFORATING EARTH FORMATIONS

It is, of course, customary for a cased well bore to be perforated at one or more points to provide fluid communication with selected earth formations therearound. Once the well is perforated, various treating operations—such as acidizing, fracturing, or sand-consolidating operations—are typically conducted to prepare the well for efficient production. Those skilled in the art will appreciate, however, that it is not at all uncommon for one or more of the perforations along a given perforated interval to be at least partially blocked by loose formation materials, debris, as well as foreign matter which is usually deposited in a perforation by a typical shaped charge. A partial or total blockage of one or more of the perforations will, of course, impede or prohibit the introduction of treating fluids into those perforations and result in the inadequate treatment of at least those portions of the earth formation immediately adjacent thereto. As a result, further and otherwise needless treating operations will ultimately be required. Accordingly, unless all of the perforations along a perforated interval are capable of readily conducting fluids, subsequent treating operations as well as the production rate of the well will be significantly impaired.

Heretofore, substantial effort has been directed toward devising perforating apparatus and techniques for cleaning perforations in those situations where the formation to be perforated is substantially composed of loose or incompetent formation materials which must be chemically bonded to limit the subsequent production of these loose materials. For example, in U.S. Pat. No. 3,153,449, unique methods and apparatus are disclosed for producing a single perforation that is first flushed of loose formation materials and then injected with a suitable treating agent for consolidating the immediately surrounding portion of the formation. Similarly, U.S. Pat. No. 3,329,204, U.S. Pat. No. 3,347,314, and U.S. Pat. No. 3,347,315, respectively disclose new and improved techniques and tools for perforating a well casing at two closely spaced points and, after clearing the perforations of loose formation materials, injecting suitable consolidation agents.

Although the several tools and techniques described in the aforementioned patents have been commercially employed, it will be appreciated that only one or, at best, two usable perforations are produced for each operation. Thus, if a formation interval of substantial length is to be perforated at several spaced points, tools such as these must be repetitively employed before the entire interval can be sufficiently perforated.

It will be appreciated, moreover, that none of these techniques or perforating tools are particularly suited for those situations where the formation that is to be perforated is competent and does not require the injection of a consolidating agent. Furthermore, with the possible exception of the techniques and tools disclosed in U.S. Pat. No. 3,305,018, little attention has been given heretofore for devising suitable procedures and perforating apparatus which are effective for perforating well-consolidated formations at a number of spaced locations and then cleaning the perforations in a single trip into a well bore.

Accordingly, it is an object of the present invention to provide new and improved methods for producing multiple debris-free perforations at spaced locations along a well bore interval traversing an earth formation irrespective of the competency of the formation.

This and other objects of the present invention are attained by arranging multiple sets of similar or like perforating devices at spaced intervals along a supporting carrier, with the perforating devices in each set being cooperatively directed so that their perforating axes will converge or at least approach an intersection within an earth formation ahead of the carrier. Means are further provided for enclosing one of the perforating devices in each set and fluidly coupling the enclosure surrounding the selected device to an enclosed chamber which is initially unfilled and is maintained at a pressure less than that

of the fluids in the well bore adjacent to a formation that is to be perforated in accordance with the methods of the present invention. Means are operatively arranged on the carrier and adapted, upon movement of the carrier to a selected position in a well bore, for at least substantially blocking the direct entrance of well bore fluids into the enclosures associated therewith whenever the selected perforating devices are operated. In this manner when the new and improved perforating apparatus is employed for practicing the methods of the present invention, operation of the perforating devices in each set will produce perforations in the formation which will be effectual for establishing fluid communication so that well bore fluids will sweep through the circuitous passage defined in the formation by the cooperatively directed perforations for flushing debris and the like therefrom and into the enclosed chamber.

The novel features of the present invention are set forth with particularity in the appended claims. The invention, together with further objects and advantages thereof, may be best understood by way of the following description of exemplary methods employing the principles of the invention as illustrated in the accompanying drawings, in which:

FIG. 1 depicts a preferred embodiment of perforating apparatus incorporating the principles of the present invention as this apparatus will appear positioned in a well bore while conducting a perforating operation in accordance with the methods of the present invention;

FIG. 2 is an enlarged cross-sectioned elevational view of a portion of the perforating apparatus depicted in FIG. 1;

FIG. 3 is a cross-sectional view taken along the lines "3—3" of FIG. 2;

FIG. 4 is an enlarged view of another portion of the perforating apparatus shown in FIG. 1;

FIG. 5 is a cross-sectional view taken along the lines "5—5" of FIG. 4; and

FIGS. 6 and 7 respectively depict the production of one pair of perforations in accordance with the methods of the present invention.

Turning now to FIG. 1, perforating apparatus 10 arranged in accordance with the present invention is shown suspended in a typical manner from an electrical cable 11 within a casing 12 that is secured within a borehole 13 by a column of cement 14. The suspension cable 11 is spooled from a winch (not shown) at the earth's surface that is adapted for selectively moving the perforating apparatus 10 through the casing 12 to bring the perforator into position adjacent to an earth formation 15 which is to be perforated in accordance with the methods of the present invention.

The perforating apparatus 10 for practicing the present invention includes an elongated body or carrier 16 which is conveniently arranged as a series of housing sections, as at 17—19, which are coupled to a plurality of tandemly arranged perforating units as at 20 and 21 for performing a given perforating operation. As is typical, suitable depth-indicating means, such as a casing-collar locator, are arranged in one of the sections as at 17; and, in the preferred embodiment of the apparatus 10, another section 18 of the carrier 16 is appropriately arranged for enclosing an electrical control system such as that shown in U.S. Pat. No. 3,327,791, for selective operation of the perforating apparatus. For reasons that will subsequently be explained in greater detail, positioning means, such as rearwardly acting opposed springs 22—25 of a new and improved design, are mounted adjacent to the upper and lower ends of the carrier 16 and cooperatively arranged for urging the carrier forwardly to maintain the forward faces of a plurality of sealing means, as at 26, respectively mounted on each of the perforating units 20 and 21 in continuous sliding engagement with the adjacent wall of the casing 12.

Turning now to FIG. 2, an enlarged view is shown of the upper perforating unit 20 which is similar or identical to the other units, as at 21, coupled therebelow. In the illustrated preferred embodiment, a cylindrical body 27 is arranged to include two longitudinally spaced lateral chambers 28 and 29

which are respectively proportioned to enclose perforating means, such as a shaped charge as at 30 and 31. In keeping with the objects of the present invention, the shaped charge chambers 28 and 29 are respectively formed about laterally directed axes 32 and 33, with the axis of the upper chamber being tilted downwardly to converge and, preferably, intersect the axis of the lower chamber at a selected distance ahead of the forward face (to the right as viewed in FIG. 2) of the body 27. A third chamber 34 of a predetermined volume is formed in the lower portion of the body 27 and fluidly coupled to the intermediate chamber 29 as by an interconnecting passage 35 in the body.

Although other coupling arrangements can, of course, be provided for the several perforating units 20 and 21, it is preferred to arrange each unit with a reduced-diameter upper end, as at 36, that is sealingly fitted, as by an O-ring 37, into the chamber 34 in the unit thereabove to close the lower end of the chamber. By means of suitable screws, as at 38, the perforating units 20 and 21 can be secured together and properly oriented to accurately direct their respective shaped charges 30 and 31 forwardly of the carrier 16. In the preferred embodiment of the tool 10, a removable plug, as at 39, is provided for draining the chamber 34 through a suitable port 40. It will, of course, be recognized that the lowermost section 19 of the carrier 16 is appropriately arranged to close the lower chamber (as at 34 in the unit 20) in the lowermost perforating unit. Similarly, the housing section 18 is appropriately arranged to sealingly receive the upper end portion of the upper perforating unit 20.

To gain access to the upper chamber 28, an enlarged lateral port 41 of sufficient size to permit the introduction of the shaped charge 30 into the chamber is arranged in a downwardly and inwardly inclined flat surface 42 formed transversely across the forward wall of the body 27 and, preferably, perpendicularly intersecting the inclined lateral axis 32. A port-closure plug 43 is secured in the port 41, as by threads 44, and cooperates with a sealing member 45 for fluidly sealing the shaped charge 30 within the upper chamber 28. In a similar fashion, a flat transverse surface 46 is formed across the forward wall of the body 27; and a lateral port 47 therein is coaxially arranged about the axis 33 and suitably sized for admitting the shaped charge 31 into the intermediate chamber 29.

Although the shaped charges 30 and 31 may, of course, be of other designs, it is preferred that they be similar or identical to those disclosed in U.S. Pat. No. 3,329,218. Accordingly, as fully explained in that patent, lateral bores 48 and 49 are respectively provided in the rear wall of the body 27 in coincidental alignment with the perforating axes 32 and 33 and appropriately arranged for respectively receiving electrical contactors 50 and 51 (such as those shown at "28" in the aforementioned patent) and detonating means such as electrically actuated initiators 52 and 53 (such as those shown at "44" in the aforementioned patent) to enable the shaped charges 30 and 31 to be selectively detonated from the surface by operation of the control system in the carrier section 18. Inasmuch as the particular details of the shaped charges 30 and 31 and their respective detonators or initiators 52 and 53 are of no significance to the present invention, further description is unnecessary.

Turning now to the new and improved sealing means 26 as best illustrated in FIGS. 2 and 3, the access port 47 is preferably threaded, as at 54, for cooperatively receiving the rearward portion of a closure member 55 having an elongated forward tubular portion 56 and an intermediate shoulder or outwardly enlarged flange 57 adapted for engagement against the flat surface 46. A sealing member 58 is cooperatively arranged to fluidly seal the closure member 55 in relation to the body 27. To prevent the entrance of well fluids into the intermediate chamber 29 until the shaped charge 31 therein is detonated, a transverse web, as at 59, is arranged across the forward tubular portion 56 and, preferably, positioned at the extreme forward end thereof. Although it could alternatively

be made integral with the closure member 55, a separate tubular member 60 is coaxially fitted over the forward portion 56 of the closure member and, for reasons that will subsequently be explained, extended forwardly thereof a sufficient distance to at least project beyond the curvature of the forward wall of the body 27.

In the preferred embodiment of the sealing means 26, an annular sealing pad 61 of a sturdy elastomeric material is coaxially fitted over the tubular extension 60 and secured to the flat body surface 46. Although the initial configuration of the forward face of the sealing pad 61 is not critical in accomplishing the objects of the present invention, it is preferred to initially shape the forward face of the sealing member (as best seen in FIG. 3) to substantially conform to the curvature of the internal wall of the casing 12. Where this is done, the tubular extension 60 is preferably arranged with a hexagonal exterior surface adapted for complementally fitting within the axial bore through the sealing pad 61 so as to prevent it from turning thereon out of its initial angular position. To prevent the sealing member 61 from being dislodged from the body 27 as the perforating apparatus 10 is being moved into position in the well bore 13, the sealing member is provided with an outwardly enlarged portion 62 which is overlaid by an annular retainer 63 and secured to the body 27 as by one or more screws (not shown). It will be appreciated, therefore, that once the shaped charge 31 is enclosed within the intermediate chamber 29 and the closure member 55, the sealing member 61 and the tubular extension 60 are respectively secured to the body 27, only the forwardmost portions of these latter two members will contact the inner wall of the casing 12 whenever the perforating apparatus 10 is urged theretoward by the upper and lower positioning springs 22-25.

It should be noted that longitudinally disposed bow springs could be substituted for the new and improved positioning springs 22-25 without unduly affecting the unique operation of the remainder of the perforating apparatus 10. Those skilled in the art will recognize, however, that it will often be necessary to introduce the perforating apparatus 10 into a well bore by way of pressure-control equipment at the surface such as blowout preventors, so-called "lubricators," and similar restrictions. Thus, typical bow springs which can be readily collapsed to pass such restrictions and still be capable of developing spring forces of the same magnitude as the new and improved positioning springs "22" would be objectionably long. Accordingly, in the preferred embodiment of the new and improved positioning springs 22-25, each spring is respectively comprised of a generally flat sheet of a somewhat resilient material such as spring steel or the like which will readily flex. As best seen in FIG. 1, the forward edge of each of the several springs 22-25 is secured longitudinally along one or the other sides of the carrier 16, as by screws 64 and 65, so that the unrestrained or cantilevered portion of each spring will initially extend well behind the rear wall of the carrier. It will be noted, therefore, that by longitudinally offsetting the upper springs 22 and 23 and mounting the springs on alternate sides of the carrier 16 as illustrated in FIG. 1 and 3, each of these springs can be transversely flexed so as to curve it back around the rear of the carrier. The lower springs 24 and 25 are similarly arranged for functioning in the same manner. The transverse deflections of the positioning springs 22-25 will, of course, impose forwardly acting spring forces on the carrier 16 which are commensurate with the material employed, the extent of their deflection, as well as their physical dimensions.

Accordingly, when the perforating apparatus 10 is first being lowered into the well bore 13, the upper and lower springs 22-25 are manually flexed inwardly and back around the rear of the carrier 16 as required for introducing the perforating apparatus into the casing 12 at the surface of the earth. Then, as best seen in FIG. 3, once the perforating apparatus 10 is disposed within the casing 12, each of the springs 22-25 will assume a generally arcuate curvature around the rear of the carrier 16 so that their longitudinal rearward edges,

as at 66 and 67, will respectively contact the wall of the casing behind the carrier and somewhat on the opposite side thereof from where that particular spring is secured. Thus, by virtue of the alternate disposition of the springs 22-25 along the rear of the carrier 16, the carrier will be reliably positioned within the casing 12 so that as the tool 10 is lowered into the well bore 13 the forwardmost portions of the extension members 60 and the sealing pads 61 will always be urged squarely against the adjacent wall of the casing.

Accordingly, in view of the continued abrasion of the casing 12 against the sealing member 61 and the tubular extension 60 of each of the perforating units 20 and 21 as the perforating apparatus 10 is moved into position adjacent to the earth formation 15, the sealing members and their associated tubular extensions will be progressively ground or lapped to complementally fit the curvature of the casing. In this manner, it will be assured that by the time the perforating apparatus 10 is positioned adjacent to the earth formation 15, at least the forward end of the tubular extension 60 and the forward face of the elastomeric sealing member 61 will closely conform to the internal configuration of the casing 12.

It will be appreciated, however, that the amount of material that will be progressively abraded from the tubular extension 60 and the sealing member 61 of each of the several perforating units as at 20 and 21 will, for the large part, be directly related to the distance which the perforating apparatus 10 moves through the well bore 13. For example, in a relatively shallow well, the amount of wear experienced by the tubular extensions 60 and the sealing members 61 will be correspondingly slight. On the other hand, should the earth formation 15 be at a substantial depth in the well bore 13, the tubular extensions 60 as well as the forward faces of the sealing members 61 might well be unduly worn by the time that the perforating apparatus 10 has finally reached its final position.

Accordingly, as best seen in FIGS. 4 and 5, to limit the amount of wear or abrasion to which the several sealing members 61 and the tubular extensions 60 will be subjected, upper and lower pairs of forwardly projecting lugs, as at 68 and 69, are respectively arranged near the upper and lower ends of the carrier 16 to prevent these several members from being excessively abraded by the time the perforating apparatus 10 is adjacent to the formation 15. It will be recognized, of course, that the wear-limiting lugs 68 and 69 will be arranged to allow the sealing members 61 and the tubular extensions 60 to always be sufficiently abraded to closely fit the curvature of the internal wall of the casing 12. In the preferred manner of accomplishing this, each of the several wear-limiting lugs 68 and 69 is comprised of a small block 70 of a hardened or abrasion-resistant material such as tungsten carbide or the like that is secured as by screws 71 to the carrier 16. The forward upright edges of each of the several hardened blocks, as at 70, are cooperatively positioned at a predetermined distance away from the forward face of the carrier 16 so that, once the sealing members 61 and the tubular extensions 60 have been sufficiently ground down to assure that their forward surfaces complementally fit the curvature of the casing 12, the several blocks will substantially limit, if not altogether prevent, further abrasion of the sealing members and the extensions. To protect the blocks 70 from striking inward projections in the casing 12 as the tool 10 is being moved therein, shoulders as at 72 are preferably provided above and below the blocks.

It will be appreciated that the perforating apparatus 10 can be normally expected to be employed in various sizes of casing. Accordingly, to permit a ready adjustment of the guides 68 and 69, each of the several blocks 70 is adapted to be selectively secured in one of at least two predetermined positions in relation to the carrier 16. To facilitate the placement of the blocks 70 in these predetermined positions, selectively arranged seating surfaces, as at 73 and 74, are formed at appropriate positions on the carrier 16 so that each of the hardened blocks can be readily secured to accurately position their outer edges at the correct position for sliding engagement with the inner wall of a given casing size once the sealing

pads 61 and the tubular extensions 60 are lapped into conformity with the casing wall.

Referring again to FIG. 1, it will be appreciated that once the perforating apparatus 10 is moved into position adjacent to the formation 15, the perforating units as at 20 and 21 are in readiness for perforating the casing 12 and the cement 14 to gain access to the earth formation 15. Thus, as best seen in FIG. 6 upon detonation of the shaped charge 30 in, for example, the upper perforating unit 20, a perforation 75 will be produced along the axis 32 into the adjacent earth formation 15. The detonation of the upper shaped charge 30 will produce a perforating jet which, as is well known in the art, will leave debris such as a slug 76 in the forward portion of the perforation 75 as well as a relatively impermeable sheath or layer of debris as at 77 along the walls of at least a substantial portion thereof.

Accordingly, in keeping with the objects of the present invention, detonation of the second shaped charge 31 in the perforating unit 20 will, as depicted in FIG. 7, produce a perforation as at 78 which substantially intersects the first perforation 75 so as to form a circuitous passage in the formation 15 through which the fluids in the well bore 13 can enter the enclosed low-pressure chamber 34 in the perforating unit. Thus, as schematically indicated by the arrow 79, once the perforating jet produced by the second shaped charge 31 pierces the transverse barrier 59 and produces the second perforation, the well bore fluids will rush through the intersecting perforations 75 and 78 into the low-pressure chamber 34. It will be appreciated, therefore, that the rapid flow of these fluids 79 will flush the debris (as at 76 and 77) from the perforation 75 as well as similar debris (not shown) in the second perforation 78. Moreover, it is believed that the sudden inrush of the well bore fluids will also be effective for removing any loose formation materials in both of the perforations 75 and 78 so that, once they are enlarged as depicted, the flow capabilities of the perforations will be significantly improved over what would otherwise be expected for perforations produced by prior perforating techniques.

It should be noted that the competency of the formation 15 will, of course, largely determine the degree of enlargement of the perforations 75 and 78 that will result from the rapid influx of the well bore fluids therethrough. Thus, should the formation 15 be relatively unconsolidated, it is expected that a substantial cavity will be formed (such as depicted at "88" in U.S. PAT. No. 3,347,314). In any event, therefore, a significant improvement in the flow characteristics of the perforations 75 and 78 will be achieved by the practice of the present invention.

Those skilled in the art will, of course, appreciate that the perforations 75 and 78 should be protected against the usual well control fluid or so-called "mud" typically used during the drilling of a well. Thus, if the present invention is to be practiced prior to a fracturing or acidizing operation, any one of several techniques may be employed to protect the perforations from damage by unclean well control fluids. For example, the drilling mud may be replaced with a clean saline solution of sufficient density to retain control of the well. Similarly, the well control fluid may also be replaced with a clean diesel oil or other fluids that are compatible with or may be employed in a subsequent fracturing or acidizing operation. It will, of course, be recognized that the well control fluid might be a pressured gas. In those situations, the pressured gas would be expected to effectively flush the perforations 75 and 78.

The same situation will, of course, exist where the formation 15 is relatively incompetent and the methods of the present invention are employed in preparation for an otherwise typical sand-consolidation operation. Thus, where sand-consolidation agents are to be subsequently injected into the formation 15, the well control fluid may be replaced by the initial treating agent which is usually a so-called "preflush fluid" such as kerosene, diesel oil, or a clean saline solution.

Other techniques may also be employed for protecting the perforations 75 and 78 produced by the present invention. For

example, before the perforating apparatus 10 is positioned in the well bore 13, the well control fluids at least immediately adjacent to the formation 15 may be replaced with a suitable temporary plugging agent such as gelled kerosene, gelled carbon tetrachloride, or such commercially available protective formulations as "Black magic" as sold by Oil Base, Inc., "Perf Heal" as sold by Chemical Additives Company, or "Plug Ban" as sold by Humble Oil & Refining Company, all of which are located in Houston, Texas. Any suitable fluid or other agent can, of course, be used so long as it does not react adversely with either the formation materials or connate fluids and can be readily removed from a perforation when the well is produced.

It should be noted that the sequence of firing the several perforating units as at 20 and 21 as well as their respective shaped charges 30 and 31 is flexible. The control system in the housing section 18 can, of course, be adapted to actuate the perforating units as at 20 and 21 in any desired order either in groups or individually. Similarly, the shaped charges 30 and 31 in any of the several perforating units as at 20 and 21 can be selectively detonated either in any order or simultaneously. Thus, it will be appreciated that the perforating apparatus 10 of the present invention is readily suited for any perforating operation.

As previously described, the cooperative relationship of the wear-limiting lugs 68 and 69 and the several sealing means 26 will assure that the forward end of each of the tubular extensions 60 will be lapped or ground down so as to closely conform to the curvature of the casing 12 once the perforating apparatus 10 is adjacent to the formation 15. Thus, it is believed that the sealing pads 61 may not necessarily be essential to the successful practice of the present invention since, at best, there could only be an insignificant flow of well bore fluids through whatever minute gap might be present between the casing wall and the well-lapped forward end of the tubular extensions 60. It is, however, preferred to include the sealing pads 61 with the sealing means 26 as a preventative measure since the forward ends of one or more of the tubular extensions 60 might be damaged as the perforating apparatus 10 is moved through the casing 12.

Those skilled in the art will, of course, appreciate that since the upper perforations, as at 75, are in communication with the well bore fluids, the pressure in the chambers 34 will rapidly become equal to the well bore hydrostatic pressure once the chambers are filled. Accordingly, it is of significance to note that, in contrast to the previously described prior perforating techniques, the perforating apparatus 10 cannot become "differentially stuck" as would be the case if pressure communication is not established between the well bore fluids and the several chambers 34 once the perforations 75 and 78 have been produced.

Accordingly, it will be appreciated that the present invention has provided new and improved methods for producing multiple perforations in earth formations of various degrees of competency and then cleaning these perforations to assure improved flow communication between the well bore and the perforated formations. Once the new and improved perforating apparatus disclosed herein is positioned, detonation of the several pairs of shaped charges will produce a corresponding number of intercommunicating flow passages in the formation between the well bore fluids and the initially enclosed chambers for inducing a rapid influx of these fluids through the flow passages to clear them of debris and other flow-blocking materials.

While a particular embodiment of the present invention has been shown and described, it is apparent that changes and modifications may be made without departing from this invention in its broader aspects; and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed is:

1. A method for completing a well bore containing fluids and traversing earth formations and comprising the steps of:

isolating a plurality of spaced surfaces along the well bore from the well bore fluids; perforating said spaced surfaces to provide a number of passages into the earth formations which are isolated from the well bore fluids; perforating a plurality of exposed surfaces along the well bore and adjacent to said spaced surfaces to provide a number of open passages into the earth formations which are respectively directed in relation to said isolated passages to be effectual for communicating therewith; and, while said spaced surfaces are still isolated, coupling a receiver at a pressure less than that of the well bore fluids into said isolated passages for drawing well bore fluids into said open passages and back out of said isolated passages into said receiver to clean said passages.

2. The method of claim 1 wherein said spaced surfaces are distributed longitudinally along the well bore.

3. The method of claim 1 wherein said spaced surfaces are distributed longitudinally along the well bore and the exposed surfaces are alternately distributed along the well bore between said spaced surfaces.

4. The method of claim 1 wherein the number of said isolated passages is equal to the number of said open passages so that only one of each of said open passages will establish communication with only one of said isolated passages adjacent thereto.

5. The method of claim 4 wherein said spaced surfaces are distributed at longitudinal intervals along the well bore and the exposed surfaces are alternately distributed therebetween.

6. The method of claim 5 wherein said spaced surfaces and said exposed surfaces are longitudinally aligned with one another.

7. The method of claim 1 wherein each of one set of said passages is directed along an axis substantially normal to the wall of the well bore and each of the other set of said passages is directed along an axis substantially intersecting the axis of the adjacent passage of said one set.

8. The method of claim 1 wherein a separate receiver is coupled to each of said isolated passages.

9. The method of claim 1 wherein the well bore fluids include liquids having an elevated hydrostatic pressure.

10. The method of claim 1 wherein the well bore fluids include gases at an elevated pressure.

11. The method of claim 1 wherein said open passages and said isolated passages are simultaneously produced.

12. The method of claim 1 wherein said open passages are produced before said isolated passages.

13. The method of claim 1 wherein said isolated passages are produced before said open passages.

14. The method of claim 1 wherein said passages are produced in an alternating sequence.

15. A method for completing a well bore containing fluids and traversing an earth formation and comprising the steps of: isolating a first surface of the well bore from the well bore fluids and from a second adjacent surface of the well bore; perforating through one of said surfaces and into the formation to provide a first passage therein; perforating through the other of said surfaces and into the formation to provide a second passage therein directed relative to said first passage to be effectual for establishing fluid communication therebetween; and, thereafter, coupling a receiver at a pressure less than that of the well bore fluids to said isolated surface and the passage therein for drawing well bore fluids into the other passage and out through the passage in said isolated surface into said receiver to flush unwanted material out of said passages and into said receiver.

16. The method of claim 15 wherein said first and second passages are respectively directed along converging axes.

17. The method of claim 15 wherein one of said passages is directed along a first axis substantially normal to the wall of the well bore and the other of said passages is directed along a second axis which substantially approaches an intersection with said first axis.

18. The method of claim 15 wherein said passages are sequentially produced.

19. The method of claim 15 wherein said passages are produced substantially simultaneously.

20. The method of claim 15 wherein said first surface is longitudinally spaced from said second surface and is vertically aligned therewith.

21. The method of claim 15 wherein the well bore fluids include liquids having an elevated hydrostatic pressure.

22. The method of claim 15 wherein the well bore fluids include gases at an elevated pressure.

23. The method of claim 15 wherein said passages are respectively produced by shaped charge perforating devices so that said unwanted material may include debris deposited in said passages by said shaped charge perforating devices.

24. A method for perforating a cased well bore containing fluids and traversing earth formations and comprising: enclosing a first perforating device within a hollow carrier having an outstanding member on one side thereof and in alignment with said first perforating device; mounting a second perforating device on said carrier and directing said second perforating

device along an axis substantially intersecting the axis of said first perforating device; placing said carrier into a cased well bore and urging said carrier laterally to position said outstanding member against the adjacent wall of the well casing; lowering said carrier into the well bore while said outstanding member is maintained against the adjacent casing wall to abrade said outstanding member into a curvature substantially complementary with the curvature of the casing wall; and actuating said perforating devices to produce first and second substantially intersecting passages in the earth formations with said first passage being substantially isolated from the well bore fluids by the complemental fit of said outstanding member with the casing wall and said second passage being in communication with the well bore fluids for inducing a flow of such fluids through said passages and into said carrier to clean said passages.

25. The method of claim 28 wherein said perforating devices are shaped charges.

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