Nov. 26, 1940. G. A. HUMASON ET AL 2,222,829

WELL TESTER

Filed Feb. 4, 1938 2 Sheets-Sheet 1

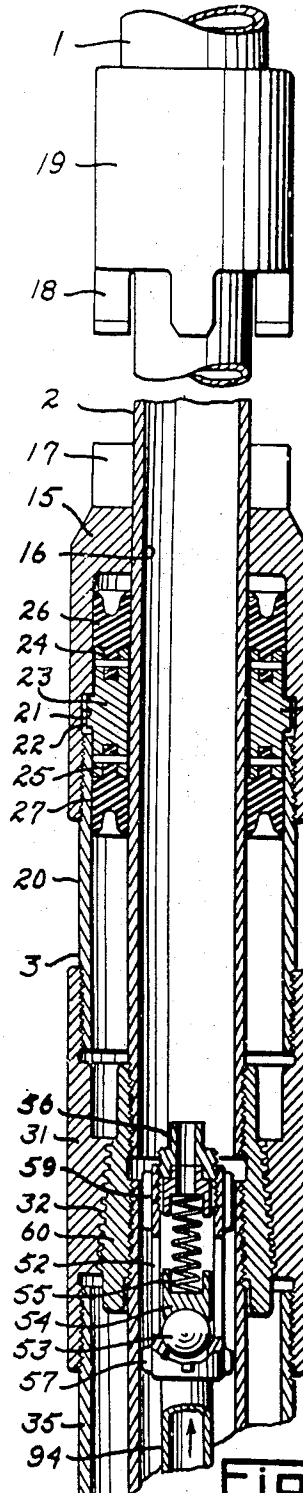

Fig. 1.

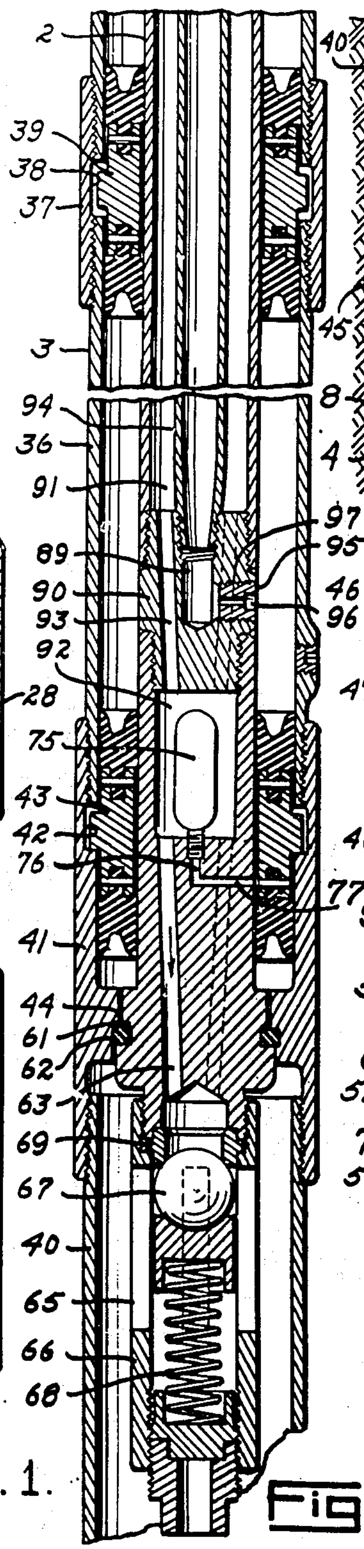

Fig. 2.

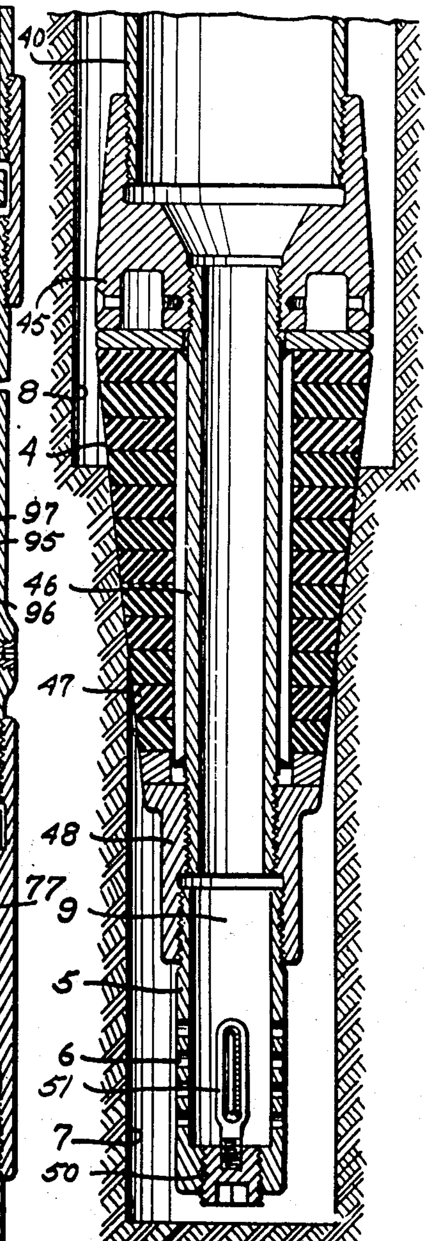

Fig. 3.

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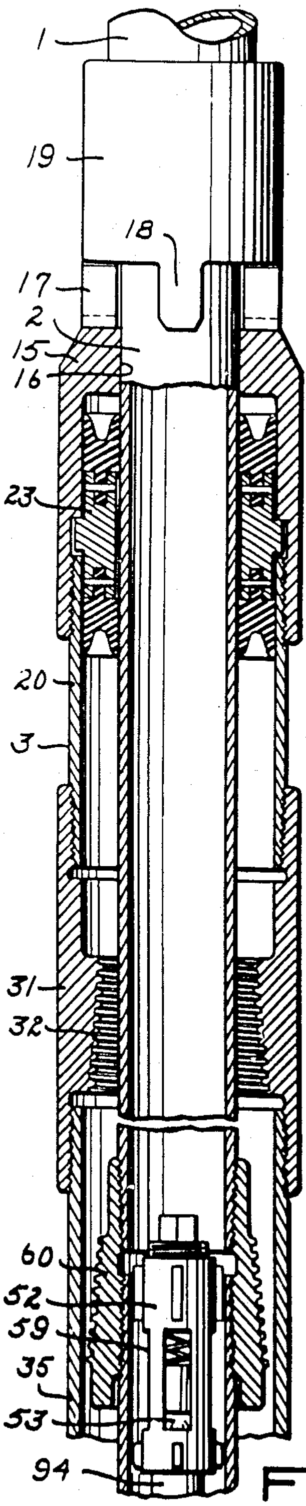

Fig. 4.

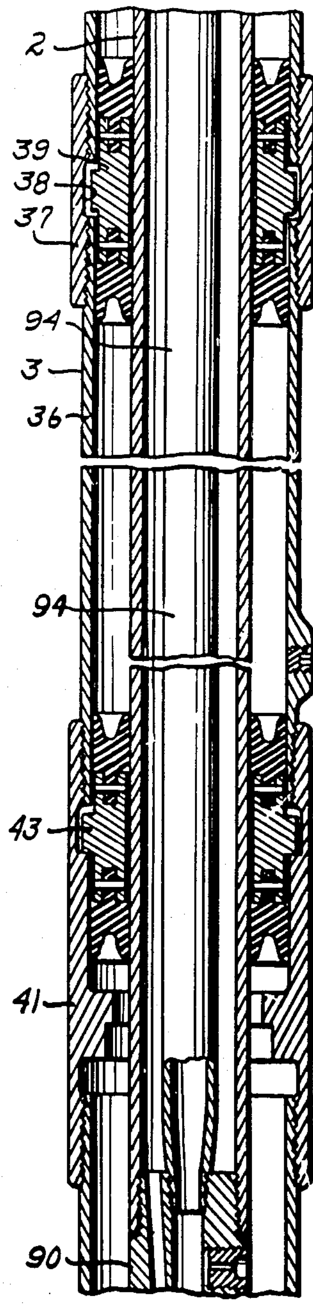

Fig. 5.

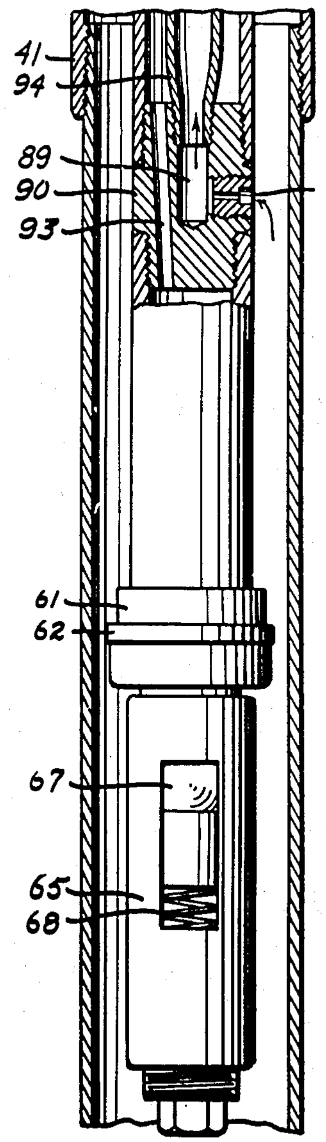

Fig. 6.

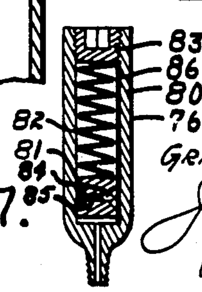

Fig. 7.

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2,222,829

WELL TESTER

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Application February 4, 1938, Serial No. 188,625

8 Claims. (Cl. 166—1)

The invention relates to a well sampling device for obtaining a sample of fluid at a desired level within an oil well, together with information of the temperature and pressure conditions at the level of sampling.

An object of the invention is to provide a device of the class described having few working parts to get out of order and a device which is easy to construct and operate.

Another object is the provision of a device for obtaining uncontaminated fluid sample from within the well bore and at the same time will permit fluid to be pumped downwardly into the well to assist in releasing and lifting the device from the well.

Another object is to provide a sample taking device in which the essential moving parts of the device are surrounded by a lubricant.

Still another object is the provision of a device for obtaining a sample in an oil well together with information of the maximum temperature and pressure at the level of sampling, the device being so constructed that the pressure indication will not be affected by pumping pressure which may be applied after the sample has been taken.

Other objects together with the foregoing will be apparent from the following description taken in connection with the drawings in which:

Fig. 1 is a vertical section through the upper portion of the device of the invention.

Fig. 2 is a vertical section comprising a continuation of the view shown in Fig. 1.

Fig. 3 is a continuation of the view shown in Fig. 2 and shows the lower end of the device in position within a rat hole at the bottom of a well bore.

Figs. 4 and 5 are successive sectional views of the device showing the relative positions of parts when a sample is being taken.

Fig. 6 is an elevation partly in section comprising a continuation of the view shown in Fig. 5.

Fig. 7 is a sectional view of a maximum pressure gauge comprising an element of the invention.

Referring more particularly to the drawings the device is shown as connected to a tubing string 1 and comprising essentially a composite stem structure 2 surrounded by a tubular casing 3 having a rat hole packer 4 secured to the lower end thereof. A tubular extension 5 on the packer 4 is provided with perforations 6 whereby liquid within the rat hole 7 at the bottom of a well bore 8 may enter the axial bore 9 within the packer 4.

A head 15 at the upper end of the casing 3 is provided with a central opening 16 and upwardly extending jaws 17 which are adapted to cooperate with complementary jaws 18 on a coupling 19 which interconnects the tubing string 1 and the stem 2. A nipple 20 is threadedly connected to the lower end of the head 15 in a manner to provide an internal annular groove 21 to receive an annular flange 22 on a ring 23. This ring has upwardly and downwardly facing annular grooves 24 and 25 within which seal rings 26 and 27 are secured whereby a sealing unit generally designated as 28 is provided between the casing 3 and the stem 2.

A coupling 31 is attached to the lower end of the nipple 20 and has a reduced central section provided with threads 32 by means of which a releasable connection is effected between the casing 3 and the stem 2, as will be further described.

Tubular sections 35 and 36 extend downwardly from the coupling 31 and are interconnected by means of coupling 37 to provide an annular internal groove 38 whereby a sealing unit 39 similar to the sealing unit 28, above described, is fixed in spaced relation with the sealing unit 28.

The packer 4 is secured to the lower end of the casing 2 through a tubular section 40 connected to the casing structure just described by means of a special coupling 41. This coupling and the tubular section 36 likewise provide an internal annular groove 42 by means of which a third sealing unit 43 similar to that above described is secured within the annular space between the casing 3 and the stem 2. The coupling 41 has a central reduced cross section at 44 to serve a purpose that will be described.

The tubular section 40 of the casing 3 is threadably connected to the head 45 of the rat hole packer 4 which includes a downwardly extending mandrel 46 surrounded by packing discs 47 of decreasing diameter whereby a tapered packer is provided. The packing discs 47 are held in assembled relation by means of a flange nut 48 to which the tubular extension 5 is attached.

A threaded opening in the lower end of the tubular extension 5 receives a plug 50 bearing a maximum temperature indicating device 51. It is believed obvious that with this construction the temperature indicating device 51 will provide an indication of the maximum temperature of the fluid which enters the bore 9 through openings 6 in the extension 5.

The stem 2 passes through the opening 16 in the head 15 and has a special coupling 60 intermediate its ends. This coupling is provided with peripheral threads which are adapted to releasably engage the threads 32 on the coupling 31 whereby the stem 2 may be held in fixed relation with the casing 3.

The stem 2 terminates at its lower end in an enlarged head 61 having a packing ring 62 to seal between the head 61 and the reduced section 44 of the coupling 41. Vertical passage ways 63 about the axis of the head 61 permit movement of fluid downwardly through the head to a downwardly opening valve 65. This valve comprises a cage 66 within which a ball valve 67 is resiliently urged upwardly against a seat 69 by means of a spring 68. This construction closes the passage into the stem 2 against inward flow of fluid. The tension on the spring 68 may be adjusted so that a valve will open downwardly when a predetermined pressure within the stem is reached.

The head 61 is also provided with an axial opening 76 into which a maximum pressure indicating device 75 is threadably secured. A radial port 77 connects the axial opening 75 with the periphery of the stem intermediate the sealing rings on the assembly 42 when the device is being lowered to sample taking position as shown in Figs. 1 to 3. A maximum pressure gauge of any type may be used, one of such gauges being illustrated in Fig. 7 as comprising a body 80 having therein a piston or plug 81 which is urged downwardly within the body by means of a spring 82 placed under compression by plug 83 screwed into the body 80. The piston 81 is provided with a stylus or other recording element 84 which is urged sidewardly under the influence of spring 85 to contact with the recording strip 86. By means of this construction a mark will be inscribed upon the strip 86 which can subsequently be removed, the height of the record produced upon the strip indicating the maximum pressure to which the gauge was subjected during the sample taking operation.

A plug 90 within the stem 2 divides the stem into upper and lower chambers 91 and 92. This plug is provided with longitudinal passages 93 about its axis so that fluid may flow from chamber 91 to chamber 92. An axial opening 89 in the plug 90 is threaded to receive the lower end of the sample tube 94 which extends upwardly within the stem 2 and is provided with a relief valve 59 at its upper end. A radial opening 97 extends from the hole 89 to the exterior of the stem 2 and is provided with a removable plug 95 having an orifice 96 therein whereby liquid may be admitted to the interior of the sample chamber 94 in a manner that will be further brought out in the description of the operation of the device.

The relief valve 59 comprises a cage 52 within which a ball valve 53 is engaged by a plug 54 urged downwardly by means of compression spring 55 adjustably positioned within the cage by the plug 56. The cage 52 is provided with a plurality of ears 57 extending radially therefrom serving to keep the sample chamber centered within the stem 2.

It is to be noted that the device described may be of any desired length and that while the device is shown as provided with a rat hole packer for taking samples within the rat hole in the bottom of a well bore, the invention is not confined thereto but the device may be provided with other types of packer or wall eng··ing devices to obtain a sample at any level within a well bore.

When using the construction illustrated, the device is lowered within the well bore until the packer 4 is seated within the rat hole 7 preliminary to the taking of a sample of liquid within the rat hole and below the packer. When the device is so positioned the liquid within the rat hole contacts the maximum temperature indicating device 51 and sufficient time will elapse during the taking of a sample that the temperature indicator will reach the temperature of the surrounding liquid.

In order to obtain an indication of bottom hole pressure and to obtain the desired sample of liquid, the tubing string 1 is rotated to release the threaded connection between the stem 2 and the casing 3. When this connection is released the stem is moved downwardly whereupon the sealing ring 62 will move from engagement between the head 61 and the coupling 41 and fluid under bottom hole pressure will be admitted to the maximum pressure indicator 76. Continued downward movement of the stem 2 will cause the orificed plug 95 to move below the sealing unit 43 whereupon fluid will move upwardly from within the rat hole into the sample chamber at a rate determined by the dimensions of the orifice 96.

As is clearly shown in Fig. 4, when the device is actuated for taking a sample, the collar 19 on the tubing 1 moves downwardly until the jaws 18 thereon engage the complementary jaws 17 on the upper end of the casing 3. Hence if necessary the entire unit may be rotated through the tubing 1 preliminary to lifting the device from sample taking position. Normally, however, the tubing string may be lifted without such rotation whereby the passage 77 to the pressure gauge 75 and the orifice 96 leading to the sample chamber 94 will be closed off from the well liquid as the stem 2 moves upwardly within the casing 3 until the ring 62 makes sealing engagement within the reduced section 44. In order to release the device from its setting within the rat hole, suitable drilling fluid may be pumped downwardly through the tubing string 1. It is to be noted that any pressure exerted by this pumping cannot affect the pressure reading on the gauge 75 since the passage 77 leading to the gauge is closed when the stem 2 is drawn upwardly within the surrounding casing. Furthermore as the bottom hole temperature is higher than the temperature of fluid that will be pumped into the well, the reading of the maximum temperature indicating device 51 will not be changed by this procedure.

What is claimed is:

1. A sampling device for oil wells for connection between a packer and a string of pipe, comprising a stem attached to said string, a casing surrounding said stem, spaced seals between the stem and casing, a connection between the stem and casing releasable by operation of the string whereby the stem may move longitudinally of the casing, a separate receiving chamber and a maximum pressure indicator within said stem, and an outwardly opening port through the stem from each said chamber and said indicator, whereby passages to the chamber and indicator are opened by downward movement of the stem within the casing.

2. A sampling device comprising a casing, a packer on the lower end of said casing to seal with the surrounding walls in a well bore, a tubing string, a stem within said casing and connected to the tubing string, spaced seals between said stem and casing to form a lubricant chamber within the casing, a threaded connection between the stem and casing whereby the stem may be released for movement longitudinally of the casing, and a sample receiving chamber within the stem and in spaced relation with the walls thereof so that fluid may be pumped downwardly past said chamber, said chamber having an outwardly opening port whereby a passage to the chamber is opened when the stem is moved longitudinally of the casing.

3. A sampling device comprising a casing, a packer on said casing to seal with the surrounding walls of a well bore, a stem within said casing, spaced seals between said stem and casing, a releasable connection between the stem and casing intermediate said seals, and a separate sample receiving chamber within said stem so that fluid may be circulated downwardly past said chamber, there being a passage from the exterior of the stem to said chamber whereby fluid is admitted to the chamber when the stem is moved downwardly within the casing.

4. A well sampling device comprising a tubular casing, a stem movable longitudinally within said casing, spaced sealing means between said stem and casing, a sample chamber within said stem, said chamber having a port adapted to be valved to admit fluid thereto by movement of the stem relative to the casing, and separate passages downwardly within said stem past the chamber whereby circulating fluid may be pumped downwardly through the stem.

5. A well sampling device comprising a tubing string, a stem attached to the lower end of said string, a casing surrounding said stem and releasably connected thereto, spaced seals between said stem and casing, a cylindrical sample chamber within said stem, a second chamber within the stem, a maximum pressure indicator in said second chamber, and a port leading from each said chamber and indicator to the exterior of the stem between the seals whereby fluid is admitted to the chambers and admit fluid when the stem is moved longitudinally of the casing.

6. A device of the class described comprising a sample chamber, a stem surrounding said chamber and in spaced relation therewith, there being a passage from the interior of the chamber to the exterior of the stem, a casing surrounding said stem, a slidable connection between the casing and stem, and seals between said stem and casing above and below said passage.

7. In a device of the class described, a sample chamber, a stem surrounding said chamber, a passage from said chamber to the exterior of said stem, a downwardly opening valve at the lower end of the stem, a casing surrounding the stem and releasably connected thereto so that the stem may move longitudinally relative to the casing and spaced seals between the stem and casing whereby fluid may be admitted to the sample chamber when the passage from the chamber moves from between the seals.

8. A sampling device comprising a casing, means for fixing the position of the casing within a well bore, a stem movably mounted within said casing, maximum temperature indicating means mounted within said device, whereby the maximum temperature of fluid surrounding the device will be registered thereon, a sample chamber within the stem, there being a passage through the stem past said chamber, and means for admitting fluid to said chamber after the device is positioned within the well bore.

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