Nov. 8, 1960 E. K. GARDNER ET AL 2,959,397

SAMPLING APPARATUS

Filed March 23, 1959 3 Sheets-Sheet 1

Fig. 1.

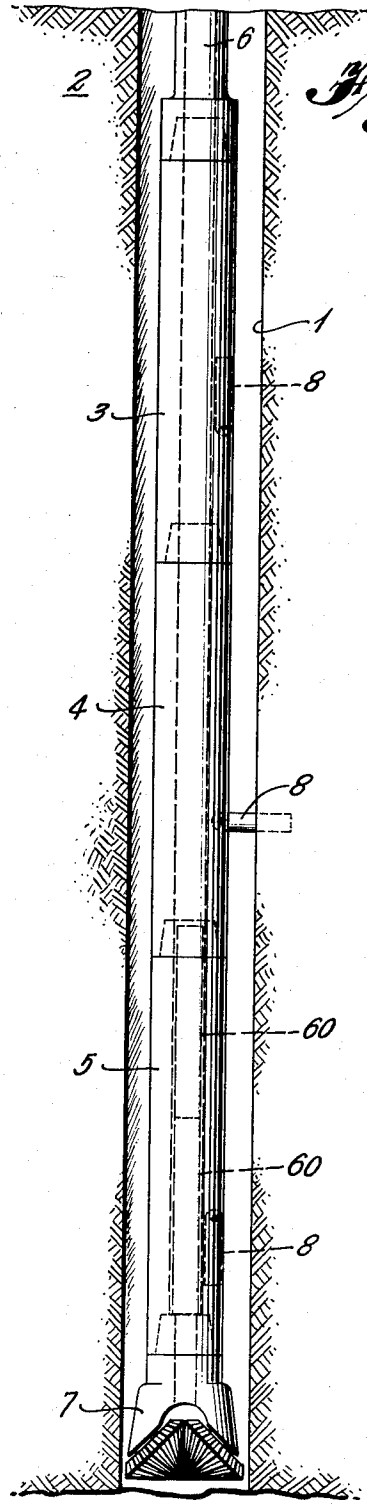


Fig. 5.

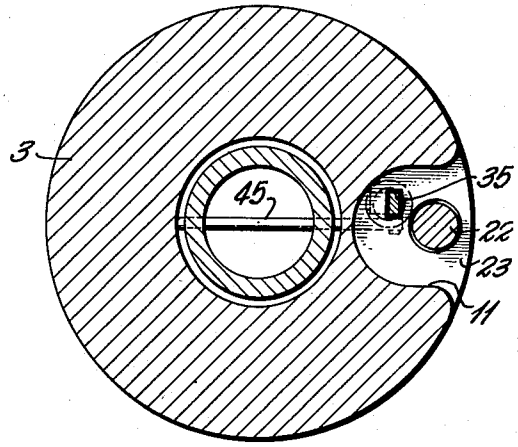
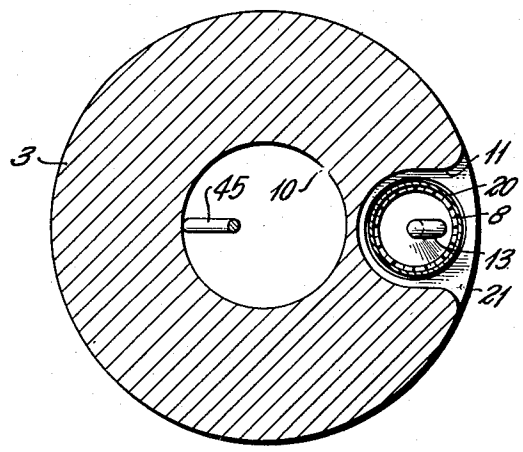


Fig. 6.



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SAMPLING APPARATUS

Filed March 23, 1959 3 Sheets-Sheet 2

Fig. 2.

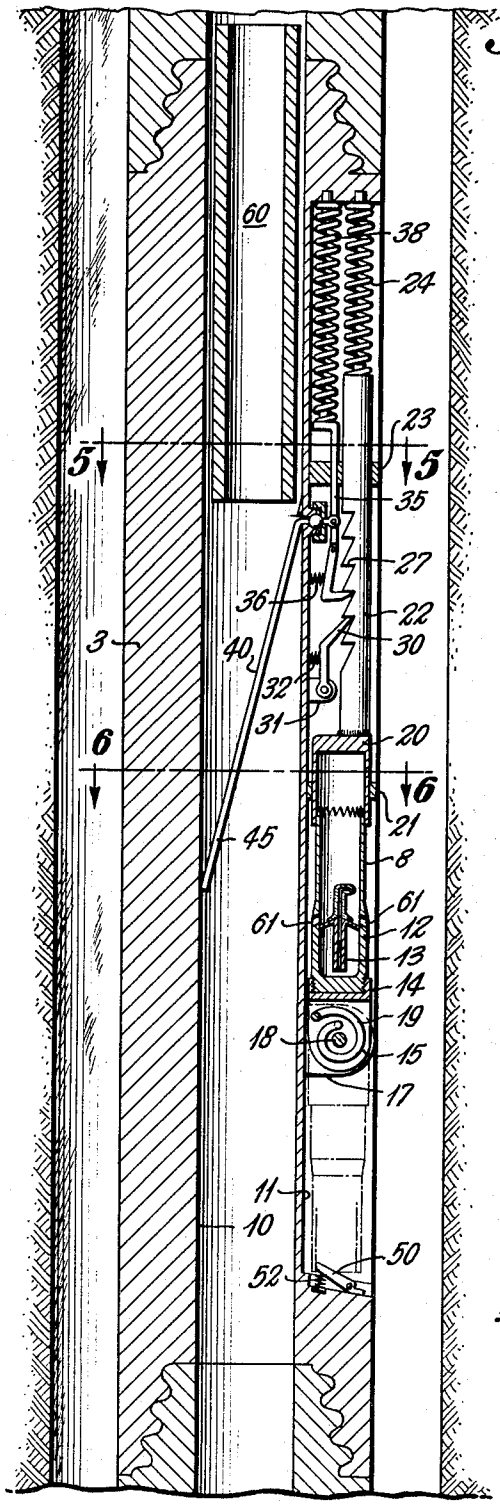
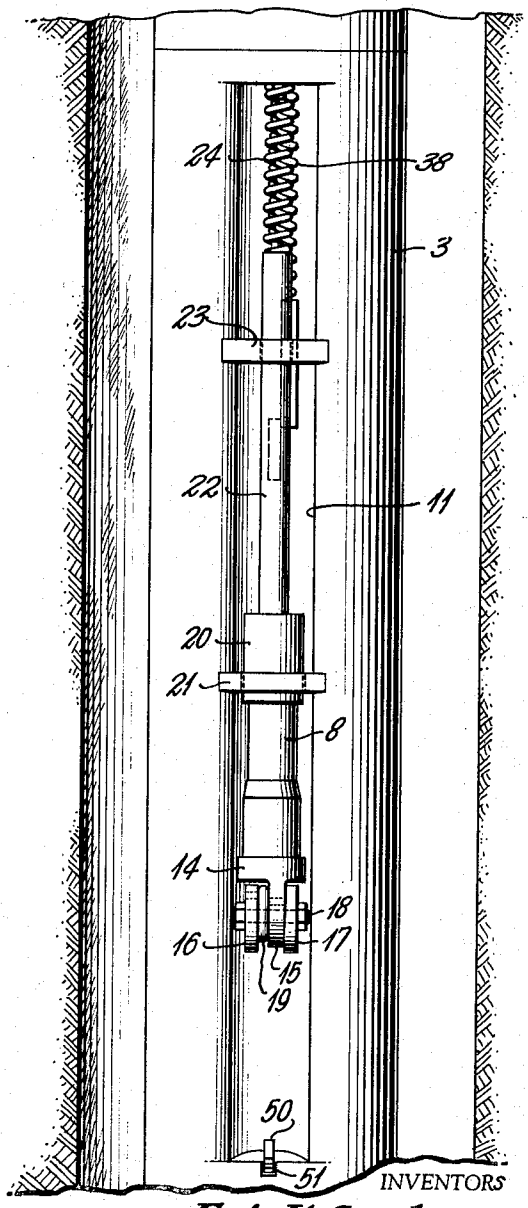


Fig. 3.



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SAMPLING APPARATUS

Filed March 23, 1959 3 Sheets-Sheet 3

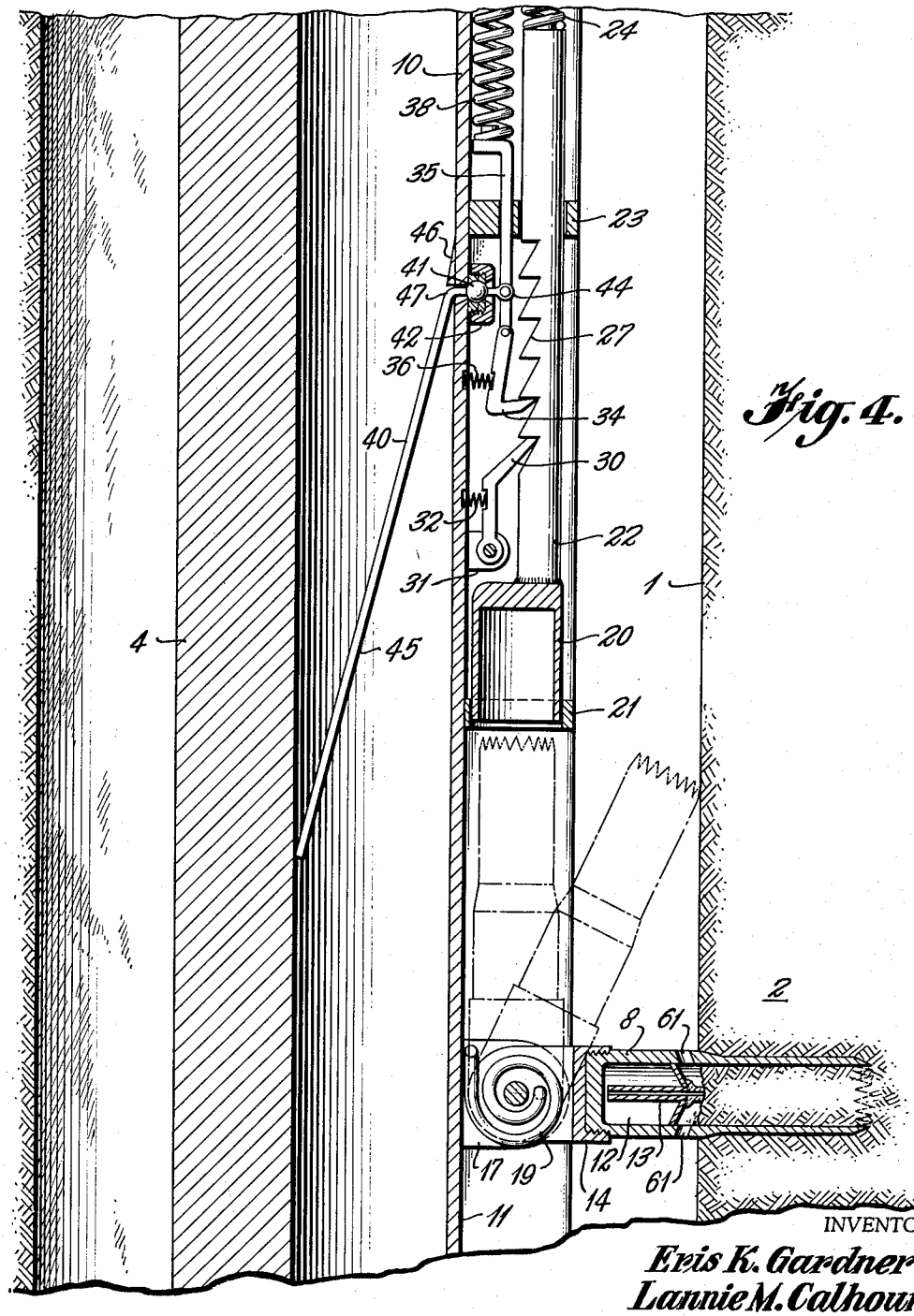


Fig. 4.

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SAMPLING APPARATUS

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11 Claims. (Cl. 255—1.4)

The present invention relates to apparatus for use in conjunction with the drilling of oil wells and the like and, in particular, provides means for taking samples of the formations and the fluids contained in the formations at the points in the well bore where the samples are taken.

As is well known to those skilled in the art of drilling oil wells, it is expedient from time to time to take samples, at various depths in the well, which samples may be examined by the geologist for the purpose of determining the possible location of oil deposits. Many different devices have been proposed and employed for the purpose of obtaining the samples from the wall of the well bore. Most of the devices employed for the purpose of sampling are separate instruments which are lowered into the well bore after the drill bit and drill string have been removed. Some of these devices also include explosive means for forcing the sampling element into the wall of the well bore. Other less effective sampling apparatus have included devices which are attached to the drill string or to the drill collar. The present invention, however, involves a sampling apparatus or device which is attached directly to the drill collar and which may be actuated or not, as desired, during or subsequent to the drilling operation. As will hereinafter appear, the sampling apparatus of the present invention is simpler and much superior to prior art devices employed for the same general purpose.

A significant feature of the present invention resides in the fact that a plurality of these sampling devices may be arranged in series such that each sampling device may be actuated independently of the others, whereby samples may be taken at different levels, as desired.

Therefore it is a principal object of the present invention to provide a sampling device which is attached directly to the drill collar such that, at some convenient time (for example, after a period of drilling when it is necessary to change the drill bit), a plurality of samples may be taken from the wall of the well bore at one or more different locations and coincident with the removal of the drill string.

It is a further object of the present invention to provide an apparatus of the type referred to above wherein a plurality of such devices may be arranged in series so that each device can be operated independently of others for the purpose of obtaining different samples at different levels.

Other and further objects and advantageous features of the present invention will hereinafter more fully appear in connection with a detailed description of the drawings in which:

Figure 1 is a vertical section through a portion of the well bore showing the lower end of the drill string, the drill bit, and three drill collars arranged in series, each drill collar being provided with a sampling device in accordance with the present invention;

Figure 2 is a vertical section through one of the drill collars showing the present invention in detail;

Figure 3 is a vertical elevation taken from the right-hand side of Figure 2;

Figure 4 is a view similar to Figure 2, but on a larger scale, showing the sampling device of the present invention in its sampling position;

Figure 5 is a transverse section through the drill collar taken along section line 5—5 of Figure 2; and

Figure 6 is a transverse section through the drill collar taken along section line 6—6 of Figure 2.

Referring to the drawings in detail, in Figure 1 there is shown a well bore 1 extending downwardly through the earth 2. Three drill collars 3, 4 and 5 are shown connected in series to the lower end of the drill string 6. A conventional drill bit 7 is attached to the lower end of the drill collar 5. As shown in dotted lines in Figure 1, the sampling tube 8 on the drill collar 5 is oriented in its lowermost position. The sampling tube 8 on the intermediate drill collar 4 is shown in its sampling position. The sampling element 8 on the uppermost drill collar 3 has not as yet been actuated. Although three drill collars, each provided with a sampling device of the present invention, are shown in the illustration in Figure 1, it should be understood that the greater number of such drill collars might be provided in series as desired.

Referring now to Figures 2 to 6, inclusive, the drill collar 3 is provided with an internal bore 10 which is substantially the same size as the bore of the drill string 6 and through which drilling mud is pumped during the drilling operation. As is well known to those skilled in the drilling art, the drill collars are larger and heavier in average cross-section than the sections of drill string for the purpose of placing additional weight on the drill bit. As best shown in Figures 5 and 6, the drill collar 3 is provided with a vertical groove 11 along one side for the purpose of mounting therein the sampling tube 8 of the present invention.

As shown in the drawings, the sampling element 8 consists of a hollow cylindrical tube which is open and preferably serrated at its upper end. Located adjacent the lower internal end of the tube 8 is a hollow and sealed container 12. The container 12 includes a vertical tube 13, preferably of glass, which extends from the bottom of the container through an opening in the top thereof, terminating at a point above the upper end of the container. The upper end of the glass tube 13 is bent over as shown so as to be easily broken thereafter when a quantity of dirt, sand or rock is picked up by the sampling tube 8 from the wall of the well bore. The container 12 is preferably placed under vacuum and the tube 13 is sealed at its upper end so as to maintain the container 12 under vacuum until the upper end of the tube 13 is broken as indicated above.

The lower external end of the tube 8 is provided with threads such that the sampling device may be screwed into an appropriate threaded portion of a pivotal support 14. The lower end of the support 14 is provided with a downwardly projecting tongue 15 which is supported between two lugs 16 and 17 by means of a bolt 18. A torsion spring 19 is positioned between the tongue 15 and the lug 16 with one end of the spring 19 being secured in an appropriate hole in the tongue 15 and the other end being secured in an appropriate hole in the lug 16. The torsion spring 19 is preloaded such that it tends, at all times, to urge the sampling tube 8 in a clockwise direction (as it appears in reference to Figure 2).

The sampling element or tube 8 is held in the position shown in Figure 2 by means of a hollow cylindrical member 20 which is arranged in telescoping relation over the upper end of the sampling tube. The hollow cylinder is vertically slidable through a collar 21 suitably secured in the groove 11. A rod 22, constituting a ratchet, as will hereinafter appear, is suitably secured, by

welding for example, at its lower end to the upper end of the cylindrical member **20**. The upper end of the rod **22** passes through a suitable hole in a plate **23** which is also secured in the groove **11**. A helical spring **24** at its lower end surrounds a suitable pin on the uppermost end of the rod **22**; the upper end of the spring **24** surrounds a pin which is located at the upper end of the groove **11**. The spring **24** continuously urges the rod **22** and, hence, the cylindrical element **20** downwardly.

The left-hand portion of the rod **22** is provided with a toothed portion **27** containing a plurality of ratchet-shaped teeth.

A lower pawl **30** is pivotally mounted adjacent its lower end on a lug **31** and is continuously urged in a clockwise direction by means of a spring **32**. The pawl **30**, therefore, is continuously urged against the ratchet teeth **27** such that, when the rod **22** is elevated stepwise as will hereinafter appear, the pawl **30** will engage one of the teeth so as to prevent the rod **22** from being urged downwardly under the action of the spring **24**. An upper pawl **34** is pivotally attached at its upper end to the lower end of a slidable bar **35**; this upper pawl is continuously urged in a counterclockwise direction by means of the spring **36**.

Another helical spring **38** (similar to the helical spring **24**) engages at its lower end a suitable pin on the upper end of the slidable bar **35**; the upper end of the spring **38** engages a downwardly projecting pin at the upper end of the groove **11**. A lever **40** (see now Figure 4), provided with an intermediate ball portion **41**, passes through a suitable hole or slot in the wall of the drill collar **3** (or **4**). The ball portion **41** of the lever **40** is held in fluid-tight relation against the wall of the drill collar by means of a threaded cap **42** and suitable gaskets. The lever **40** is provided with a short arm **44**, which at its right-hand end, pivotally engages the slidable bar **35**. It should be mentioned that the slidable bar **35** also passes through a suitable hole in the plate **23**. The other and longer arm **45** on the lever **40** extends downwardly and diagonally across the bore **10** of the drill collar. The bore **10** of the drill collar also is provided with a sloping projection **46** which serves to protect the bend **47** in the lever **40**.

From a consideration of Figures 2 and 4, it should be apparent that, when the longer arm **45** of the lever **40** is depressed in a counterclockwise direction, the slidable bar **35** will be moved upwardly together with the pawl **34**. This movement of the pawl **34** will cause the rod **22** to be moved upwardly one notch or one tooth against the action of the spring **24**. As the rod **22** moves upwardly one step at a time, the stationary pawl **30** will move into engagement with the next lower tooth each time that the arm **45** of the lever **40** is urged backwardly into its original position by the action of the spring **38**. Movable pawl **34** will return to a position below the next lower tooth and the rod **22** will be retained in a new position one notch higher than before. Thus, moving the arm **45** of the lever **40** a number of times corresponding to the degree of movement required to elevate the hollow cylindrical portion **20** above the upper end of the sampling tube **8**, will result in a release of sampling tube **8** as indicated in Figure 4.

If, after the sampling tube **8** is released, the drill string **3** is elevated a few inches, the sampling tube **8** will be forced into the side of the well bore so as to penetrate into the formation as shown in the solid line position of Figure 4. The force of the material in the formation, as it is urged into the sampling tube **8**, will break the upper end of the sealed tube **13** thus opening the vacuum to the container **12** and causing any liquid present to be sucked into the interior of the container **12** through the tube **13**. After the device has been held in the position shown in solid lines of Figure 4 for a period of time sufficient to permit the container **12** to suck in whatever liquid or gas it is capable of drawing in, the drill string is elevated again so that the tube **8** swings downwardly into the dotted line position shown in Figure 2.

As indicated heretofore, the spring **19** is adapted to urge the sampling element **8** downwardly into the dotted line position shown in Figure 2. In this regard it should be pointed out that the spring is sufficiently strong and is always sufficiently preloaded to urge the element **8** through a complete 180° angle to its downmost position. However, purely for the purposes of insuring safety, a catch is provided for locking the sampling tube **8** in its down position. The catch consists of a small lever **50** pivotally mounted in a suitable slot **51** at the bottom of the groove **11**. A suitable spring **52** urges the small lever **50** to the position shown in Figure 2. Thus, as the sampling tube **8** moves past the lever **50** into the dotted line position shown in Figure 2, the lever **50** will be depressed and immediately thereafter will lock the tube **8** in its down position.

The means for actuating the lever **40** can be any slug or other member capable of being dropped down the bore of the drill string; however, for the purposes of illustration the actuating slug consists of a hollow pipe **60** of any convenient length preferably not longer than the length of one of the drill collars.

If it is desired to actuate one or more of the sampling tubes **8**, and after the kelly has been removed at the surface of the well, one of the slugs or pipes **60** is dropped down into the bore **10** extending throughout the entire length of the drill string. The hollow pipe **60** will descend through the drilling mud until it strikes the arm **45** of the lever **40**. As the hollow pipe section **60** passes the lever **40**, the movement of the arm **45** in a counterclockwise direction will lift the rod **22** a distance equal to the separation between adjacent teeth on the ratchet portion **27**. If two or more of the drll collars employng the present invention are connected in series, it should be understood that each hollow pipe section **60** will actuate each arm **45** of each lever **40** as it passes through each drill collar. Thus, dropping a pipe section **60** down through the drill string will advance each one of the hollow cylinders **20** up one position.

With the above idea in mind, it is preferred to have the lowermost drill collar set in such a manner that one movement only of the lever **40** will lift the hollow cylinder **20** sufficiently to release the sampling tube **8**. The next higher drill section should be set so that two deflections of the lever **40** will cause release of its sampling tube **8**. The third drill collar from the bottom should be set so that three deflections of the corresponding lever **40** will be required to release the corresponding sampling tube **8**, and so on. Thus, when the first slug or hollow pipe **60** is dropped through the drill string, the sampling tube **8** in the lowermost drill collar will be released; the next higher drill collar will be actuated so that the next slug will release its tube **8**; and the next higher drill collar will be actuated so that two additional deflections of its lever will release its sampling tube **8**; and so forth. The above described relationship between the settings on adjacent drill collars is perhaps the preferred arrangement, but, of course, the drill collars could be set in the reverse order so that the uppermost sampling tube would be released first, etc.

Referring now to Figure 1, the dawing shows in dotted lines that two hollow pipe sections **60** have been dropped down through the drill string. The lowermost pipe **60** is resting on the drill bit and the second pipe **60** is resting on the first. The lowermost slug **60** has previously actuated the sampling tube **8** in the drill collar **5**, the sample having been taken by elevating the drill string in two stages. The second slug has passed through the drill collars **3** and **4** and has caused release of the sampling tube **8** in the drill collar **4**. This second slug has also advanced the setting of the drill collar **3** so

that the next slug which is dropped down through the drill string will actuate the corresponding tube 8.

With regard to the condition of the sampling tube 8 on the drill collar 4 as shown in dotted lines in Figure 4, the drill string should be elevated slightly until the sampling tube 8 projects horizontally into the wall of the drill bore (as shown in solid lines). The forcing of the material inwardly into tube 8, as indicated heretofore, will break the end of the tube 13 so as to cause any liquid which is present in the formation to be sucked into the container 12. Also, as the material from the formation is forced into the sampling tube 8, any drilling mud in the sampling tube will be permitted to escape from the holes 61 in the side of the tube. The drill string is maintained in this position for a few minutes (while the sampling tube 8 remains horizontal). Thereafter, the drill string is elevated until the sampling tube 8 assumes its downmost position. This same procedure is repeated following the actuation of each sampling tube 8.

The advantages of the present invention should be apparent from the foregoing description. However, it should be emphasized that the present invention permits the sampling at various levels in the well bore without requiring that the drill string be completely withdrawn as is the case where a separate sampling apparatus must be lowered into the well bore.

If it is desired to employ the apparatus of the present invention in conjunction with a drift meter (which would be lowered down first into the bore of the drill string) the ratchet of each drill collar would be retarded one notch such that the drift meter would not actuate the lowermost sampling tube 8. However, the next slug 60 which was dropped down the bore of the drill string would come to rest on top of the drift meter and would also actuate the lowermost sampling tube 8.

One distinctive advantage of the sampling tube employed in the present invention is that a sample of the formation and also a sample of the liquid present in the formation are obtained simultaneously. The frangible tube 13 has been described as being made of glass, but obviously any other material which would be easily broken so as to release the vacuum at the appropriate moment would also be suitable for the purposes of the present invention.

If it is desired to obtain a greater quantity of fluid that would be received in the container 12, and/or if it is desired to secure an indication of the pressure at the point where the sample was taken, a slot or groove similar to groove 11 could be provided adjacent the existing groove 11 and a larger container could be situated in such a groove. The larger container could be connected to the container 12 through a tube containing a check valve. Thus, some of the liquid passing into the vacuum chamber 12 might also pass into the large container; also, the pressure at the location of the sampling would be transmitted into the interior of this larger container. The pressure in the container could be measured at the surface, and this information might be of assistance to the geologist in making predictions as to the possible location of oil deposits.

As pointed out above, the sampling tube 8 is threadedly received in the pivotal support 14, which, of course, makes the sampling tube removable. Thus when all of the drill collars have been brought to the surface, the sampling tubes may be removed; the geologist can make an analysis of the solid material in the sampling tube and a separate analysis of the liquid in the container 12. The sampling tubes in this sense can be considered as expendable. If desired, they can be discarded after use, or a new glass tube 13 can be inserted and placed in sealed relation with the upper end of the container 12; the container can then be evacuated and the upper end of the tube 13 can be sealed and bent as shown in the drawings.

Although the container 12 has been shown as being integral with the sampling tube 8, it might be desirable to make this container as a separately insertable element in which case the container can be of metal or glass. The container itself could be expendable or reusable as desired. The frangible tube 13 with the breakable tip could be made of glass or of any other suitable material which could be formed with a breakable tip.

Whereas the present invention has been described in particular relation to the drawings attached hereto; it should be understood that other and further modifications, apart from those shown or suggested herein, might be made within the spirit and scope of this invention.

What is claimed is:

1. Apparatus for obtaining samples of the formation in a well bore comprising a drill collar having an internal bore extending throughout the length of said collar, said collar also having a groove extending longitudinally in the outer surface of said collar, a hollow and open ended sampling tube mounted at its closed end on a pivotal axis in said groove, means for resiliently urging said tube about its pivotal axis from a first position lying along said groove outwardly away from said collar and said groove to a second position in said groove opposite from said first position, whereby the open end of said tube in moving from said first position to said second position passes through an arc beyond the outer surface of said collar, means mounted in said groove for engaging and holding said sampling tube in said first position against the action of said resiliently urging means, and means responsive to the passage of a solid object through said bore for moving said engaging and holding means out of engagement with said sampling tube whereby said resiliently urging means moves said sampling tube out of said first position towards said second position.

2. Apparatus for obtaining samples of the formation in a well bore comprising a drill collar having an internal bore extending throughout the length of said collar, said collar also having a groove extending longitudinally in the outer surface of said collar, a hollow and open ended sampling tube mounted at its closed end on a pivotal axis in said groove, means for resiliently urging said tube about its pivotal axis from a first position lying along said groove outwardly away from said collar and said groove to a second position in said groove opposite from said first position, whereby the open end of said tube in moving from said first position to said second position passes through an arc beyond the outer surface of said collar, a hollow cylinder slidably mounted in said groove and engaging in telescoping relation the outer open end of said sampling tube for retaining said tube in said first position, ratchet means including a plurality of ratchet teeth connected to said hollow cylinder for advancing said hollow cylinder step-wise in a direction away from said sampling tube, and a lever pivotally mounted within said collar, said lever having a first arm projecting into the bore of said drill collar, said lever having a second arm projecting into said groove, a pawl mounted on said second arm of said lever and engageable with individual teeth of said ratchet means for actuating said ratchet means, whereby, upon successive actuation of said lever, said pawl is moved successively from one tooth to the next adjacent tooth of said ratchet means and said hollow cylinder is moved step-wise until said hollow cylinder is out of telescopic engagement with said tube and said tube is released from said first position under the action of said urging means.

3. A sampling apparatus as set forth in claim 2 wherein a plurality of drill collars are arranged in series, each drill collar having therein all of the elements recited in claim 2 but wherein the ratchets and pawls of all of the drill collars are adjusted in different positions relative to each other and, thus, to the release of their respective sampling tubes.

4. Apparatus for obtaining samples from the wall of

a well bore comprising a drill collar containing a central bore therethrough and having an elongated groove in the outer surface extending parallel with the longitudinal axis thereof, an open-ended sampling tube mounted at its closed end on a pivotal axis in said groove, means for resiliently urging said sampling tube about its pivotal axis from a first position lying along said groove outwardly away from said collar and said groove to a second position lying along said groove in a direction opposite to that of said first position, whereby the open end of said tube in moving from said first position to said second position passes through an arc beyond the outer surface of said collar, a hollow open-ended cylinder slidably mounted in said groove and having its open end engaging in telescoping relation the open end of said sampling tube, a rod secured at one end to said hollow cylinder and extending longitudinally of said groove, means connected between one end of said groove and the other end of said rod for urging said cylinder resiliently towards said sampling tube, a plurality of ratchet teeth on said rod, a first pawl pivotally mounted on a fixed support within said groove and engaging said ratchet teeth, resilient means mounted within said groove and bearing against said first pawl so as to urge said first pawl resiliently into engagement with said ratchet teeth, a slidable bar mounted within said groove, a second pawl pivotally mounted at the end of said slidable bar, means mounted within said groove and bearing against said second pawl for resiliently urging said second pawl into engagement with said ratchet teeth, a lever pivotally mounted within said groove and having an arm engaging the slidable rod, means for resiliently urging said slidable rod in a direction towards said cylinder, said lever also having an elongated arm extending through the wall of the drill collar and into the internal bore thereof, whereby, when the elongated arm of the lever is actuated by the passage of a solid object through the internal bore of the drill collar, said solid object deflecting said elongated arm of said lever towards the inner wall of said central bore in passing thereby, the slidable bar and the second pawl are urged in a direction to move the hollow cylinder away from said sampling tube and whereby, immediately thereafter, said first pawl engages another tooth of said ratchet teeth so as to maintain the hollow cylinder in the position to which it was immediately moved by the last actuation of the elongated arm of said lever.

5. The improvement as set forth in claim 4 including a sealed and evacuated container mounted internally of said sampling tube, a narrow frangible tube extending within said container from a point adjacent the lower end of said sampling tube outwardly beyond said container, said frangible tube having a turned and breakable tip at the outer end thereof.

6. Apparatus for obtaining samples from the wall of a well bore comprising a drill collar containing a central bore therethrough and having an elongated groove in its outer surface extending parallel with the longitudinal axis of said drill collar, a support pivotally mounted on a pivotal axis within said groove, an open-ended sampling tube threadedly received at its closed end in said pivotal support, means for resiliently urging said pivotal support about its pivotal axis for moving said sampling tube from a first position lying along said groove outwardly away from said collar and said groove to a second position lying along said groove in a direction opposite from that of said first position, whereby the open end of said tube in moving from said first position to said second position passes through an arc beyond the outer surface of said collar, a hollow open-ended cylinder slidably mounted in said groove and having its open end engaging in telescoping relation the open end of said sampling tube, a rod secured at one end to said hollow cylinder and extending longitudinally of said groove, spring means engaging one end of said groove and the other end of said rod for urging said cylinder resiliently towards said sampling tube, a plurality of ratchet teeth on said rod, a first pawl pivotally mounted on a fixed support within said groove, means mounted within said groove and bearing against said first pawl for urging said first pawl resiliently into engagement with said ratchet teeth of said ratchet, a slidable bar mounted within said groove, a second pawl pivotally mounted at the end of said slidable bar, means mounted within said groove and bearing against said second pawl and urging said second pawl resiliently into engagement with said ratchet teeth, a lever pivotally mounted within said groove and having an arm engaging the slidable rod, means for resiliently urging said slidable rod in a direction towards said cylinder, said lever also having an elongated arm extending through the wall of the drill collar and into the internal bore thereof, whereby, when the elongated arm of the lever is actuated by the passage of a solid object through the internal bore of the drill collar, said solid object deflecting said elongated arm of said lever towards the inner wall of said central bore in passing thereby, the slidable bar and the second pawl are urged in a direction to move the rod and the hollow cylinder away from said sampling tube and whereby, immediately thereafter, said first pawl engages a different toothed portion of said ratchet teeth so as to maintain the hollow cylinder in the position to which it was immediately moved by the last actuation of said elongated arm of said lever.

7. The improvement as set forth in claim 6 including a sealed and evacuated container mounted internally of said sampling tube, a narrow frangible tube extending within said container from a point adjacent the lower end of said sampling tube outwardly beyond said container, said frangible tube having a turned and breakable tip at the outer end thereof.

8. Apparatus for obtaining samples from the wall of a well bore comprising a plurality of drill collars connected in series, each drill collar containing a central bore therethrough and having an elongated groove in its outer surface extending parallel with the longitudinal axis thereof, a support pivotally mounted on a pivotal axis within each groove, an open-ended sampling tube threadedly received at its closed end in each pivotal support, means for resiliently urging each pivotal support about its pivotal axis for moving each sampling tube from a first position lying along its corresponding groove outwardly away from said collar and said groove to a second position in a direction opposite to that of said first position, whereby the open end of said tube in moving from said first position to said second position passes through an arc beyond the outer surface of said collar, a hollow open-ended cylinder slidably mounted in each groove and having its open end engaging in telescoping relation the open end of the corresponding sampling tube, a rod secured at one end to each hollow cylinder and extending longitudinally of each groove, spring means connected between one end of each groove and the other end of each rod for urging each cylinder resiliently towards each sampling tube, a plurality of ratchet teeth on each rod, a first pawl pivotally mounted on a fixed support within each groove, means mounted within each groove and bearing against each first pawl for urging each first pawl resiliently into engagement with each plurality of ratchet teeth, a slidable bar mounted within each groove, a second pawl pivotally mounted at the end of each slidable bar, means mounted within each groove and bearing against each second pawl for urging each second pawl resiliently into engagement with each plurality of ratchet teeth, a lever pivotally mounted within each groove and having an arm engaging each slidable rod, means for resiliently urging each slidable rod in a direction towards each cylinder, each lever having an elongated arm extending through the wall of its corresponding drill collar and into the internal bore thereof, whereby when the elongated arm of each lever is actuated by the passage of a solid object through the internal bore of its corresponding drill collar,

said solid object deflecting said elongated arm of said lever towards the inner wall of said central bore in passing thereby, each slidable bar and second pawl are urged in a direction to move each hollow cylinder away from each sampling tube and whereby, immediately thereafter, each first pawl engages another portion of each plurality of ratchet teeth so as to maintain each hollow cylinder in the position to which it was immediately moved by the last actuation of the elongated arm of its corresponding lever, the first pawl in each drill collar engaging a different portion of its corresponding plurality of ratchet teeth with respect to the first pawls of the other drill collars.

9. The improvement as set forth in claim 8 including a sealed and evacuated container mounted internally of each sampling tube, a narrow frangible tube extending within each cotnainer from a point adjacent the lower end of each sampling tube outwardly beyond each container, each frangible tube having a turned and breakable tip at the outer end thereof.

10. Apparatus for obtaining samples from the wall of a well bore comprising a drill collar containing a central bore therethrough and having an elongated groove in its outer surface extending parallel with the longitudinal axis thereof, a support pivotally mounted on a pivotal axis within said groove, an open-ended sampling tube threadedly received at its closed end in said pivotal support, means for resiliently urging said pivotal support about its pivotal axis for moving said sampling tube from a first position lying along said groove outwardly away from said collar and said groove to a second position lying along said groove in a direction opposite from that of said first position, whereby the open end of said tube in moving from said first position to said second position passes through an arc beyond the outer surface of said collar, a hollow open-ended cylinder slidably mounted in said groove and having its open end engaging in telescoping relation the open end of said sampling tube, a rod secured at one end to said hollow cylinder and extending longitudinally of said groove, spring means engaging one end of said groove and the other end of said rod for urging said cylinder resiliently toward said sampling tube, a plurality of ratchet teeth on said rod, a first pawl

pivotally mounted on a fixed support within said groove, means mounted within said groove and bearing against said first pawl and urging first said pawl resiliently into engagement with said ratchet teeth, a slidable bar mounted within said groove, a second pawl pivotally mounted at the end of said slidable bar, means mounted within said groove and bearing against said second pawl for urging said second pawl resiliently into engagement with said ratchet teeth, a lever pivotally mounted within said groove and having an arm engaging the slidable rod, means for resiliently urging said slidable rod in a direction towards said cylinder, said lever also having an elongated arm extending through the wall of the drill collar and into the internal bore thereof, whereby, when the elongated arm of the lever is actuated by the passage of a solid object through the internal bore of the drill collar, said solid object deflecting said elongated arm of said lever towards the inner wall of said central bore in passing thereby, the slidable bar and the second pawl are urged in a direction to move the rod and the hollow cylinder away from said sampling tube and whereby, immediately thereafter, said first pawl engages a different tooth of said ratchet teeth so as to maintain the hollow cylinder in the position to which it was immediately moved by the last actuation of said elongated arm or said lever, and a spring urged latch mounted at the other end of said groove for engaging and holding the outer end of said sampling tube when said tube is moved to said second position.

11. The improvement as set forth in claim 10 including a sealed and evacuated container mounted internally of said sampling tube, a narrow frangible tube extending within said container from a point adjacent the lower end of said sampling tube outwardly beyond said container, said frangible tube having a turned and breakable tip at the outer end thereof.

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