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(54) **METHOD FOR CUTTING SLOT-LIKE KEY SEATS IN PRODUCING FORMATION OF PRODUCING OR PUMPING WELLS**

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(57) **ABSTRACT**

This method relates to the fields of mining, specifically oil, gas and hydro-geological industries and is intended for relief of tangential stress which originates in well side areas of producing formation from underground pressure by means of cutting vertical slot-shaped seats in well side zones of producing formation.

The determined task is solved by introducing essential changes into the known method of constructing slot-like key seats from the well wall inside the rock consisting of generation of hydro-abrasive jet, its transportation to the perforator's nozzle, which is lowered into the well inside the casing pipe and directed towards the rock, and the nozzle's travel along the surface of the forming seat.

The changes are as follows:—The slot-like seat is automatically formed out of the series of drainage canals on the seat surface which are performed one after another;—The perforator is moved from the place of the previous drainage canal to the place of forming the next one by step when it is switched off;

Each drainage canal is formed when the perforator is in immovable position with regard to the casing pipe walls;—The moment of casing pipe cutting is fixed by spasmodic drop of hydro-abrasive jet pressure in pressure line which is not less than 10%;—Time T of forming each drainage canal after cutting the casing pipe is calculated according to the following formula (1):

$$T = \frac{\sigma mr}{Mabr\ V\min} \tag{1}$$

where: σ—breaking point of rock, in which the drainage canal is formed; mr—body of rock which carried out the drainage canal; mabr—mass of operating fluid with abrasive, pumped in time T;

Vmin—minimal speed of abrasive particle in working jet that ruins the rock, in which the drainage canal is formed. It s calculated by the following formula: Vmin=σ/mabr;

The process of drainage canal formation is stopped T min after the casing pipe cutting;

Then the perforator is switched off and moved to the place of cutting the next opening in the casing pipe in order to form the next drainage canal;—The process of forming the next and subsequent canals is stopped T min after not less than 10% uneven reduction of the abrasive jet pressure.

To optimize the construction of slot-like key seat, centers of the adjacent drainage canals are placed at a distance of the drainage port diameter ±5%. The moment of destruction the crosspiece between the previous and the drained canals can be determined by the second jumping reduction of the abrasive jet pressure which took place in the process of the next canal drainage. The number of drainage canals is determined by means of dividing the producing formation thickness by the drain port diameter. In order to construct vertically oriented seat the drainage canals are placed vertically one under another by means of lowering the perforator nozzle. In order to construct horizontal seat the drainage canals are placed horizontally by means of turning the perforator nozzle. In order to construct sloping seat the drainage canals are placed slanted by means of vertical movement of the perforator nozzle with its simultaneous turn.

METHOD FOR CUTTING SLOT-LIKE KEY SEATS IN PRODUCING FORMATION OF PRODUCING OR PUMPING WELLS

FIELD OF THE INVENTION

[0001] This invention relates to the fields of mining, specifically oil, gas and hydro-geological industries and is intended for relief of tangential stress which originates in well side areas of producing formation from underground pressure by means of cutting vertical slot-shaped seats in well side zones of producing formation.

BACKGROUND OF THE INVENTION

[0002] Cutting of slot-shaped seats which starts from the outer well wall and is directed deep down the rock is known as one of the most effective methods of enhancement of efficiency (productivity) of producing or pumping well by means of stress relief in the well side area of producing formation. The seat size depends on the characteristics of producing formation in the well side area, normally the seat width (slot opening) is 0,5-1 of well diameter, the depth (distance from the well edge deep into the rock) is 3-4 of well diameter.

[0003] Practical cutting of slot-like seats is a quite difficult process. It is performed after construction and long-term exploitation of the well when its capacity considerably goes down. Productivity slowdown is the result of the abutment zone which is formed around the well in the course of exploitation. It essentially reduces rock permeability in the area. To increase well capacity one can decide on pressure relief in the well side area.

[0004] By known input data (e.g. according to experimentally measured characteristics of the well and rock samples of the processed producing formation) required minimum dimensions of key seats are determined by the following formula:

$$t = \frac{2(P_2 - P_1)a(1-\mu^2)}{E}$$

[0005] where

[0006] t—width of slot opening, a—depth (distance from the well edge deep into producing formation, P_2—geostatic pressure, P_1—bottom-hole pressure, μ^2—Poisson's ratio of producing formation, E—deformation module of producing formation (e.g. see Instructions on slot unloading of well side zone, VNIMI, Minuglеprom, L, 1987).

[0007] Construction of seats is carried out at significant depth in the producing formation area, i.e. distantly through a precut casing pipe and a cement sheath. There is no other path to producing formation which is subject to unloading.

[0008] The casing pipe is lowered from the surface to the well bottom in order to preserve the well and to protect it from caving; the cement sheath around the casing pipe ensures isolation of layers, which were uncovered during well boring and prevents from cross-flows and communication between producing formations.

[0009] The equipment for construction of a slot-like seat towards the producing formation, that is deep into the well, can be delivered only through the said casing pipe. There is no other way of equipment delivery to the place of seat construction.

[0010] Cutting of casing pipe, cement sheath and well side area by hydro-abrasive jet of high pressure is the most commonly used method of slot-like seat construction in the mentioned heavy conditions with remote control. For that, the perforator which is operated from the hydro-abrasive pressure source (e.g. pump-and-compressor equipment with addition of abrasive) is placed on the lower end of the tubing string which is lowered into the casing pipe up to the place of seat construction. The perforator nozzles are directed from within the casing pipe towards the rock. From the well surface where the source of hydro abrasive pressure is mounted up to the place where the cutting nozzle of the perforator is mounted, hydro-abrasive liquid is pumped and piped along the tubing string which passes through the casing pipe.

[0011] The depth of seat opening mainly depends on cutting period and characteristics of the casing pipe and the cement sheath (which have to be preliminary cut), as well as on rock characteristics. Naturally, the most important factors which determine cutting depth are parameters of the jetting device (jet pressure and abrasive material).

[0012] Thus it becomes clear that when parameters of hydro-abrasive jetting device, rock characteristics as well as those of the casing pipe and cement sheath are known, the rated depth of the slot-like seat is provided with the duration of perforation.

[0013] Examples of methods and devices for slot unloading of well side area of producing formation by hydro-sandblasting method are particularly stated in:

Reference book on oil production, M, "Nedra". 1974

International Application PCT/RU93/00101 (WO94/05898 of Mar. 3, 1994).

[0014] U.S. application Ser. No. 10/957,871 of Apr. 10, 2004.

Author's certificates USSR #14645551, published on Aug. 11, 1988; #1167925 of 1983, published on Mar. 15, 1988.

Russian Federation patent #2074957; published on Oct. 3, 1997.

[0015] In these examples the slot-like key seat is formed by smooth and continuous movement of permanently operating hydro-abrasive perforator (nozzle) inside the casing pipe and along its wall opposite the unloaded producing formation.

[0016] Devices which ensure such smooth and continuous movement are put into action by the abrasive jet pressure in the tubing string. The pressure is often put by means of tubing weight, which affects the hydro brake. The hydro brake can be performed, for example, on the cross-flow of viscous fluid between the hydro brake chambers which is controlled by the canal section and flowing fluid viscosity.

[0017] Similar structures one can find in the above-mentioned reference bibliography.

[0018] A method described in the U.S. application Ser. No. 10/957,871 of Apr. 10, 2004 was chosen as a prototype (the closest analogue).

[0019] The method consists of slot-like key seat construction from the well wall deep into rock of the well side area by means of hydro-sandblasting abrasive jet which flows out of the perforator. The perforator is fixed on the lower end of the tubing string, which is lowered into the well inside the casing pipe. At that the slot-like seat is formed by means of smooth and continuous movement of the perforator along the well (casing pipe). Rated depth and height of the seat are ensured by previously calculated and rated speed of perforator movement and duration of its operation. The duration of its operation, for example, can be assigned by volume and viscosity of the hydro brake viscous fluid and speed of the perforator by the cross-flow canal section and the flowing fluid viscosity.

[0020] This method is in common practice worldwide. We consider it the most popular in the world. Reasons for that are as follows: universality, variability, comparative unpretentiousness, possibility of assigning speed and duration of perforator operation, i.e. program management of the process of cutting key seats.

[0021] However, the method has significant shortcomings.

[0022] 1) Technologically complicated realization of the method

[0023] The method of ensuring constant speed and rated duration of the perforator movement is difficult and inaccurate. Cutting mode is set in advance. In the process of key seat formation the mode is not controlled. Only on completion of the slot unloading of the well (sometimes after long time) one can assess the conformity of seat sizes with the desired ones.

[0024] Resetting of the equipment for the change of mode is possible only in a specialized shop with the use of specialized devices;

[0025] 2) Fundamental inaccuracy of the method—the formed seat is always notably different from the rated (desired) one.

[0026] The method does not allow comparing the seat to be formed with the rated one in the process of construction. This could be done only after forming the seat, by means of complicated, laborious and indirect way. For example, by acoustic broadband sounding or ultrasonic scanning of the well walls.

[0027] The used technique of slot depth assignment by selecting speed of the perforator movement does not succeed in practice.

[0028] Reasons

[0029] Deviation of actual characteristics of casing pipe and cement sheath from preset ones, their changes in the process of production and placing in the hole (bends, cracks, stop etc.).

[0030] Deviation of actual characteristics of the processed rock from preset ones, which were determined by measuring samples previously recovered from the well as the rock is heterogeneous in structure, density, strength etc.;

[0031] Deviation of characteristics of the perforator efficacy from the rated one, which is connected with fluid head variations, sample structure, cutting nozzles and the distance to the pipe wall.

[0032] In practice upon completion of cutting according to prescribed mode (speed and duration of the perforator movement) it often appears that the casing pipe and cement sheath are here and there not cut at all, and in some points the penetration into producing formation noticeably differs.

[0033] We would like to draw attention to the fact that when constructing key seat in bottomhole formation zone of producing formation by means of hydro-abrasive perforation from inside the casing pipe, most of the time (around 92%) is spent for cutting of the casing pipe which strength is many times more than that of cement rock and rock.

[0034] Time of cutting cement ring is much less than that needed for cutting the softest rock, that is why when calculating drainage it can be disregarded. When programming hydro-brake, the speed of perforator movement is selected taking into account required total time for cutting the casing pipe, cement ring and the rock drainage. Even slight deviations of actual time of cutting the casing pipe from the rated one (they are very likely because of different distances from the perforator nozzle to the pipe wall, for example) may cause considerable deviations from the drainage time, i.e. from the drain port size.

OBJECTS OF THE INVENTION

[0035] It is an object of the invention to simplify the method and to increase its accuracy.

TASK SOLUTION (DETAILED DESCRIPTION OF THE INVENTION)

[0036] The determined task is solved by introducing essential changes into the known method of constructing slot-like key seats from the well wall inside the rock consisting of generation of hydro-abrasive jet, its transportation to the perforator's nozzle, which is lowered into the well inside the casing pipe and directed towards the rock, and the nozzle's travel along the surface of the forming seat.

[0037] The changes are as follows:

[0038] The slot-like seat is automatically formed out of the series of drainage canals on the seat surface which are performed one after another;

[0039] The perforator is moved from the place of the previous drainage canal to the place of forming the next one by step when it is switched off;

[0040] Each drainage canal is formed when the perforator is in immovable position with regard to the casing pipe walls;

[0041] The moment of casing pipe cutting is fixed by spasmodic drop of hydro-abrasive jet pressure in pressure line which is not less than 10%;

[0042] Time T of forming each drainage canal after cutting the casing pipe is calculated according to the following formula (1):

$$T = \frac{\sigma m_r}{M_{abr} V_{\min}} \quad (1)$$

where

σ—breaking point of rock, in which the drainage canal is formed;

m_r—body of rock which carried out the drainage canal

m_{abr}—mass of operating fluid with abrasive, pumped in time T;

V_{min}—minimal speed of abrasive particle in working jet that ruins the rock, in which the drainage canal is formed. It s calculated by the following formula:

$V_{min}=\sigma/m_{abr}$;

[0043] The process of drainage canal formation is stopped T min after the casing pipe cutting;

[0044] Then the perforator is switched off and moved to the place of cutting the next opening in the casing pipe in order to form the next drainage canal;

[0045] The process of forming the next and subsequent canals is stopped T min after not less than 10% uneven reduction of the abrasive jet pressure.

[0046] To optimize the construction of slot-like key seat, centers of the adjacent drainage canals are placed at a distance of the drainage port diameter ±5%.

[0047] The moment of destruction the crosspiece between the previous and the drained canals can be determined by the second jumping reduction of the abrasive jet pressure which took place in the process of the next canal drainage.

[0048] The number of drainage canals is determined by means of dividing the producing formation thickness by the drain port diameter.

[0049] In order to construct vertically oriented seat the drainage canals are placed vertically one under another by means of lowering the perforator nozzle.

[0050] In order to construct horizontal seat the drainage canals are placed horizontally by means of turning the perforator nozzle.

[0051] In order to construct sloping seat the drainage canals are placed slanted by means of vertical movement of the perforator nozzle with its simultaneous turn.

[0052] We consider the claimed solution to be new and unknown from accessible sources of information. It does not evidently result from the known technical background.

SUMMARY OF THE INVENTION

[0053] The essence of the invention is explained by the following detailed description of the method and two examples of its application.

[0054] For construction of slot-like key seats which start from the outer well wall and are directed deep down the producing formation by sand-blasting perforation, the perforator is mounted on the lower end of tubing. The perforator is connected with the hydro-abrasive pump which is placed on the ground surface through the said tubing string. This tubing is lowered into the well inside the casing pipe up to top of the processed interval of producing formation.

[0055] The producing formation interval, its thickness and density are determined by any known method, radiation logging, for example. According to the obtained data the required depth and height of the slot-like seat are calculated.

[0056] Then the construction of slot-like seat in the well side area of the producing formation is started. It is performed through casing pipe and cement sheath. A series of successive drainage canals along the assigned pass on the well wall is formed.

[0057] To form the first drain port, the perforator is switched on; starting value of jet pressure is assigned and the opening in casing pipe is cut. The fact of cutting is fixed by the moment of jumping reduction of the jet pressure by not less than 10%. Until the pipe wall is not cut it shows strong resistance to the jet, which maintains initial pressure. After cutting the casing pipe wall the abrasive jet stops setting against it. The jet starts processing much more soft material of cement sheath and producing formation of the rock. Resistance to the jet becomes much less. Accordingly, the jet pressure considerably drops. Practically according to our measurements the pressure drops by not less than 10%. As it happens quite rapidly and in a jumping manner, this drop can be considered the moment of the abrasive jet passing through the casing pipe and the beginning of construction of the next drainage canal.

[0058] Then the canal formation by abrasive jet is continued until the assigned seat depth is reached. This time T is calculated in advance based upon known characteristics of the processed rock and abrasive perforator capacity by the above formula (1).

[0059] Then the perforation is stopped and the perforator is moved down to the next drainage canal. The most efficient is to move it at a distance of about one drainage canal diameter.

[0060] The perforator position is fixed with regard to the well walls and cutting of the next opening in the casing pipe begins. At that the changes in abrasive jet pressure are being checked. The formation of the next drainage canal adjacent to the formed one is performed in the same manner. First cutting of the casing pipe wall is done. The moment of casing pipe cutting is fixed by spasmodic drop of hydro-abrasive jet pressure by not less than 10%. Then the jet starts cutting the cement sheath and the rock. The cutting lasts the same rated time T. At that upon forming the second and the next drainage canals the crosspiece between adjacent drainage canals has to be destroyed. After such destruction abrasive resistance to the jet spasmodically reduces again which leads to reduction in jet pressure. This moment is fixed and it confirms the fact of junction of the adjacent drainage canals. If such jump does not happen within the estimated time T—the duration of drainage is prolonged until the crosspiece is destroyed.

[0061] Then the perforation is stopped and the perforator is moved down to the next drainage canal. The most efficient is to move it at a distance of about one drainage canal diameter. The perforator position is fixed with regard to well walls and cutting of this opening begins.

[0062] The process of forming the third and the next drainage canals is analogous to the drainage of the second one. It is also stopped in estimated time T after cutting the casing pipe. The moment of casing pipe cutting is fixed by spasmodic drop of abrasive jet pressure. If within time T the destruction of crosspieces between the adjacent drainage canals is not confirmed (by spasmodic drop of abrasive jet pressure) the drainage is continued until the said crosspieces are destroyed.

[0063] As it was already shown, to optimize seat construction, the cutting centers of adjacent drainage canals are placed at a distance of one drainage canal diameter ±5%. At less distances excess number of canals is produced. At greater distances time of forming the next drainage canal up to its connection with the previous one increases cost-ineffectively. If deviations are even bigger the closure of adjacent canals into a single slot-like seat is not guaranteed at all.

[0064] Naturally, common rational number of drainage canals is defined by means of dividing producing formation thickness by drainage canal diameter.

[0065] In order to construct vertically oriented seat the drainage canals are placed vertically one under another by means of lowering the perforator nozzle.

[0066] In order to construct horizontal seat the drainage canals are placed horizontally by means of turning the perforator nozzle.

[0067] In order to construct sloping seat the drainage canals are placed slanted by means of vertical movement of the perforator nozzle with its simultaneous turn.

INDUSTRIAL USE

[0068] The claimed method has been repeatedly practiced by the applicant. Two cases of forming slot-like key seats in oil wells in Texas, USA, are listed below.

[0069] 1) The No 4 Hall oil well. Initial capacity totaled 1,2 barrels of oil per day Two years later it reduced to 0,2 barrels per day. It was decided to raise production by means of forming slot-like key cavities. The producing formation was situated at a depth of 1012 feet and is 10 feet thick.

[0070] The tubing string with the perforator on its lower end equipped with two diametrical nozzles of hard metal T15K45 treated with fullerene, Ø0,18"×1,6" was lowered into the cemented in the rock casing pipe. On the surface the tubing is connected with the pump that ensures operating fluid supply (ready degassed oil with 5% by volume silica sand was used as operating fluid). Operating fluid was supplied at a rate of 2-5 barrels per minute at a pressure of 3000-5000 psi accordingly and silica sand content of 8-12 pounds in a barrel, which is 5% by volume. Silica sand of 20-40 fractions was used (grain size of 0,2-0,7 mm). Perforator nozzles of Ø0,18" were directed oppositely outwards. The casing pipe characteristics are as follows: diameter 5,5"; wall thickness 17 pounds/foot; steel of P105 model with strength of 2800-3100 pounds/square inch.

[0071] Characteristics of the treated interval of the producing formation are as follows: density 2,63 g/cm^3; strata pressure 9547 psi; compressive resistance breaking point 1975 g/cm^3. Rated depth of the slot-like seat is 1,2 feet. Drainage canal diameter is 1,0 feet, rated time of forming the first drainage canal of the productive layer is 10 min. Rated time for drainage of the next and subsequent drainage canals after the casing pipe cutting (uneven reduction of abrasive jet pressure) is 15 min.

[0072] Number of drain ports is 10. The pressure drop of 460 psi at initial pressure of 3500 psi was recorded when cutting the first port in the casing pipe. This happened 7 min after cutting started. When cutting the casing pipe at the next drainage canals the pressure drop was fixed after 5-6 min. After that the perforator was kept at each station for rated time T. The perforator was moved from port to port by mere lowering of the tubing at a distance equal to one drain port diameter, i.e. 1 foot.

[0073] Walls between adjacent drain ports were surely destroyed, that was fixed by 4-5% pressure drop in the tubing, and after a time (the time of cutting transport from the formed slot-like seat) on the surface crags appeared in a carried out flow. They differed by size and shape from mud carried out during the drainage canal formation.

[0074] The well productivity has increased by 700% and totaled 1,4 barrels per day.

[0075] 2) The No 4 Brinkmayer oil well. Initial capacity totaled 2,3 barrels of oil per day. A year and a half later it reduced to 0,8 barrels per day. It was decided to raise production by means of forming slot-like key cavities. The producing formation was situated at a depth of 1203 feet and is 18 feet thick.

[0076] The tubing string with the perforator on its lower end equipped with two diametrical nozzles of hard metal T15K45 treated with fullerene, Ø0,18"×1,6" was lowered into the cemented in the rock casing pipe. On the surface the tubing is connected with the pump that ensures operating fluid supply (ready degassed oil with 5% by volume (Silica sand was used as operating fluid). Operating fluid was supplied at a rate of 2-5 barrels per minute at a pressure of 3000-5000 psi accordingly and silica sand content of 8-12 pounds in a barrel, which is 5% by volume. Silica sand of 20-40 fractions was used (grain size of 0,2-0,7 mm). Perforator nozzles of Ø0,18" were directed oppositely outwards. The casing pipe characteristics are: diameter 5,5"; wall thickness 17 pounds/foot; steel of P105 model with strength of 2800-3100 pounds/square inch.

[0077] Characteristics of the treated interval of the producing formation are as follows: density 2,74 g/cm^3; strata pressure 543 psi; confining pressure 12118 psi; compressive resistance breaking point 1673 g/cm^3. Rated depth of the slot-like seat is 1,2 feet. The drainage canal diameter is 1,2 feet, rated time of drainage of the first port of the productive layer is 17 min. Actual time for drainage of the next and subsequent drainage ports after the casing pipe cutting (uneven reduction of abrasive jet pressure) is 11 min. It was fixed by the 4-5% pressure drop in the tubing and after a time (the time of cutting transport from the formed slot-like seat) crags appeared on the surface in a carried out flow. They differed by size and shape from mud carried out during the drainage canal formation.

[0078] Number of drain ports is 10. When cutting the first port in the casing pipe the pressure drop of 460 psi at initial pressure of 3500 psi was recorded. This happened 9 minutes after the cutting started. When cutting the casing pipe in the next points, the pressure drop was fixed in 5-6 minutes, after that the perforator was kept at each station for 17 minutes. It was moved from port to port by mere lowering of the tubing at a distance of one drain port diameter, i.e. 1,2 feet.

[0079] Walls between adjacent drain ports were surely destroyed, that was fixed by 4-5% pressure drop in the tubing string, and after a time (the time of cutting transport from the formed slot-like seat) crags appeared on the surface in a carried out flow They differed by size and shape from mud carried out during the drainage canal formation.

[0080] The well productivity has increased by 470% and totaled 3,8 barrels per day.

[0081] Experimental data confirm the efficiency of the claimed method and accomplishment of assigned technical effect—constructing slot-like seat has become considerably easier, and assigned and gained seat parameters have become notably closer. Due to complete avoidance of uncut or not enough cut areas the efficiency of seat unloading has considerably increased.

[0082] Essential differences which ensure technical effect are as follows:

[0083] 1) The slot-like seat is formed out of the series of drainage canals (in analogues it is done by continuous drain slot)

[0084] 2) The perforator is moved from canal to canal by step when it is switched off (in analogues it is done by continuous movement of working perforator);

[0085] 3) Each drainage canal is formed when the perforator is in immovable position with regard to the casing pipe walls (in analogues it is done with moving perforator);

[0086] 4) The accuracy of depth of a slot-like key seat is higher as the depth of each drainage canal which forms the basis of the key seat is controlled by the duration of construction of a drainage canal from the moment of casing pipe cutting, i.e. directly from the moment of the drainage start (in analogues—the drainage duration is the remainder of total operating time of the perforator when it cuts the pipe, sheath and rock; if calculated like this the perforator may have no time to reach the rock);

[0087] 5) The moment of cutting the casing pipe by abrasive jet is exactly determined by spasmodic drop of hydro-abrasive jet pressure in pressure line which is not less than 10%;

[0088] 6) The drainage canals are placed at a distance of the drainage port diameter from each other. At work unambiguous information about the junction of adjacent canals is determined by jet pressure change and appearance of crags in a carried out flow which illustrates the fact of destruction of crosspieces between the adjacent canals;

[0089] 7) Simple construction of vertically and horizontally-oriented seats as well as sloping seats by means of appropriate movements of the perforator.

[0090] Consequently, we consider the claimed solution to be new and unobvious for specialists. It does not evidently result from the known technical background. It is exploitable and ensures quite important technical outcome.

1. A method for construction of a slot-like key seat from the well wall inside the rock consisting of the generation of hydro-abrasive jet, its transportation to the perforator's nozzle, which is lowered into the well inside the casing pipe and directed towards the rock and the nozzle's travel along the surface of the forming seat. The method includes the exposure of producing formation, defining of its thickness, calculation of the slot-like seat depth and height;

the distinction of the method lies in the fact that

the slot-like seat is formed out of series of subsequently performed drainage canals which are situated along the seat surface. The canals automatically unite into the slot-like key seat of necessary parameters. The perforator slowly moves from canal to canal, and each drainage canal is formed when the perforator is in a stationary position with regard to the casing pipe walls. The process of drainage canal formation lasts not less than T minutes after the moment of cutting the casing pipe by abrasive jet; time T is calculated by the following formula (1)

$$T = \frac{\sigma m_r}{M_{abr} V_{\min}}$$

where

σ—breaking point of rock, in which the drainage canal is formed;

m_r—body of rock which carried out the drainage canal

m_{abr}—mass of operating fluid with abrasive, pumped in time T;

V_{min}—minimal speed of an abrasive particle in working jet that ruins the rock, in which the drainage canal is formed. It s calculated by the following formula:

$$V_{min} = \sigma / m_{abr};$$

Then the perforator is switched off and moved to the place of cutting the next opening in the casing pipe to form the next drainage canal. It is then switched on, the casing pipe is cut and the drainage process of the next canal lasts not less than T min after the cutting of the casing pipe. The perforator is switched off again. These operations of switching off, moving to the place of next opening cutting and the next canal drainage are repeated until all drainage canals along the whole thickness of the producing formation are constructed.

2. Method as in claim 1, the distinction lies in the fact that the moment of cutting the pipe with abrasive jet is defined by not less than 10% uneven pressure drop of the abrasive jet in pressure line.

3. Method as in claim 1, the distinction lies in the fact that the drainage of the second and following canals goes on until the crosspiece between the previous and the drained canals is destroyed.

4. Method as in claim 1, the distinction lies in the fact that the moment of the crosspiece destruction is determined by not less than 10% uneven reduction of the abrasive jet pressure in the drainage process.

5. Method as in claim 1, the distinction lies in the fact that the drainage canals are placed at a distance of the drainage canal diameter ±5% from each other.

6. Method as in claim 1, the distinction lies in the fact that the number of drainage canals is determined by means of dividing the producing formation thickness by the drain port diameter.

7. Method as in claim 1, the distinction lies in the fact that in order to construct vertically oriented seats the drainage canals are placed vertically one under another by means of lowering the perforator's nozzle.

8. Method as in claim 1, the distinction lies in the fact that in order to construct horizontal seats the drainage canals are placed horizontally by means of turning the perforator's nozzle.

9. Method as in claim 1, the distinction lies in the fact that in order to construct sloping seats the drainage canals are placed slanted by means of vertical movement of the perforator nozzle with its simultaneous turn.

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