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(54) **DEVICE FOR CUTTING SLOT-SHAPED SEATS IN WELLS BY HYDRO-SANDBLASTING METHOD**

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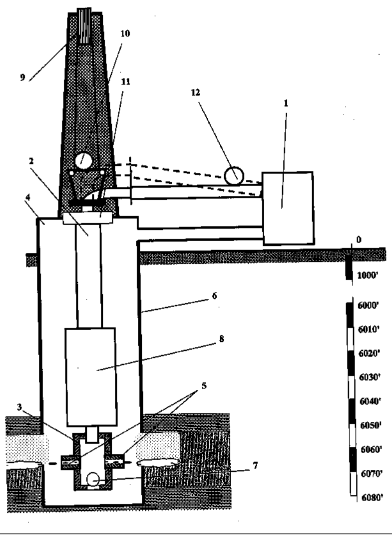
(57) **ABSTRACT**

This device relates to the fields of mining, specifically oil and gas industry, hydro-geological, geological engineering and water supply industries and is intended for cutting slot-shaped seats in well side zones of producing formation by hydro-abrasive blast. The determined task is solved by introducing essential changes into the known device for construction of cutting slot-shaped seats from the well wall inside the rock consisting of the hydro-abrasive jet generator connected with the perforator through the pump-and-compressor tubing string; the perforator is put into the casing pipe and has two diametrical nozzles which are directed at the well wall; there is a ball valve at the perforator end, as well as devices for adjustable partial unloading of PCS, PCS weight measuring device, abrasive jet pressure measuring device and the sealer for sealing of wellhead. The changes are as follows:—The perforator is directly connected with PCS;—A pin mounted under the perforator with possible axial movements is introduced;—A cylindrical retainer washer is put on the upper part of the perforator above nozzles; the washer is fixed so as to permit axial movement;—PCS indexing mechanism, step rings and a tripping muff are mounted bottom up and in alignment on the lower tube of PCS which is in series connected with the perforator;—At the same time the pin is connected with the cylindrical washer situated on the upper part of the perforator by control-rods with possible axial movement;—The indexing mechanism is put on PCS with the possibility of fixed coupling of its body with the casing pipe wall and split engagement of its body by step rings. Step rings are to be rigidly fixed on the lower PCS tube, and the tripping muff-on the PPS with its skirt down. At least a couple of rotary fluke-claws, with one end of each hingedly connected with the body of indexing mechanism, and the other end clasped to the casing pipe wall by spacer springs mounted between the indexing mechanism body and the fluke-flaw end, can be a variant of engagement of the indexing mechanism body with the casing pipe wall. At least a couple of spring-mounted pins installed on the interior surface of the indexing device body can be a variant of split engagement of the indexing mechanism by step rings. At that the pin heads are of round shape at the contacting end set against PCS. A muff with conical inside surface and the exterior of streamlined form can be a variant of tripping muff for forced tripping of the indexing mechanism from the casing pipe wall. The optimum distance between the step rings equals to one drain port diameter D±5%, and the number of rings has to amount to prescribed length of the slot-shaped seat divided by the drain port diameter D. At the same time adjacent drainage canals will unite and form a single slot-shaped seat. The recommended force for coupling of the split pin heads with PCS lies within the limits of 10-20% of PCS weight. The recommended force for coupling of the indexing device body with the casing pipe wall is in the range from 30% of PCS weight up to breaking strength point of the casing pipe.



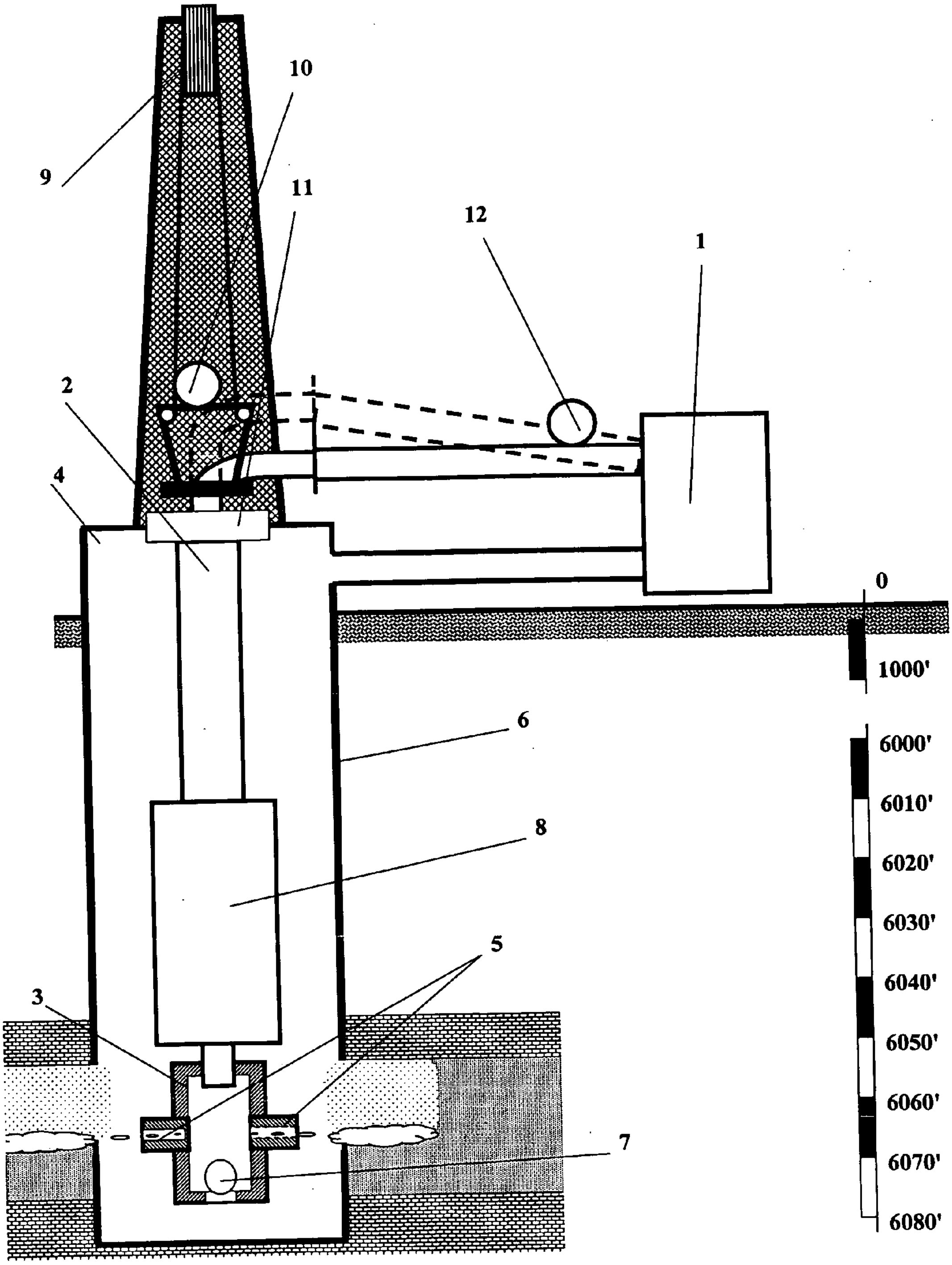

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Figure 1

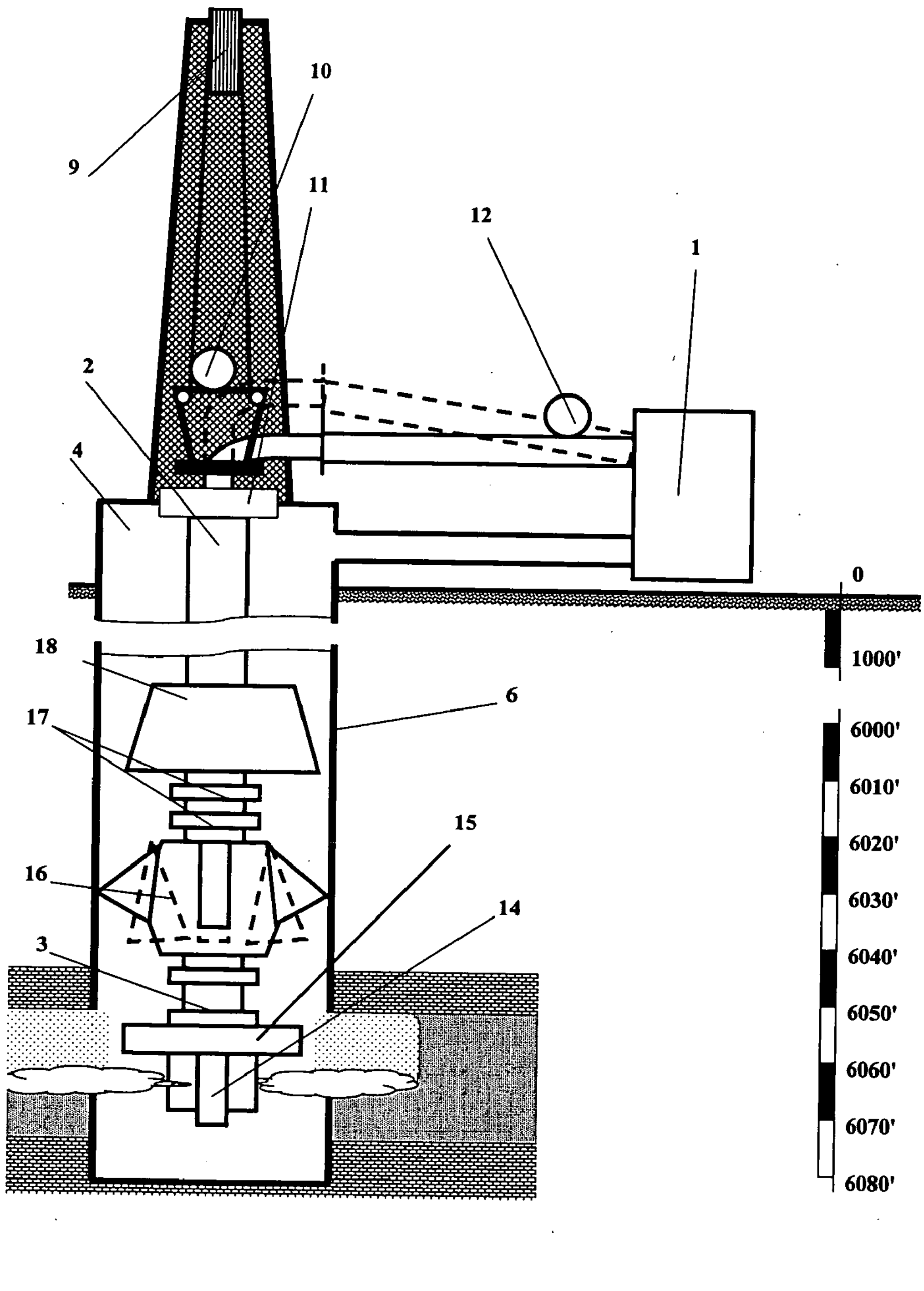
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Figure 2

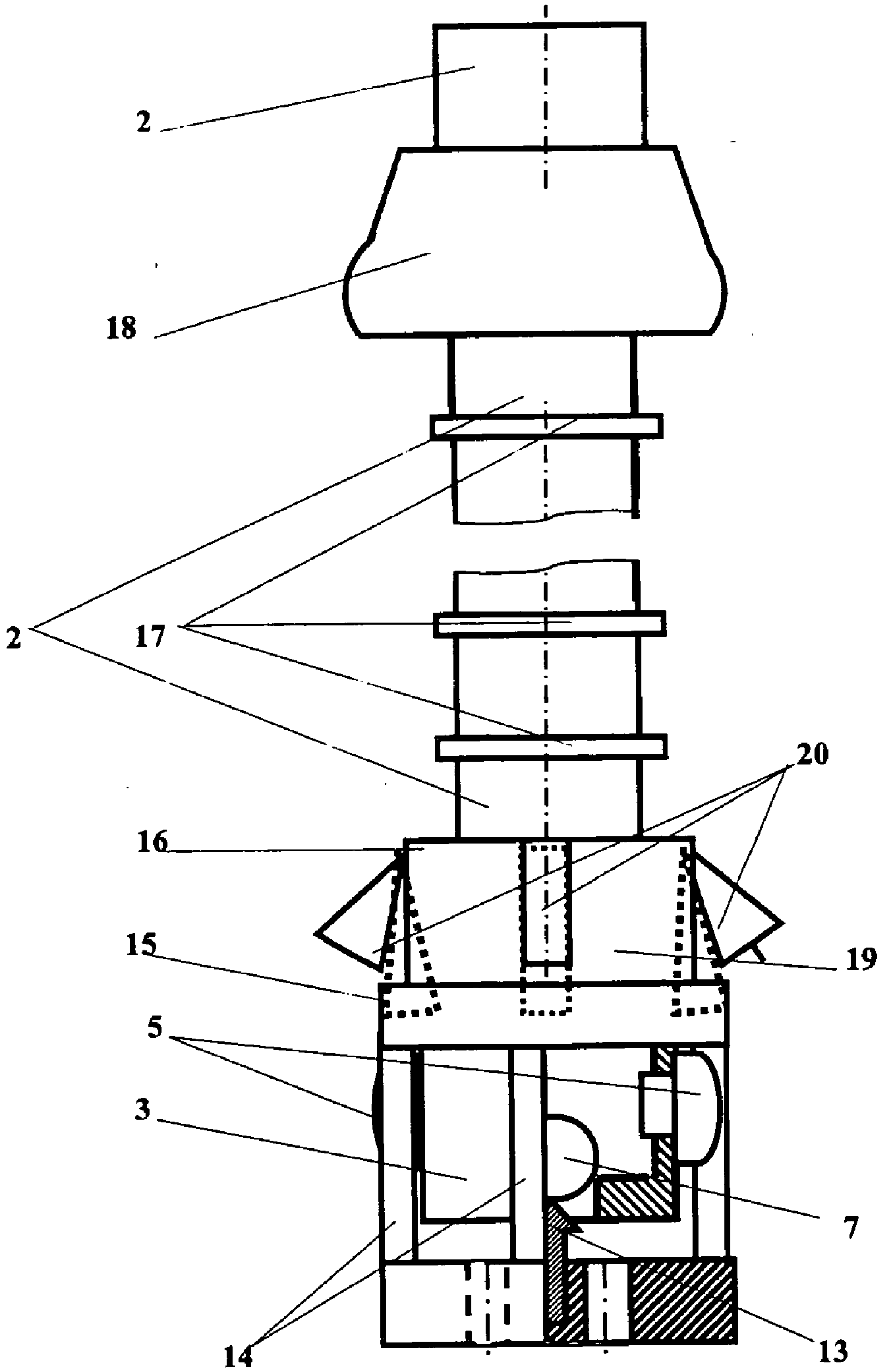

Figure 3

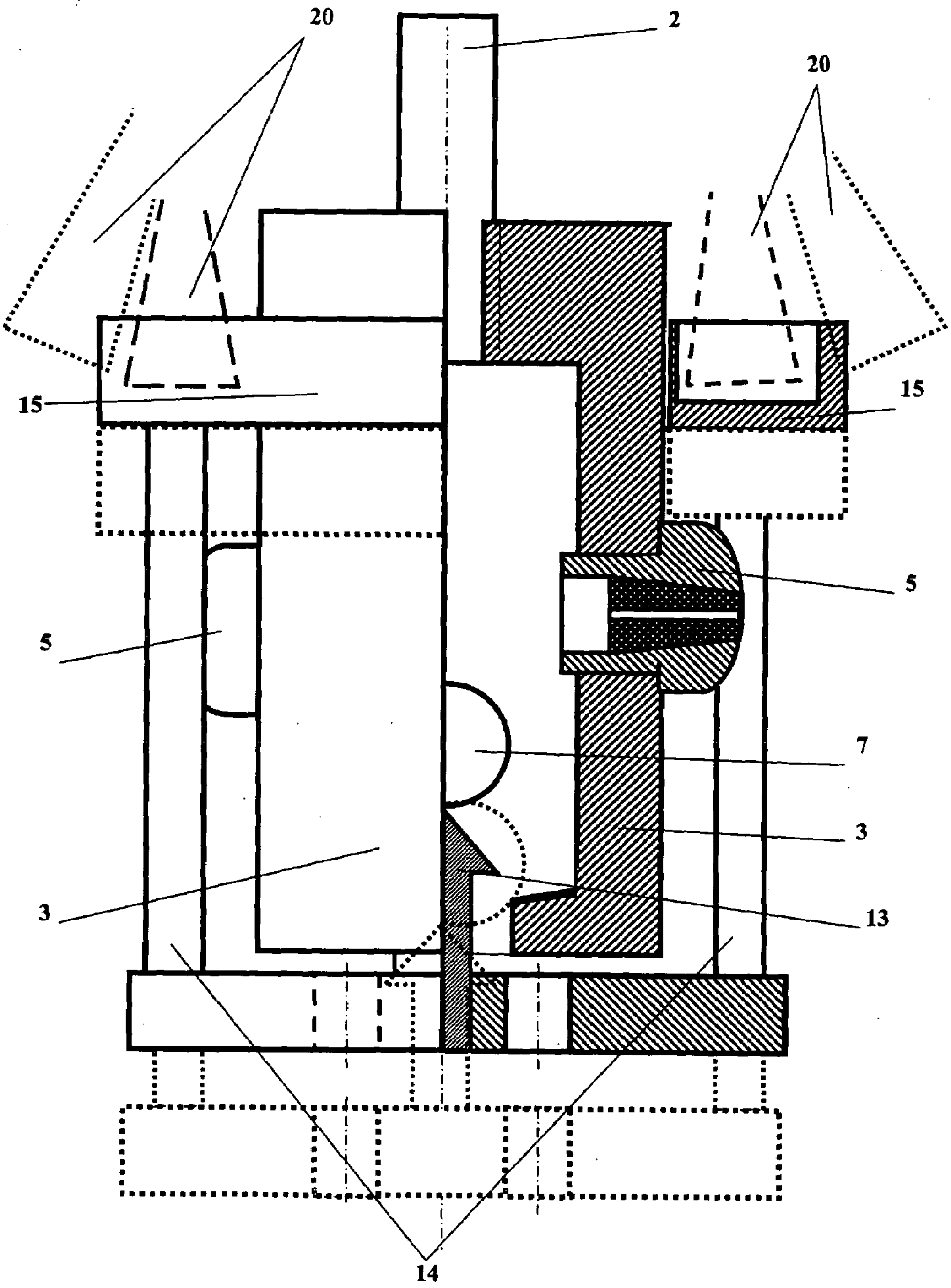

Figure 4

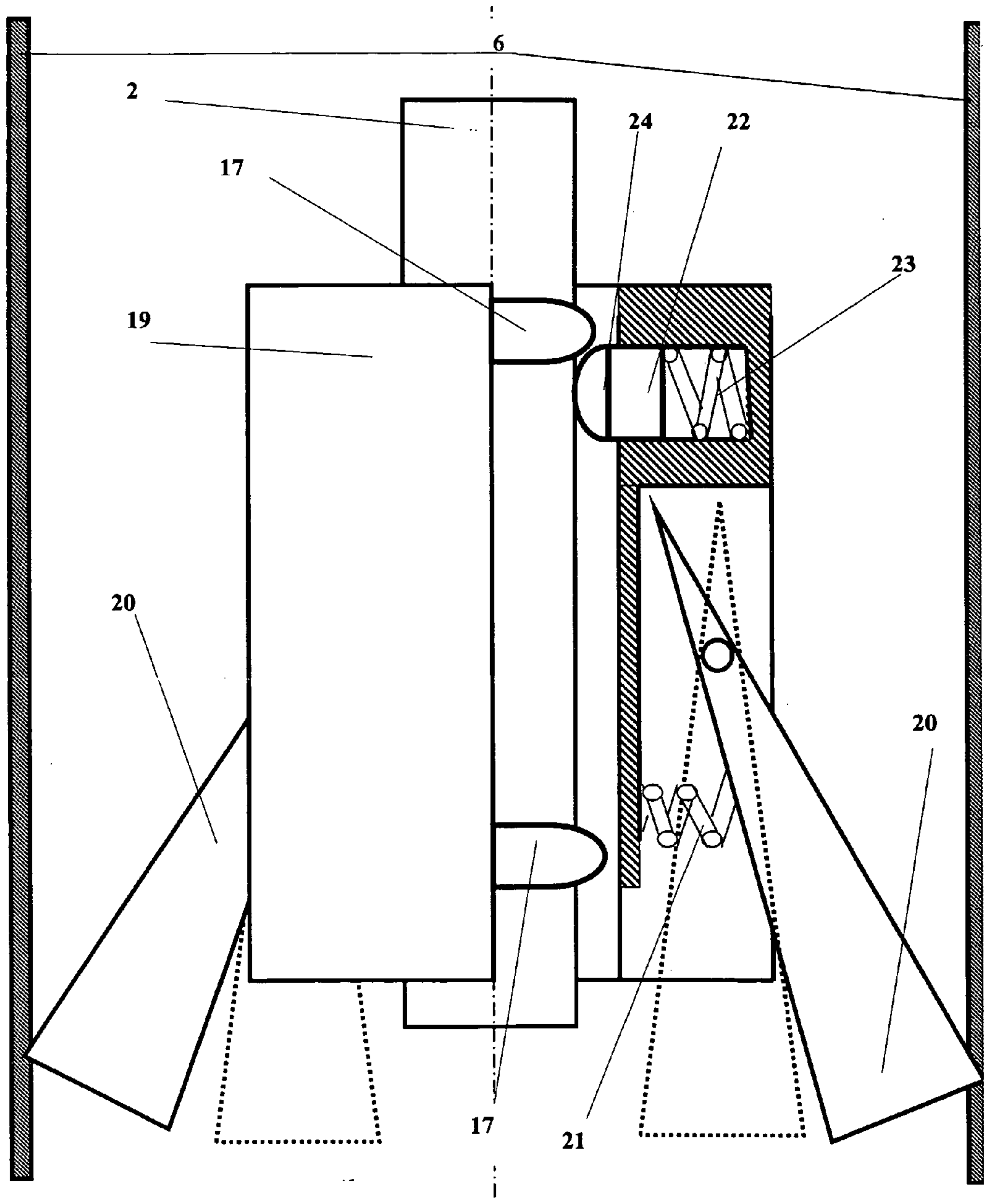

Figure 5

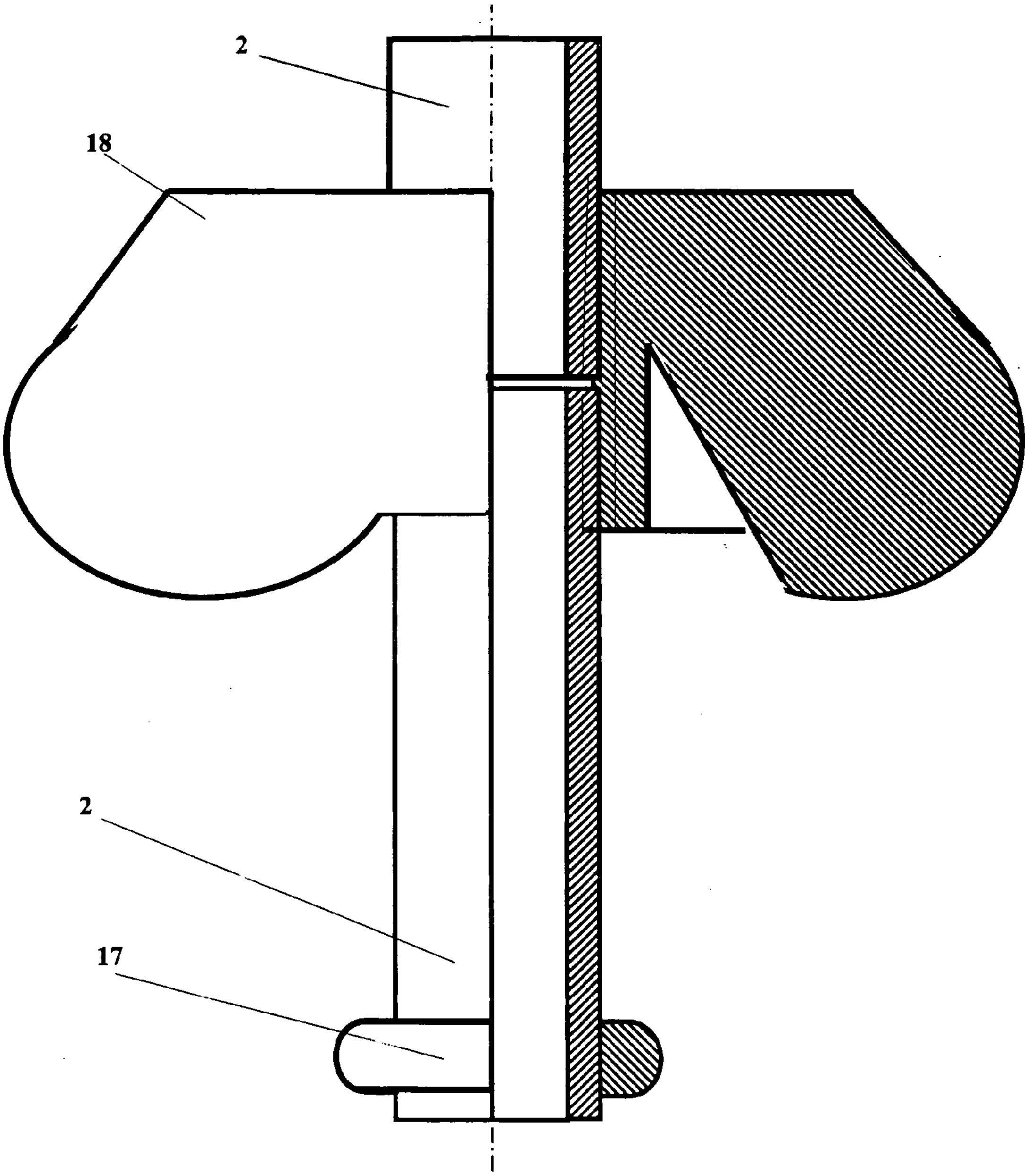

Figure 6

DEVICE FOR CUTTING SLOT-SHAPED SEATS IN WELLS BY HYDRO-SANDBLASTING METHOD

FIELD OF THE INVENTION

[0001] This invention relates to the fields of mining, specifically oil and gas industry, hydro-geological, geological engineering and water supply industries and is intended for cutting slot-shaped seats in well side zones of producing formation by hydro-abrasive blast.

BACKGROUND OF THE INVENTION

[0002] Slot unloading of well side zones of producing formations is known as one of the most effective methods of enhancement of efficiency (productivity) of oil, gas, pumping, hydro-geological, geological engineering and water supply wells. This method provides for construction of slots in a well side zone which width, depth and orientation are predefined by known methods according to characteristics of the well and producing formation (e.g., see Reference bibliography in the end of the application). Practical cutting of slots with desired parameters is quite difficult technical task as it is performed in complex conditions of different rocks and temperatures, at great depths, in the presence of extractive product and/or washing fluids and with remote control only. One of the most successful methods of slot cutting is hydro-abrasive perforation when cutting is performed by fluid jet and sand at high pressure. For outlined devices used in this method see FIG. **1**.

[0003] Effective examples of such devices are described in e.g., USSR, author's certificate #1031263, Russian Federation patent #2,074,957; Reference book on oil production, M, "Nedra". 1974; Instructions on slot unloading of well side zone, VNIMI, Minugleprom, L, 1987; U.S. Pat. No. 6,651,741 and U.S. application Ser. No. 10/957,871 of Apr. 10, 2004).

[0004] A device which is technically the closest to the claimed one was generally described in U.S. Pat. No. 6,651,741 of Nov. 25, 2003 and is selected as a prototype.

[0005] They consist of a hydro-sandblast jet generator **1** which is connected with a perforator **3** by a tubing string **2**. The perforator is put into the well inside a casing pipe **4**. The tubing string **2** is formed of series-connected tubing. The perforator **3** has two diametrical nozzles **5**, which are directed to the well wall. A ball valve **7** is mounted at the perforator end. The tubing string **2** is connected with the perforator **3** through a hydro brake with a lead up spring **8**. This connection is complicated in construction and contains waterproof chambers with cross-flow canals for viscous fluid, a piston, pipes connected with each other and the tubing string (hereinafter PCS) by movable and fixed joints.

[0006] Furthermore the above ground part is equipped with standard devices used on oil-rigs and elevator units for well repair: device **9** for partial unloading of PCS, PCS weight measuring device **10** and preventor **11** for sealing of wellhead **4** and pressure measuring device for abrasive jet **12**. Their placing and function are evident from their names.

[0007] The device in FIG. **1** works as follows. The hydro-brake tubular body is connected with PCS **2** by a muff, the second PCS end is connected with the hydro-abrasive jet generator **1** of above-ground equipment. In a laboratory by imitation of bottomhole conditions, the upper chamber of the hydro brake is pre-filled with viscous fluid. Its properties are to be chosen for each cutting based on preset working conditions in the well (temperature, pressure, physical and mechanical properties of the casing pipe and rocks which form producing formation). Setting of the device is performed by selecting parameters of a cross-flow canal which connects chambers of the hydro brake. These parameters are fluidity of viscous fluid, length and diameter of the canal, temperature and pressure which are planned when the device is at work, as well as changes of parameters through temperature, pressure or efficacy of the hydro-abrasive jet.

[0008] Then PCS **2** (with the mounted hydro brake **8**, lead up device, perforator **3** and ball valve **7**) is put into casing pipe **6**. . . at a given depth so as nozzles **5** of perforator **3** turn out to be in the well, where the top edge (roofing) of the cut slot is supposed to be. A small ball is thrown down into the hydro brake internal pipe through PCS **2** (for closing ball valve **7**). The hydro-abrasive jet **1** generator of the above-ground equipment is engaged and it starts injecting abrasive compound into internal pipe of the device at preset (rated) pressure. The compound reaches ball valve **7** and closes it tightly. The perforator **3** through nozzles **5** starts cutting slots, first in walls of casing pipe **6**, and then in well side area. The future slot cutting depth particularly depends on the perforator speed when it is traveling along the casing pipe.

[0009] For detailed description of the device and its work see the above-mentioned sources.

[0010] Let's analyze processes which take place during cutting slot-shaped seats by hydro-abrasive method. The perforator **3** is put into well **4** on PCS **2**. The working perforator travels along the casing pipe at a speed determined by parameters of hydro-brake **8**. It is significant to note that controlling the speed of perforator **3** movement in the process of cutting is technologically impossible. To get information about the end of travel, special signaling devices are applied. It can look like an upward pin mounted under the ball valve **7**. The pin opens the ball valve **7** (i.e. it pushes the small ball out of the ball valve **7** when the perforator **3** travel is completed. This will cause abrupt pressure drop in the tube space (it will open from below) thus informing of the travel completion.

[0011] The described devices have some common shortcomings:

[0012] They are Complicated not Enough Reliable and Stable:

[0013] The design of hydro-brake **8**, its tight and movable joints with PCS **2**, perforator **3** and the wall of casing pipe **6** contains a lot of elements which change their characteristics when in use. Unpredictable stops and changes in cutting depth are unavoidable as the very principle of the hydro-brake in this application is unstable. The main reasons for such stops and changes are the attenuation of viscous fluid flow through the hydro-brake cross-flow canal which can be caused by temperature changes of viscosity and cross-flow canal, canal choking, and changes of the abrasive jet pressure or depressurization of the structure. In case of stop or significant change of perforator travel speed it is necessary to lift face equipment up and recalibrate it. This action is costly and time consuming.

[0014] Not Enough Reliable and Precise Cutting of Seats

[0015] This is over absence of control of cutting depth. Presumably the device works according to preliminary settings. Actual cutting depth can significantly differ from the rated one, for example, because of the jet pressure fluctuation, abrasive composition, thickness and hardness deviation of the casing pipe **4** or rock characteristics. Ordinary cases were reported when on completion of the correctly calculated cutting process it appeared that even the casing pipe is not completely cut.

[0016] Besides, the device which signals about the completion of perforation process is situated under ball valve **7** of perforator **3** and almost bridges the "direct" liquid flow from the perforator end. This prevents cleaning of the well dib hole from accumulated mud and sand.

[0017] In other words, the known devices are complicated, not stable, not reliable and not usable enough.

OBJECTS OF THE INVENTION

[0018] It is an object of the invention to decrease the listed shortcomings, and namely to simplify the device and enhance its convenience, reliability and stability.

TASK SOLUTION (DETAILED DESCRIPTION OF THE INVENTION)

[0019] The determined task is solved by introducing essential changes into the known device for construction of cutting slot-shaped seats from the well wall inside the rock consisting of the hydro-abrasive jet generator connected with the perforator through the tubing string; the perforator is put into the casing pipe and has two diametrical nozzles which are directed at the well wall; there is a ball valve at the perforator end, as well as devices for adjustable partial unloading of PCS, PCS weight measuring device, abrasive jet pressure measuring device and the sealer for sealing of wellhead.

[0020] The changes are as follows:

- **[0021]** The perforator is directly connected with PCS;
- **[0022]** A pin mounted under the perforator with possible axial movements is introduced;
- **[0023]** A cylindrical retainer washer is put on the upper part of the perforator above nozzles; the washer is fixed so as to permit axial movement;
- **[0024]** PCS indexing mechanism, step rings and a tripping muff are mounted bottom up and in alignment on the lower tube of PCS which is in series connected with the perforator;
- **[0025]** At the same time the pin is connected with the cylindrical washer situated on the upper part of the perforator by control-rods with possible axial movement;
- **[0026]** The indexing mechanism is put on PCS with the possibility of fixed coupling of its body with the casing pipe wall and split engagement of its body by step rings. Step rings are to be rigidly fixed on the lower PCS tube, and the tripping muff—on the PPS with its skirt down.

[0027] At least a couple of rotary fluke-claws, with one end of each hingedly connected with the body of indexing mechanism, and the other end clasped to the casing pipe wall by spacer springs mounted between the indexing mechanism body and the fluke-flaw end, can be a variant of engagement of the indexing mechanism body with the casing pipe wall.

[0028] At least a couple of spring-mounted pins installed on the interior surface of the indexing device body can be a variant of split engagement of the indexing mechanism by step rings. At that the pin heads are of round shape at the contacting end set against PCS.

[0029] A muff with conical inside surface and the exterior of streamlined form can be a variant of tripping muff for forced tripping of the indexing mechanism from the casing pipe wall.

[0030] The optimum distance between the step rings equals to one drain port diameter D±5%, and the number of rings has to amount to prescribed length of the slot-shaped seat divided by the drain port diameter D. At the same time adjacent drainage canals will unite and form a single slot-shaped seat.

[0031] The recommended force for coupling of the split pin heads with PCS lies within the limits of 10-20% of PCS weight.

[0032] The recommended force for coupling of the indexing device body with the casing pipe wall is in the range from 30% of PCS weight up to breaking strength point of the casing pipe.

SUMMARY OF THE INVENTION

[0033] The essence of the invention is explained by the following six Figures, and namely:

[0034] FIG. **1**—an example of structure chart of the prototype device;

[0035] FIG. **2**—an example of structure chart of the claimed device;

[0036] FIG. **3**—an example of structure chart of the device subsurface part;

[0037] FIG. **4**—an example of implementation of the pin and the cylindrical retainer washer;

[0038] FIG. **5**—an example of implementation of the indexing (holding) mechanism;

[0039] FIG. **6**—an example of implementation of the tripping muff.

[0040] Accepted notations in the figures are as follows: **1**—hydro-abrasive jet generator, **2**—production pipe string (PPS), **3**—perforator, **4**—casing string, **5**—nozzles, **6**—well, **7**—ball valve, **8**—hydro-brake with the lead up spring, **9**—device for PPS unloading, **10**—weight measuring device (dynamometer), **11**—preventor, **12**—hydro-abrasive jet pressure measuring device (manometer), **13**—recessed pin, **14**—control-rods, **15**—cylindrical retainer washer, **16**—indexing mechanism (holder), **17**—step rings, **18**—tripping muff, **19**—body of indexing mechanism, **20**—fluke-claws, **21**—spacer springs, **22**—pins, **23**—springs, **24**—pin heads.

[0041] The structure chart of the claimed device (FIG. **2**) consists of hydro-abrasive jet generator **1** which is connected with perforator **3** by PCS **2**. The perforator is put into well **6** inside casing string **4**. The perforator **3** has two diametrical nozzles **5**, which are directed to the well **6** wall. The ball valve **7** is mounted at the perforator **3** end. The device **9** for controllable unloading of PCS, PCS weight measuring device **10** and sealer **11** for wellhead sealing and jet pressure measuring device for abrasive **12** are mounted at the surface above well **6**.

[0042] Inside casing pipe **4**, perforator **3** is connected directly to the lower end of PCS **2**. Under the perforator there is a pin **13** which is able of axial movement. The cylindrical washer **15** connected with pin **13** by control-rods **14** are mounted on the upper part of perforator **3** in series and in alignment. The indexing mechanism **16**, step rings **17** and tripping muff **18** are put in series and in alignment on PCS

2 above perforator **3** with the possibility of axial movement. For more detailed description of this part of the device see FIG. **3**.

[0043] The pin **13** is connected with cylindrical washer **15** by control-rods **14**. The washer is put on the upper part of the perforator with possible axial movement. This connection is shown in more detail in FIG. **4**.

[0044] The holder **16** is put on PCS **2** with possible rigid engagement of its body **19** with a casing pipe **4** wall and possible split engagement of its body by step rings **17**, which are rigidly mounted on PCS **2**. For an example of such structure see FIG. **5**.

[0045] The tripping muff **18** is rigidly mounted and fixed on PCS **2** with its skirt down. For an example of such structure see FIG. **6**.

[0046] In FIG. **4** pin **13** passes ball valve **7** seat and protrudes above the ball valve **7** opening. The pin **13** is mounted with possible axial movement. Dotted lines show the position of pin **13** after axial downward movement. The pin **13** is connected with cylindrical washer **15** mounted in the upper part of perforator **3** above nozzles **5** by control-rods **14**. The washer **15** is also able of axial movement. Dotted lines show the position of the washer after axial downward movement. At that washer **15** has a hollow (groove) on its upper end. Depth and width of the hollow are enough for placing there the ends of fluke-claws **20** of the indexing mechanism **16** in run-in position. Dotted lines show the position of the fluke-claws ends **20** in the indicated washer's hollow-groove **15** (run-in position) and after axial downward movement of washer **15**—outside the hollow-groove (on-position). Run-in position is that in which the device is let down to casing pipe **4**. In these positions fluke-claws **20** have to be pressed to PCS **2** so as not to prevent it from its lowering to well **4**.

[0047] FIG. **5** shows an example of engagement of the body **19** of indexing mechanism **16** with the casing pipe **6** wall. It has a pair of rotary fluke-claws **20** for reliable engagement with the casing pipe **6** wall in the process of forming the slot-shaped seat. At the same time it should not interfere with the casing pipe lowering-in to the place of forming slot-shaped seat at the beginning of the work. For that, one of the ends of each fluke-claw **20** is hingedly connected with the body **19** of indexing mechanism **16**, and the other end of the claw **20** in run-in position is clasped to the body **19** of indexing mechanism **16** by cylindrical washer **15**. In run-in position washer **15** will be moved downward and the ends of fluke-claws **20** will move apart set against the wall of casing pipe **6** and will rigidly fix the position of PCS **2** in well **6**. Firm lines show the position of fluke-claws **20** in on-position, and dotted lines—in run-in position. The force for coupling of body **19** of indexing mechanism **16** with the casing pipe **4** wall is chosen in the range from 30% of PCS weight up to breaking strength point of the casing pipe. Minimum value by weight indicator **10** allows unique distinguishing of the coupling of the indexing mechanism with the casing pipe from accidental coupling and friction of PCS **2** against the casing pipe **4** wall. Maximum value excludes the destruction of integrity of casing pipe **4**.

[0048] FIG. **5** shows an example of split engagement of indexing mechanism **16** by step rings **17**. It has a pair of spring-loaded pins **22**, which are installed on the interior surface of body **19** of indexing mechanism **16**. Heads **24** of pins **22** are set against PCS **2** and are round in shape.

[0049] The force for coupling of pin **22** heads **24** with PCS **2** is chosen within the limits of 10-20% of PCS weight. In case of larger force in the process of indexing of PCS **2**, the displacement of fluke-claws **20** along the casing pipe is possible. In case of lesser force one can hardly notice indexing earlier, when PCS is lowered or lifted.

[0050] FIG. **6** shows an example of arrangement of tripping muff **18**. It is mounted on PCS **2** directly above the last step ring **17**. The muff is meant for the forced disengaging of indexing mechanism **16** from the wall of the casing pipe **4** on completion of the last drainage port. It has conical inside surface for resolute putting down of fluke-claws **20** of indexing mechanism **16** after partial loading of PCS **2**. Outer surface has streamlined form for better extraction from the well.

[0051] Optimal distance between step rings equals the diameter of drain port D±5%, and the number of step rings amounts to predetermined productive formation thickness divided by the drain port diameter. At such distance between the ports, adjacent drainage canals reliably connect with each other and form desired slot-like seat.

[0052] The device for cutting slot-shaped seats operates as follows.

[0053] First the device for performing the prescribed cutting is formed. By known drain port diameter D and seat height T, necessary number of drainage canals N and distance D between them are determined. These are calculated by dividing the seat height by the drain diameter. Then perforator **3** is fixed on PCS **2** end (i.e. the lower tube of PCS), its nozzles **5** directed outwards in the opposite direction. The perforator **3** has ball valve **7** with pin **13** on the end. In the upper part of perforator **3** above nozzles **5**, cylindrical retainer washer **15** is placed and connected with pin **13** by control-rods **14**. Then indexing mechanism **16** is put on PCS **2** above cylindrical washer **15**, after that N of step rings **17** is coaxially fixed at a distance D from each other. Directly above the upper step ring, tripping muff **18** is rigidly fixed with its skirt down. After that indexing mechanism **16** is set into starting run-in position—when fluke-claws **20** are clasped to the indexing mechanism **16** body and cylindrical washer **15** is moved up to them. At that, spring-loaded heads **24** of pins **22** are set against PCS **2** under the lower step ring **17**. Then the lower pipe of PCS (with the mounted equipment) is connected to PCS **2**.

[0054] Then PCS **2** (with the installed equipment) is lowered at predetermined depth, and wellhead **6** is supplied with sealer **11**. For example, if a seat should be formed at a depth of 100-101 meters, PCS **2** end is lowered so as nozzles **5** of perforator **3** stay at a depth of 100 meters.

[0055] At that, PCS **2** with the equipment is retained hanging on top, this being done from the surface by device **9** for adjustable unloading of PCS **2**.

[0056] Then a small ball is thrown to PCS **2** for closing ball valve **7** on the perforator end. The ball falls into the ball valve **7** opening on pin **13**, but does not sink it.

[0057] The hydro-abrasive jet generator is then switched on for pumping abrasive solution into PCS **2**. Under pressure of the abrasive solution pin **13** is sunk by ball valve **7** and it pulls control-rods **14** and cylindrical retainer washer **15**. The pressure of the abrasive solution exceeds the friction of cylindrical retainer washer **15** with the ends of fluke-claws **20** which are pushed into it. The pin **13** moves cylindrical washer **15** from the spring-loaded end of fluke-claws **20**. After displacement of cylindrical retainer washer **15** fluke-claws **20** are deflected by the spacer spring **21**. The fluke-claws **20** set against the casing pipe **4** walls of well **6** and become reliably engaged with it, not allowing indexing mechanism **16** to move along the well depth.

[0058] Simultaneously the penetration of the first pair of openings starts through nozzles **5** of perforator **3**. At first, casing pipe **4** is cut, then the critical area of formation. When casing pipe **4** characteristics, the critical area rock and the efficiency of the perforator are given, the operator determines the time of forming a drainage canal at selected depth. At that, the operator fixes the pressure drop value in PCS **2** after opening of the casing pipe and at the end of estimated time of forming the drainage canal. After the drainage canal (opening) is formed, the operator switches perforator **3** off.

[0059] Then by means of device **9** the operator unloads PCS **2** by 20% loosening of drilling cable. Such gain in PCS **2** weight leads to sinking of spring-loaded heads **24** of pins **22** of indexing mechanism **16** by the first lower step ring **17**, which it is set against. At that PCS **2** becomes free from its stop at pins **22** and by its own weight starts lowering itself. Spring-loaded heads **24** of pins **22**, released from the pressure of step ring **17**, will straighten themselves up and will push themselves out again towards PCS **2**. At PCS lowering, pins **22** slide along its surface until set against the next step ring **17**, which is mounted on PCS. The pins **22** will set against it and stop PCS from further moving down. Stop of pipe travel before the next ring **17** arises from the fact that PS tube is elastic, and the movement of the lower part of PCS relieves the vertical load (they say 'the column is gaining weight'); the drilling cable tension increases and the pins load goes down.

[0060] This ensures PCS pacing at predetermined interval.

[0061] Actions are repeated as many times as many step rings **17** are mounted.

[0062] After passing the last (upper) step ring **17**, fluke-claws **20** of indexing mechanism **6** set against the tripping muff **18** skirt. Then PCS **2** weight is unloaded by device **9** by more than 30%. At the indicated gain in the PCS **2** weight, muff **18** sets against fluke-claws **20** by inside cone and with corresponding weight, thus laying them down into run-in position. When performing this operation, breakage of fluke-claws **20** is allowed. Increase in drilling cable tension is considered a signal of laying down or breakage of fluke-claws **20**, which is in other words PCS **2** uncoupling from the casing pipe **4** wall. At uncoupling it becomes equal to the full weight of the instrument.

[0063] In case of need to pull out or release tools at work, the procedure of PCS **2** displacement inside indexing mechanism **16** is repeated the required number of times, not exposing casing pipe **4**.

[0064] The exposures of casing pipe **4** are well fixed by abrasive jet pressure drop (manometer **12**). Operating time of the drainage canal is determined by mud which is washed out from the well. The fact of destruction of crosspieces and bridges of drainage canals is fixed by abrasive jet pressure drop (manometer **12**) and is distinctive by the size and shape of mud (debris) that is removed from the well.

Industrial Use

[0065] The offered engineering solutions have been repeatedly practiced. We have not faced any difficulties during the industrial production of devices. All necessary components, materials and technologies have been known for a long time and are well coped with. The cost of the claimed devices is considerably lower than that of prototype devices (minimum two times less). This is evident from the comparison of the components'complexity and costs.

[0066] The claimed devices have been used for reduction of prices for equipment and works at construction of slot-shaped seats in well side areas of producing formations. The devices have raised reliability and usability of such work. Specifically, they were applied in July-December, 2005 at the wells of Hall, Brinkmeyer and Rieger, the USA.

[0067] The works carried out there proved efficiency of the claimed device and accomplishment of the set tasks. Thus, the claimed device processed four producing formations in different wells at depths of 1060-2870 feet of average thickness of 6-20 feet. In each case a slot with 1.0-1.2 feet spacing to the full thickness of the producing formation was constructed. Each time a clear and precise signal of casing pipe penetration was picked up.

[0068] (32 actions—pressure drop from 5000-6000 psi to 4300-4200 psi).

Well capacity initially totaled 1-2 barrels of oil per day. At all indicated producing formations before the construction of unloading slots according the claimed technology, intensification works with the use of acid treatment and powder generators of elastic vibrations were carried out. But for all that, none of the indicated methods of intensification has produced any noticeable increase in efficiency of the said wells. After treating wells according to the claimed method, the efficiency increased up to 7-16 barrels of oil per day.

[0069] As the prototype devices had been used at the same projects until the claimed devices were introduced, it was possible to compare their efficiency. Working hours have reduced almost by two times (mainly due to elimination of stoppage and resetting of cutting equipment), and well capacity of treated wells has risen up to 350-700% (due to more precise design size accomplishment of slots at the well side area). Moreover, serviceability has notably improved due to securing of simple and reliable travel of the perforator along the well depth.

[0070] Thus, problems posed by the invention are solved.

[0071] The authors are not aware of any devices similar to the claimed one.

[0072] The offered solutions are unobvious for specialists-otherwise they would have already been in use. Oil, pressure, hydro geological and water-supply wells and gassers are in great demand in the world. A great number of specialists are occupied with their improvement—enhance efficiency, reduce costs, increase durability etc.

[0073] In our opinion the offered solutions comply with all the requirements specified for an invention—they are new, unobvious for a specialist (have an invention level) and are exploitable.

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1. A device for construction of slot-shaped seats from the well wall inside the rock consisting of a hydro-abrasive jet generator which is connected with a perforator through tubing string; the perforator is put into casing pipe and has two diametrical nozzles which are directed at the well wall; there is a ball valve at the perforator end,

as well a device for adjustable partial unloading of PCS, PCS weight measuring device, abrasive jet pressure measuring device and a sealer for the wellhead sealing;

the distinction lies in the fact that:

The perforator is directly connected with PCS; a pin is mounted into the opening on the lower end of the perforator with possible axial movements; a cylindrical retainer washer is put on the upper part of the perforator above nozzles; the washer is connected with the pin by control-rods; on the lower tube of PCS which is connected with the perforator, the PCS indexing mechanism, step rings and a tripping muff are bottom up mounted in series and in alignment. The indexing mechanism is put on PCS with the possibility of fixed coupling of its body with the casing pipe wall and split engagement of its body by step rings, which are rigidly fixed on the lower PCS tube, and the tripping muff—on PCS with the skirt down.;

2. Device as in claim **1**, the distinction lies in the fact that the indexing mechanism body is engaged with the casing pipe wall in the form of at least a couple of rotary fluke-claws, with one end of each hingedly connected with the body of indexing mechanism, and the other end is clasped to the casing pipe wall by spacer springs mounted between the indexing mechanism body and the fluke-flaw.

3. Device as in claim **1**, the distinction lies in the fact that the indexing mechanism's split engagement by step rings is in the form of at least a couple of spring-mounted pins installed on the interior surface of the indexing device body; with pin heads of round shape at the contacting end set against PCS.

4. Device as in claim **3**, the distinction lies in the fact that the force for coupling of the indexing device with the casing pipe wall is chosen in the range from 30% of PCS weight up to breaking strength point of the casing pipe.

5. Device as in claim **3**, the distinction lies in the fact that the force for coupling of the split pin heads with PCS is chosen within the limits of 10-20% of PCS weight.

6. Device as in claim **1**, the distinction lies in the fact that the distance between the step rings is equal to the drain port diameter D±5%, and the number of rings amounts to the productive formation thickness divided by drain port diameter D.

7. Device as in claim **1**, the distinction lies in the fact that the tripping muff has a conical inside surface and the exterior of streamlined form.

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