Sept. 8, 1964 F. R. WHITTEN 3,147,807

FORMATION TESTER

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Fig. 2

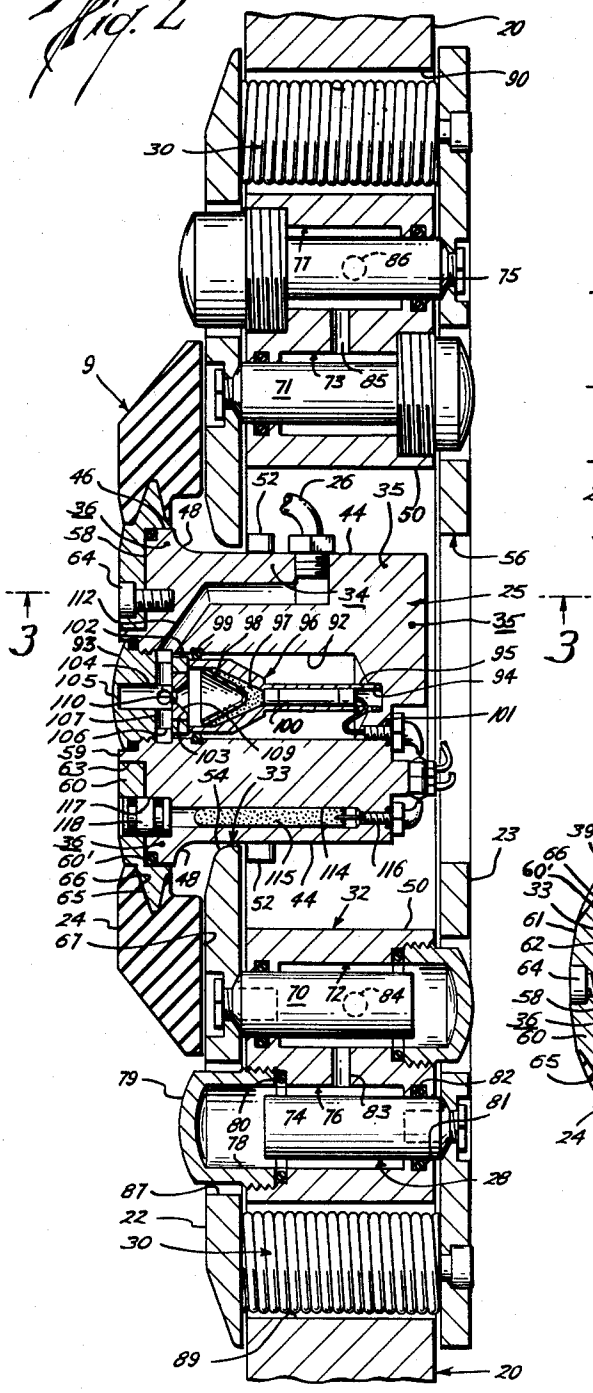


Fig. 1

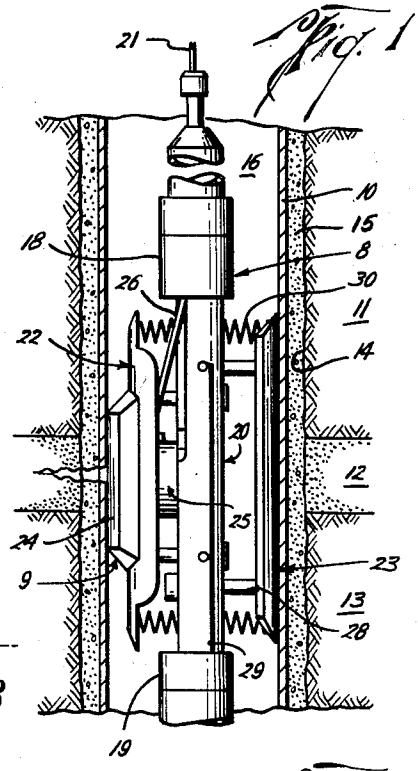
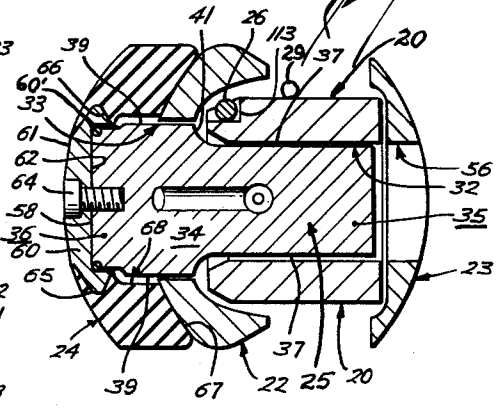


Fig. 3



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This invention relates to an improved pack-off shoe for engaging the sidewall of a smooth bore and, more particularly, pertains to sealing means and a gun block ideally suited for association with sidewall formation fluid sampling apparatus.

Formation samplers heretofore employed have been provided with a pack-off shoe which is to be driven into engagement with the sidewall of an open borehole at the depth of a formation to be sampled. The pack-off shoe includes an attached flexible sealing member having a relatively large engaging surface designed to seal a portion of the formation from the drilling fluid that usually fills the borehole. Thus, fluid from the formation may flow via an entry port in the sealing member and the pack-off shoe to a sample-receiving chamber. After a desired amount of fluid is obtained, the sample-receiving chamber is closed, the shoe and sealing member retracted and the apparatus withdrawn from the borehole so that the sample may be measured and analyzed. Reference may be made to Patent No. 2,674,313 to Lawrence S. Chambers in which such apparatus is more completely described.

The operation of the above-described formation sampler is generally satisfactory and has achieved wide commercial acceptance; however, in some instances, such as testing in a cased hole or smooth bore through hard formations, an imperfect seal may occur due to differences in radii between the sealing member and bore so that a leak occurs resulting in undesirable contamination of the fluid sample. Also, facing the shoe with the sealing member presents an undesirable cost factor as the sealing member may be damaged or require replacement after only a few operations.

Improvements in pack-off shoes are illustrated in the Patent No. 2,821,256 to Harry B. Boller where a sheet or pad of flexible material is attached about its periphery to the pack-off shoe so that the forward force of the pack-off shoe is applied about the peripheral edge surfaces of the pad, thereby permitting irregular and rough portions of the borehole to be effectively sealed. However, the pad is subject to separation from the shoe attachment and sometimes requires replacement after a limited number of operations.

It is accordingly an object of the present invention to provide a new and improved sealing apparatus to engage the sidewall of a smooth bore for use with a fluid sampler.

Another object of the present invention is to provide a new and improved sealing apparatus featuring an inexpensive and improved type of construction to obtain a better seal and longer use expectancy than heretofore possible for use with a fluid sampler.

A sealing apparatus in accordance with the present invention comprises a support member movable between retracted and operative positions, an independent gun block loosely mounted on the support member and a sealing member secured to the gun block so as to be unconstrained yet adapted to cooperate with the support member to seal off a portion of a smooth bore. Another aspect of the present invention is the provision of means to isolate the debris produced by an explosive device in the gun block from the flow line of a fluid sampler.

The novel features of the present invention are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation together with further objects and advantages thereof may best be understood by way of illustration and example of certain embodiments when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side view of a portion of the apparatus embodying the present invention shown in an operative condition in a cased borehole;

FIG. 2 is a cross section of the apparatus embodying the present invention drawn to an enlarged scale and shown retracted;

And FIG. 3 is a cross section taken along line 3—3 of FIG. 2.

In FIG. 1 of the drawings, a fluid sampler 8 incorporating a sealing apparatus 9 embodying the present invention is shown disposed in a casing 10 which traverses earth formations 11, 12 and 13 where formation 12 is the one of interest and from which a fluid sample is to be obtained. The annulus between casing 10 and the bore 14 is filled with the customary cement 15 while the casing 10 contains fluid 16 to provide a hydrostatic control pressure in the well.

The fluid sampler 8 comprises upper and lower pressure resistant housing sections 18, 19 connected together in longitudinally spaced relation by a block member or carrier 20. The apparatus thus far described is suspended in the casing 10 by a cable 21 which in connection with a winch (not shown) located at the surface of the earth is employed to lower and raise the apparatus in the casing in a customary manner.

The block member 20 provides a carrier for a pack-off shoe 22 or support member and a back-up shoe 23, the shoes being shown in an extended position so that a sealing member 24 associated with the pack-off shoe 22 is in engagement with the casing 10. The sealing apparatus 9 includes a gun block 25 containing explosive means, which is affixed to the sealing member 24, the explosive means being adapted to perforate the casing, cement and formation so that formation fluids may flow through the gun block and through a sample-conveying tube 26 to the sample-receiving chamber (not shown) in housing 18. Hydraulic piston and cylinder arrangements 28 are provided to extend the respective shoes 22, 23 relative to the block member 20 and are connected via hydraulic lines 29 to hydraulic actuating means (not shown) in housing section 19. The sample-receiving chamber in housing 18 and the hydraulic actuating means in housing 19 may be, for example, of the type shown in the aforesaid Chambers patent. Springs 30 connected to the shoes 22, 23 facilitate retraction of the shoes toward the block member 20 when the hydraulic arrangements 28 are de-actuated.

As best shown in FIGS. 2 and 3, block member 20 is elongated and has a generally square cross section in a plane perpendicular to the longitudinal axis of the member. The shoes 22, 23 are elongated and positioned centrally of the member 20, the shoes being horizontally curved about a longitudinal axis of the block member 20 with inner surfaces adapted to conform about the block member 20 and outer cylindrically curved surfaces to conform to the curvature of a casing.

Block member 20 has an elongated opening 32 centrally located between shoes 22, 23 so as to face each shoe, the opening being adapted to receive the gun block 25. Pack-off shoe 22 similarly has an elongated rectangular opening 33 disposed adjacent to block opening 32, the shoe opening 33 being adapted to loosely receive an intermediate portion 34 of the gun block 25. The rear end portion 35 of the gun block 25 being received within the block opening 32 while the forward portion 36 of the gun block 25 extends outwardly of the pack-off shoe 22.

The rear end portion 35 of gun block 25 has substantially parallel side surfaces 37 (FIG. 3) of a lesser di-

mension than substantially parallel side surfaces 39 of the intermediate and forward portions 34, 36 of the gun block 25 thereby forming side shoulders 41 on the gun block. The rear end portion 35 of gun block 25 is slidably received within the block opening 32 so that shoulders 41 thereby limit relative movement of gun block 25 into block member 20. The shoe opening 33 is, of course, large enough to slidably accommodate the side surfaces 39 of the portions 34, 36 of the gun block 25.

The rear end portion 35 and intermediate portion 34 have substantially parallel end surfaces 44 (FIG. 2) of a lesser dimension than substantially parallel end surfaces 46 of the forward portion 36 of the gun block thereby forming shoulders 48 which extend over the shoe opening 33 and may limit relative movement between the gun block 25 and pack-off shoe 22 when the shoe is moved outwardly relative to the carrier 20. To limit movement of the gun block 25 relative to the pack-off shoe 22 in an opposite direction, the spacing between the end surfaces 50 of the block opening 32 is made larger than the spacing between the end surfaces 44 of the gun block 25 so that abutment means such as screws 52 may be received by the gun block 25, the outward extension of the screws being sufficient to engage the rearward surface of the pack-off shoe 22.

Back-off shoe 23 is also provided with a rectangular opening 56 to permit access to rear end portion 35 of gun block 25 and is also large enough that the rear end portion of the gun block may extend into the shoe opening 56. Thus, it will be seen that gun block 25 is loosely mounted in the pack-off shoe 22 and may have limited relative movement with respect thereto, the limited movement being determined by the spacing between shoulders 48 and the screw means 52 on the gun block 25.

The forward portion 36 of the gun block has a substantially flat forward surface 58 with a centrally located annular projection 59 extending outwardly therefrom. A rectangular face plate member 60 having a cylindrically curved outer surface 61 (FIG. 3) and a rectangular recessed inner surface 62 (FIG. 3) is fitted over the forward portion 36 of the gun block and sealed by an O ring 60', the plate member 60 having a circular opening 63 sized to receive the annular projection 59. Means such as screws 64 (only one shown) are provided to removably secure the face plate 60 to the gun block 25. The edge surfaces 65 of the face plate 60 extend or taper outwardly about the rectangular periphery of the face plate and are V shaped and adapted to be received within a corresponding V shaped recess 66 in a rectangular aperture formed in the sealing member 24. The sealing member 24 may be suitably bonded to the edge surfaces 65 of face plate 60 in a well-known manner to form an integral sub-assembly.

The sealing member 24 is preferably constructed of a relatively thick and elongated sheet of elastic material such as rubber and is cylindrically curved in a manner conforming to the pack-off shoe 22. The dimensions of the sealing member are such that it coextends laterally over the forward surface of the pack-off shoe 22 and longitudinally over the large portion of the shoe. The inner surface 67 of the sealing member is also relieved or recessed at 68 (FIG. 3) about the gun block 25, the recess extending to a location adjacent to the V shaped recess 66 to facilitate the sealing characteristics of the sealing member 24 as will become apparent from the discussion to follow. Sealing member 24 has a thickness which is generally twice that of the shoe 22 and has a relative hardness, for example, of 55 shore durometer. In the unstressed position of the sealing member 24, the inner surface 67 may bear against the pack-off shoe 22 or be slightly separated therefrom.

Turning now to the means for moving the shoes relative to the block member 20, pack-off shoe 22 is suitably connected to pistons 70, 71 above and below the block opening 32, the pistons being received in cylinders 72, 73 arranged transversely relative to the longitudinal axis of the apparatus. Back-up shoe 23 is similarly connected to pistons 74, 75 above and below the block opening 32, the pistons 74, 75 being received in cylinders 76, 77 transversely arranged relative to the longitudinal axis of the apparatus. The cylinders 72, 73, 76, 77 and pistons 70, 71, 74, 75 are similarly constructed so that a description of one will suffice for all. Cylinder 76, for example, typically consists of a bore 78 of larger diameter than the diameter of the piston 74. One end of the bore 78 receives a threaded cap member 79 which is suitably sealed relative to the bore by an O ring 80. At the other end of the bore 78 is a bore 81 of smaller diameter which slidably receives the piston 74, the bore 81 and piston 74 being sealed by an O ring 82.

Cylinders 72, 76 are connected together by a passageway 83 in the block member 20 and an opening 84 to the hydraulic lines 29 (FIG. 1) while cylinders 73, 77 are interconnected by a similarly arranged passageway 85 and an opening 86 to the hydraulic lines 29 (FIG. 1). Each of the shoes 22, 23 is also typically provided with openings 87 adjacent to a cap member 79 to permit full retraction of the shoes 22, 23 to the block member 20. Above and below the block opening 32 there are provided transverse openings 89, 90 through which springs 30 extend, the springs 30 being connected to the respective shoes near their respective extremities thereby to facilitate retraction of the shoes.

The gun block 25 has a central bore 92 which is threaded at one end to receive a cap member 93 and terminated at the other end with a bore 94 of reduced diameter which receives a tubular extension 95 of a shaped charge container 96. The shaped charge container 96 is generally hollow and conically shaped to receive an explosive charge 97 and liner 98 in a well-known manner. Means such as an O ring 99 are provided to centralize the container 96 in the bore 92. A high explosive initiator such as a blasting cap 100 for the explosive charge is contained within the tubular extension 95 and is connected to a pressure sealed conductor 101 in the gun block 25, the conductor being connected to a firing circuit (not shown) at the surface in a well-known manner.

The cap member 93 has a cylindrical extension 102 which bears upon the shaped charge container 96 to hold the tubular extension 95 in bore 94. Cap member 93 also has bore 104 which extends from a thin wall section 105 at the forward portion of the cap to a cylindrical insert 103 in the extension 102. The insert 103 provides a "catcher" for the debris of the container 96 when the explosive charge 97 is detonated and is secured in a counterbore of larger diameter in the end of the cap member. Insert 103 has a conically tapered surface 109 facing the charge and a small diameter opening 110 aligned with the larger bore 104. The diameter of the opening 110 is made such that the perforating jet formed by the detonation of the explosive charge 97 may pass unhindered therethrough yet prevent the passage of debris.

To convey a fluid sample from bore 104 to the sample-receiving section in housing 18, cap 93 has an annular recess 106 which is connected by ports 107 to bore 104. Annulus 106 is connected by a passageway 112 in the gun block 25 and via the conduit 26 to the sample-receiving chamber in housing 18 (see FIG. 1). The conduit 26 is arranged to lie in a groove 113 on one side of the block member 20 (FIG. 3) behind the pack-off shoe when it is retracted.

Gun block 25 is also provided with a "get-away" device which permits equalization of pressures across the sealing member 24 after a fluid sample has been taken. The device consists of a bore 114 containing an explosive charge 115 into which an electrical igniter 116 extends. The bore 114 opens into an enlarged bore 117 in the gun block and face plate 60, the bore 117 receiving a closure member 118. By igniting the charge 115 in the cus-

tomary manner from the surface the explosion expels the closure member **118** and portions of the igniter **116** permitting the pressures on either side of the sealing member **24** to be equalized.

In operation, the device is passed through a casing or borehole to the level to be tested in a customary manner, the sealing apparatus being in a collapsed position, as shown in FIGS. 2 and 3. At the level of interest, the hydraulic motive means in housing **19** are actuated so that cylinders **73, 77, 72, 76** receive fluid under pressure which forces pistons and thus the shoes **22, 23** outwardly of the block member **20**. As the pack-off shoe **22** moves outwardly relative to the block member **20**, the forward face of the shoe engaging the rearward face of the sealing member carries the sealing member **24** towards the casing or borehole wall, the sealing member being unconstrained. Thereafter, at its outer periphery, the forward face **61** of the face plate **60** on gun block **25** engages the casing and thereby limits the movement of the gun block **25** while the pack-off shoe **22** continues its movement thereby moving relative to the gun block **25** and compressing the sealing member **24** between the shoe and the casing. Compression of the sealing member **24** is facilitated by the relative movement between the sealing member **24** and the pack-off shoe **22**. Since the sealing member **24** is unconstrained the outer edge portions of the sealing member **24** protrude outwardly around the edge portions of the pack-off shoe while the recessed portion **68** moves inwardly towards the gun block **25** thus providing a strong efficient seal on the casing **10**.

After a seal has been made, the explosive charge **97** is detonated producing a perforating jet which passes through aligned bores **110** and **104** of the cap member, penetrating thin-walled section **105**, the casing **10**, cement **15** and the formation. The debris from the charge container **96** is retained within the bore **92** gun block by the insert **103** which impedes the passage of the fragments from the container. Thereafter, a fluid sample may flow through the open bore **104** in cap member, bores **107** and annulus **106** to passageway **112** and through conduit **26** to the sample-receiving chamber in housing **18**. Thus, the fluid sample effectively bypasses the bore **92** in gun block **25** which extends beyond insert **103** so that the flow path bypasses the retained debris in the gun block.

After the sample has been taken by the sample-receiving section in housing **18**, the pressure in the pistons and cylinders **28** is relieved and is less than the hydrostatic pressure so that hydrostatic pressure causes the shoes to retract towards the housing. Should the hydrostatic pressure be insufficient to retract the shoes, the springs **30** may facilitate retraction of the shoes **22, 23** towards the housing. After the shoes are retracted, the "get-away" charge **115** is fired which permits equalization of pressure across the sealing member **24** and eliminates the seal on the wall. Thereafter the apparatus is retrieved and the fluid sample may be analyzed.

The particular embodiments of the present invention having 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. In a formation sampler for use in a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having an aperture, means on said carrier for moving said force-applying member selectively toward and away from the bore wall, and a fluid-receiving apparatus including a fluid-receiving block slidably mounted in said aperture, said block having a gun bore, a cap member received by said gun bore, said fluid-receiving apparatus further including a plate member secured to said block having an opening aligned with said gun bore and an elastic packer element having an opening, said packer element being secured to said plate member solely about the periphery of said element opening and having outer peripheral portions extending outwardly about said element opening, said outer peripheral portions being thicker than said plate member and in separate confronting relation to said force-applying member for sealing about said block opening upon compression of said outer peripheral portions between said force-applying member and the bore wall toward which said force-applying member is moved.

2. In a formation fluid sampler for use in a generally cylindrical portion of a well bore, the combination comprising: an elongated carrier, an elongated, generally rectangular force-applying member having a cylindrically curved, outer face and an aperture therein, means on said carrier for moving said force-applying member toward and away from the bore wall, a fluid-receiving block slidably fitted in said aperture, a plate member second to said fluid-receiving block having an opening, and a relatively thick walled, elongated and rectangular elastic packing element having generally cylindrical curved inner and outer faces and having an opening to receive said plate member, said packing element being secured solely about the inner periphery of said element opening to said plate member and having outer peripheral portions which are thicker than said plate member and which are disposed in separate confronting and conforming relation to the outer surface of said force-applying member, said packing element being compressible in sealing relation to the bore wall by said force-applying member.

3. In a formation fluid sampler for use in a generally cylindrical portion of a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having a cylindrically curved, outer face and an aperture therein, means on said carrier for moving said force-applying member toward and away from the bore wall, a fluid-receiving block slidably fitted in said aperture, a plate member secured to said fluid-receiving block having an opening, a relatively thick walled, elongated and rectangular elastic packing element having generally cylindrically curved inner and outer faces and having an opening to receive said plate member, said packing element being secured solely about the inner periphery of said element opening to said plate member and having outer peripheral portions which are thicker than said plate member and which are disposed in separate confronting and conforming relation to said outer face of said force-applying member, said packing element being compressible in sealing relation with the bore wall by said force-applying member, and means located behind the inner face of said force-applying member and projecting from said block to engage said inner face thereby to limit movement of said block relative to said force-applying member.

4. In a formation fluid sampler for use in a generally cylindrical portion of a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having a cylindrical curved, outer face and an aperture therein, means on said carrier for moving said force-applying member toward and away from the bore wall, a fluid-receiving block slidably fitted in said aperture, said block having a gun bore, a cap member received by said gun bore, a plate member secured to said fluid-receiving block and having an opening to receive said cap member, and a relatively thick walled, elongated and rectangular elastic packing element having generally cylindrically curved inner and outer faces and having an opening to receive said plate member, said packing element being secured solely about the inner periphery of said element to said plate member and having outer peripheral portions which are thicker than said plate member and which are disposed in separate confronting and conforming relation to the outer face of said force-applying member, said packing element being com-

pressible in sealing relation with the bore wall by said force-applying member.

5. In a formation fluid sampler for use in a generally cylindrical portion of a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having a cylindrically curved, outer face and an aperture therein, means on said carrier for moving said force-applying member toward and away from the bore wall, a fluid-receiving apparatus slidably fitted in said aperture, said fluid-receiving apparatus having a gun bore. a shaped charge means disposed in said gun bore, a closure member at one end of said gun bore, means in said gun bore intermediate said shaped charge means and said closure member for permitting passage of a perforation jet yet impede passage of debris from said charge means when said charge means is detonated, said fluid-receiving apparatus having a sample-receiving passage opening into said gun bore between said last-mentioned means and said closure member, said fluid-receiving apparatus further including an elastic packing portion extending outwardly about said fluid-receiving portion to unconfined peripheral edge portions, said packing portion having a thickness and rigidity sufficient to maintain its shape relative to said peripheral edge portions while being passed through a well bore, said packing portion being in separate confronting relation to said force-applying member for sealing about said port upon compression of said packing portion between said force-applying member and the bore wall toward which said force-applying member is moved.

6. In a formation fluid sampler for use in a generally cylindrical portion of a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having a cylindrically curved, outer face and an aperture therein, means on said carrier for moving said force-applying member toward and away from the bore wall, a fluid-receiving block slidably fitted in said aperture, said block having a gun bore, a shaped charge means disposed in said gun bore, a cap member received in one end of said gun bore and having a first bore terminating at one end with a thin-walled portion, said cap member having a second bore aligned with said first bore and opening into the remaining end of said first bore, said second bore being disposed adjacent to said charge means and sized to pass a perforating jet yet impede passage of debris from said charge means when said charge means is detonated, said cap member having a third bore disposed transversely to said first and second bores and opening into said first bore to permit fluid received by said first bore to flow primarily through said third bore, a plate member secured to said fluid-receiving block and having an opening to receive said cap member, and a relatively thick walled, elongated and rectangular elastic packing element having generally cylindrically curved inner and outer surfaces and having an opening to receive said plate member, said packing element being secured solely about the inner periphery of said element opening to said plate member and having outer peripheral portions which are thicker than said plate member and which are disposed in separate confronting and conforming relation to the outer face of said force-applying member, said packing element being compressible in sealing relation with the bore wall by said force-applying member.

7. In a formation fluid sampler for use in a generally cylindrical portion of a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having a cylindrically curved, outer face and an aperture therein, means on said carrier for moving said force-applying member toward and away from the bore wall, a fluid-receiving block slidably fitted in said aperture, said block having a gun bore, a shaped charge means disposed in said gun bore, a cap member received in one end of said gun bore and having a first bore terminating at one end with a thin-walled portion, said cap member having a second bore aligned with said first bore and opening into the remaining end of said first bore, said second bore being disposed adjacent to said charge means and sized to pass a perforating jet yet impede passage of debris from said charge means when said charge means is detonated, said second bore having a portion facing said charge means which is conically shaped, a plate member secured to said fluid-receiving block and having an opening to receive said cap member, and a relatively thick walled, elongated and rectangular elastic packing element having generally cylindrically curved inner and outer surfaces and having an opening to receive said plate member, said packing element being secured solely about the inner periphery of said element opening to said plate member and having outer peripheral portions which are thicker than said plate member and which are disposed in separate confronting and conforming relation to the outer face of said force-applying member, said packing element being compressible in sealing relation with the bore wall by said force-applying member.

8. In a gun block for use with a fluid sampler, a gun bore, a shaped charge means disposed in said gun bore, a closure member received in one end of said bore and having a relatively thin-walled portion aligned with the axis of the perforating jet when the shaped charge means is detonated, means intermediate said thin-walled portion and said shaped charge means for impeding the passage of debris from said shaped charge means when detonated yet permitting passage of the perforating jet, said gun block further having a sample-receiving passage opening into said gun bore intermediate said thin-walled portion and said impeding means.

9. In a formation sampler for use in a relatively smooth well bore, the combination comprising: an elongated carrier, an elongated force-applying member with an outer cylindrically-curved surface about a vertical axis, said force-applying member having a centrally-located aperture, means on said carrier for moving said force-applying member selectively toward and away from the bore wall, and a fluid-receiving apparatus slidably mounted in said aperture for movement relative to said force-applying member, said fluid-receiving apparatus having a fluid-receiving port, said fluid-receiving apparatus further including an elastic packing portion extending outwardly about said fluid-receiving port on one side of said force-applying member to unconfined peripheral edge portions, said packing portion having a thickness and rigidity sufficient to maintain its shape relative to said peripheral edge portions while being passed through a well bore; said peripheral edge portions of said packing portion being in confronting relation to the curved surface of said force-applying member about said port; means on the other side of said force-applying member for retaining said elastic packing portion in said confronting relation and normally restraining relative movement between said force-applying member and said fluid-receiving apparatus, said fluid-receiving apparatus being moved relative to said force-applying member upon compression of said packing portion between said curved surface of said force-applying member and a bore wall.

10. In a formation sampler for use in a relatively smooth well bore, the combination comprising: an elongated carrier, an elongated force-applying member having inner and outer wall surfaces, said force-applying member having an aperture, means on said carrier for moving said force-applying member selectively toward and away from the bore wall, and a fluid-receiving apparatus slidably mounted in said aperture for movement relative to said force-applying member, said fluid-receiving apparatus having a forward portion with a fluid-receiving port, said fluid-receiving apparatus further including an elastic packing element secured about the periphery of said forward portion and extending outwardly from said forward portion to outer unconfined peripheral edge portions, said outer peripheral edge portions being in confronting relation to the outer wall surface of said force-

applying member, said fluid-receiving apparatus having means cooperating with said inner wall surface of said force-applying member for retaining said elastic packing in said confronting relation and normally restraining relative movement between said force-applying member and said fluid-receiving apparatus, said fluid-receiving apparatus being moved relative to said force-applying member upon compression of said packing element between said outer wall surface of said force-applying member and a bore wall.

11. In a gun block for use with a fluid sampler, a gun bore, a shaped charge means disposed in said gun bore, a closure member received in one end of said bore and having a relatively thin-walled portion aligned with the axis of the perforating jet formed when the shaped charge means is detonated, means intermediate said thin-walled portion and said shaped charge means forming an opening sized for passage of a perforating jet yet small enough for impeding the passage of debris from said shaped charge means when detonated, said gun block further having a sample-receiving passage opening into said gun bore intermediate said thin-walled portion and said impeding means.

12. In a gun block, a gun bore, a shaped charge means disposed in said gun bore and facing toward the open end of said gun bore, closure means received in said open end of said gun bore and having a thin-walled closure portion and a first bore extending inwardly from said thin-walled closure portion, said closure means having a second bore aligned with said first bore and disposed intermediate of said shaped charge means and said first bore, said second bore having a smaller diameter than said first bore, said second bore being sized for passage of a perforating jet yet small enough for impeding the passage of debris from said charge means when said charge means is detonated thereby retaining such debris in said gun bore, a flow passageway in said gun block, said closure means having a fluid communication passageway intermediate of said first and second bores for placing said first bore in fluid communication with said flow passageway.

13. The apparatus of claim 12 wherein the portion of said second bore facing said shaped charge means has a conical surface facing said shaped charge means.

14. In a formation sampler for use in a relatively smooth well bore, the combination comprising: an elongated carrier, a force-applying member having an outer cylindrically-curved surface about a vertical axis and an opening therein, means on said carrier for moving said force-applying member toward and away from the bore wall; a fluid-receiving apparatus slidably mounted in said opening; an elastic packing member having a thickness defined between inner and outer surfaces, a flat, plate member detachably secured to said fluid-receiving apparatus, said packing member being elongated and rectangularly shaped, inner and outer packer member surfaces having generally cylindrical curvature about a vertical axis, said packing member having a first aperture extending inwardly from its outer surface, said first aperture of said packing member being attached to said plate member, said packing member having a second aperture extending inwardly from its inner surface to said first aperture, means on said fluid-receiving apparatus for bringing the inner surface of said packer member in contacting relationship to said force-applying member, said second aperture permitting relative movement between said force-applying member and said fluid-receiving apparatus upon compression of said packing member between a well bore wall and the force-applying member.

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