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THE CREATION OF WELL HYDRAULIC TECHNOLOGY OF THE BITUMINOUS BREEDSMINING

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ABSTRACT

In connection with growth of oil consumption, it is necessary to search for new sources of hydrocarbon raw materials and methods of their implicating in extraction and application sphere. Such raw materials are treated bituminous breeds containing high viscosity oil, bitumen, etc.

In Kazakhstan on the territory of Atyrau, Aktyubinsk and Aktau areas, it is reconnoitered and registered over 100 deposits bituminous breeds. According to the preliminary data, on depths to 120 m lie down 15-20 billion t of bituminous breeds. The reconnoitered deposits of bituminous breeds whenever possible their workings out are divided into two types. The deposits which are lying down immediately on the surface or on small depth (to 50) are treated to the first which can be effectively developed by an open method. The deposits which are lying down on rather deep water are treated to the second type (more than 100 m). These deposits are reconnoitered less in details, working out by their open method is inexpedient because of great volumes stripping operations[1]. Relatively low value of raw materials is economically unprofitable and their underground working out. For working out of deposits of the second type effectively are applied well hydraulic technology. Insufficient extend of exploration deposits of bituminous breeds and absence of great demand for these raw materials in the past have caused low level of technique and engineering of working out, shipment and application of bituminous breeds of Kazakhstan.

The substantiation of the effective and nonconventional technology of working out of bituminous breeds, effective methods of open-cast mining of bituminous breeds with application of traditional set of the equipment taking into account features of physic mechanical properties of breeds during summer and winter time, possibility and perspectives of well techniques of working out of bituminous breeds, efficiency of designed techniques of extraction and application of bituminous breeds and bituminous emulsion to conduct their industrial trials and introduction[2]. To define effect critical parameters on the

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array for well technology of working out of bituminous breeds and to justify regularities and analytical dependences for definition of critical parameters of effect on the array.

The complex of research methods, powering up is applied in the work: the analyzes of mountain-geological conditions folding of bituminous breeds and the contents in them of bitumen; the assaying of experience of working out of bituminous breeds; laboratory experimental researches on large-scale sample pieces; analytical and technical and economic calculations; trial inspection of designed techniques under production conditions.

Result consists in the substantiation of new techniques of working out of bituminous breeds with deriving of considerable actual saving of means at their application at the mountain and building operations. The results of the work are realized at the mountain and building operations with the big saving of means.

The substantiation of the rational parameters of open pits for working out of bituminous breeds, which are lying down on depths to 50 m, taking into account the basic features of physic mechanical properties of breeds, first of all high viscosity of their compartment from an array and low carrying capacity at vertical loads. The installation of nonlinear sedate dependences of well capacity geotechnologies of bituminous breeds from hydraulic fluid and pressure temperature on mounting attachments of hydromonitors. The efficiency substantiation of well technology of working out of bituminous breeds on depth folding over 50 m.

Key words: Bitumen, Deposit, Extraction, Oil, Working out.

INTRODUCTION

The technology provides extraction from bowels of all mass bituminous breeds. There at breed fails by forcing stream of hydraulic fluid by means of the hydro monitor placed in the slit, drilled with surface, and is produced on the surface in the form of hydro mixture (fine pulp) with the help air lift.

Experiments showed that the application of clear water as hydraulic fluid even hot, is not effectively. The clear water does not disturb adhesive links of bitumen with lean material and collapse of bituminous breeds particles does not occur. Therefore, as a hydraulic fluid it is expedient to use washing water alkaline solution (on a.c. № 1059952 USSR), which is used for extraction bitumen from bituminous breeds.

By the application of such solute simultaneously to collapse bituminous breeds pressure head stream will occur fractional cleaning of bitumen from breed (the basic flow diagram of process is reduced on Fig. 1). The flow diagram powers up following processes: mining slit is equipped with mining aggregate, which includes well hydro monitor and air lift. The bituminous breed is washed away by hydro monitor stream in the form of hydro mixture (fine pulp), air lift is produced on the surface and sand pump is pumped over on the

installation for bitumen extraction. Here, the fine pulp is exposed to the cleaning process bitumen in stirrers. Further, the washed out fine pulp is exposed to thickening in hydro cyclones or radial thickeners[3]. Draining of thickeners moves on extraction of bitumen by flotation, commodity bitumen as a result turns out. The sand after thickening is exposed to scrubbing action and is a commercial product, which can be used in building. The tails of fine pulp after flotation are integrated with water from scrubbing action of sand and move on regeneration of cleaning solution, which after heating up to the right temperature moves on breed washout.

In case of need commercial product is not pure bitumen, and bituminous emulsion. With this purpose part of the fine pulp (or all fine pulp) after sand compartment passes to flotation process, goes on process of selection of residual and homogenization in which result the commodity bituminous emulsion turns out. The selection of residual-clay particles and the crushed sand, for example, by means of centrifugal machine, promotes scrubbing action of emulsion from mineral particles. Besides, as together with residual the certain quantity of water is extracted this process promotes increase in the contents of bitumen in emulsion. The homogenization process promotes stabilization and emulsion improvement in quality.

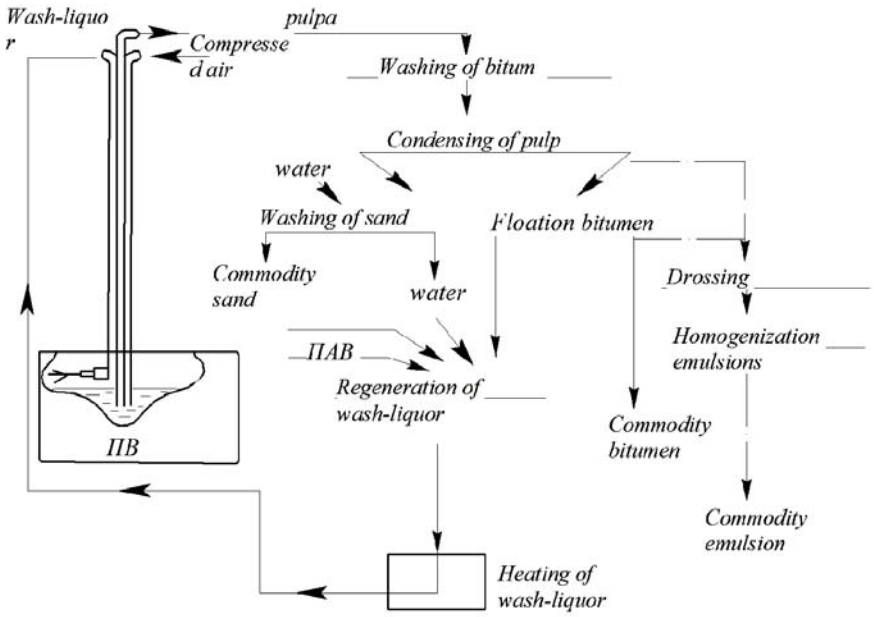

Fig. 1: An extraction circuit diagram of bituminous breeds method of well hydro extraction and the subsequent processing of received fine pulp

As coating breeds on bituminous deposits breeds are usually unstable, and bituminous breeds with temperature increase lose carrying capacity, well hydro extraction of bituminous breeds chamber variants of systems of working out is impossible. Therefore, for working out of such deposits by well method of hydraulic technology the continuous system of working out with smooth omitting of coating breeds without their violation (Fig. 2) is offered.

Its essence consists in the following:

The deposit is drilled out by the system mining slits, which are arranged with well hydro monitors and air lift. In the center of each mesh, forming mining slits is drilled out forcing slit, which is arranged with a casing pipe punched in an interval of bituminous breeds. Deposit working off can begin with as flank, and from the deposit midpoint to flanks.

In forcing slits is pumped hot cleaning solution which sates and warms up bituminous breeds. As a result of it adhesive links between bitumen and particles of sand are fractionally disturbed, And also strength and carrying capacity of bituminous breeds is diminished. In mining slits with the help well hydro monitor is done washout of bituminous breeds and formation of fine pulp, which air lift is pumped off on the surface is fabricated and goes for the further processing.

In process of connection to flute bituminous breeds of the next rows mining slits and area increase on which the flute is fabricated, coating breeds under body weight smoothly are lowered without violation of denseness[4]. Thus warmed up and lost carrying capacity of bituminous breeds are wrung out from the central part of developed zone, where pressure of coating breeds as much as possible, to periphery. It promotes heightening of efficiency of working out and lowering of losses of bituminous breeds.

EXPERIMENTAL

Experimental researches of technological parameters well hydro productions of bituminous breeds

The basic technological parameters defining efficiency of well hydraulic technology of extraction of bituminous breeds are the hydraulic fluid temperature, pressure on the hydro monitor mounting attachment, hydraulic fluid expenditure through the hydro monitor. Forced bituminous heated hydraulic fluid warms up breeds. Thus, strength and carrying capacity of bituminous breeds is sharply diminished.

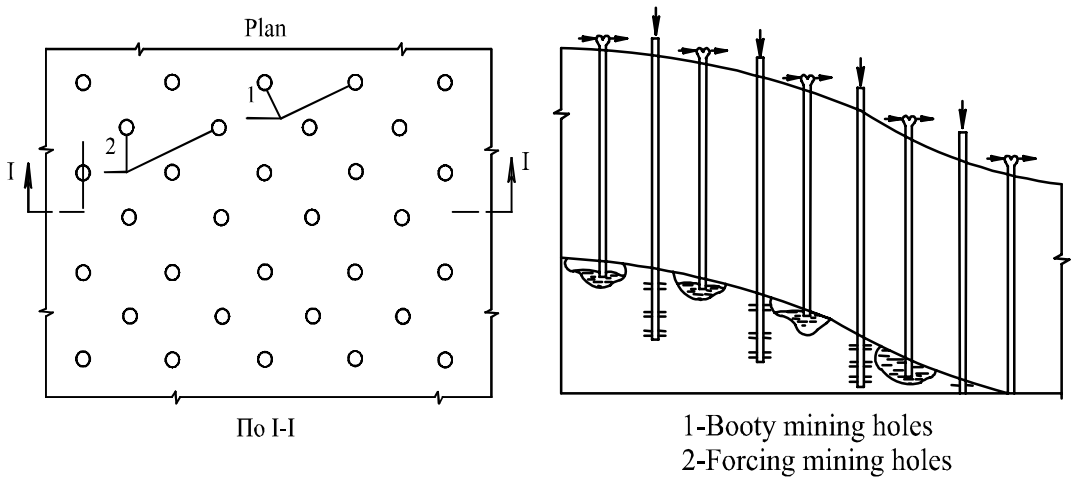

Fig. 2: The circuit of well hydro productions of bituminous breeds continuous flute with smooth omitting of coating breeds without their violation
1-mining slits; 2-delivery slits

The hydraulic fluid temperature is of great importance as well at collapse of bituminous breeds hydro monitor stream. The parameters defining efficiency of hydro monitor working out are hydraulic fluid pressure on mounting attachment of the hydro monitor and hydraulic fluid expenditure through mounting attachment, i.e. diameter of mounting attachment.

The research is carried out (Fig. 3) at the modeling stand, which is powering up temperature controlled sample piece infinitesimal mining of mesh with four forcing and one mining by slits 1; temperature controlled capacity with hydraulic fluid 2; the air engine 3; capacity for gathering of the hydro mixture organized in the course of hydro monitor washout of breed 4; vacuum pump 5; hot water from the thermostatically controlled chamber 6.

The sample piece infinitesimal mining meshes represented metal box filled with bituminous breed, containing 15% of bitumen. The box had double walls, through cavity between them hot water for maintenance with necessary constant of temperature of rock mass was pumped over.

On sample piece edges was placed the metal handsets punched in the heel imitating forcing slits.

In the sample center was placed a sample piece of the mining aggregate, representing two concentrically located handsets connected from above and from below. The internal

handset serves for removal of breed of hydro mixture is organized at washout. The space between internal and external handset serves for hydraulic fluid feeding to the mounting attachments placed on the heel of external handset which shape the streams, which are washing away breed.

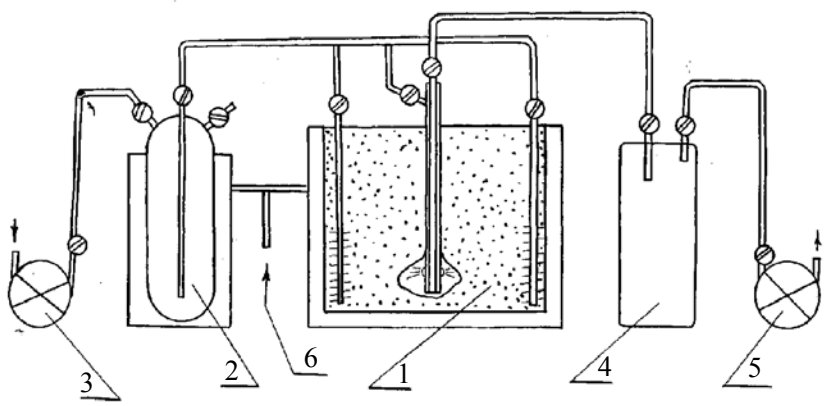

Fig. 3: 1 is the temperature-stabilized model of elementary booty cell; 2 is the temperature-stabilized capacity for a working liquid; 3 is a compressor; 4 is a capacity for collection of slurry; 5 is a vacuum-pump; 6 is hot water from a thermostat

The hydraulic fluid is filled into the temperature controller the capacity withstanding high pressure. The hydraulic fluid is forced in sample piece by pressure of the compressed air given by the air engine.

Formed at washout hydro mixture, it is sucked away in modular capacity at the expense of the rarefying created by vacuum pump. Connecting piping are stocked by cranes and valves, allowing to regulate hydraulic fluid expenditure on washout of breed and rate of removal of the formed hydro mixture.

In the first series of experiences, influence of temperature on the hydraulic fluid on intensity of washout of bituminous breeds was studied.

Experiments are carried out with two samples of bituminous breeds. The first contained 10% of the bitumen, the second – 15%. In the sample a piece mining meshes forced hydraulic fluid, which temperature is changed from 20^{o}C to 100^{o}C with interval in 20^{o}. At the exit was defined tightness of the formed hydro mixture. Results of experiments are shown on Fig. 3.

Apparently from graphs, intensity of washout bituminous breeds is diminished with increase in the contents of bitumen in them. This results from the fact that more amount of bitumen links sand particles in breed more strongly.

Intensity of washout starts to increase sharply at hydraulic fluid temperature 50-60^{o}C and reaches maximum at temperature 90-95^{o}C, and then slumps. This results from the fact that at this temperature intensive volatilization begins, tightness of hydraulic fluid is diminished and force of stream effect is accordingly diminished by stemming.

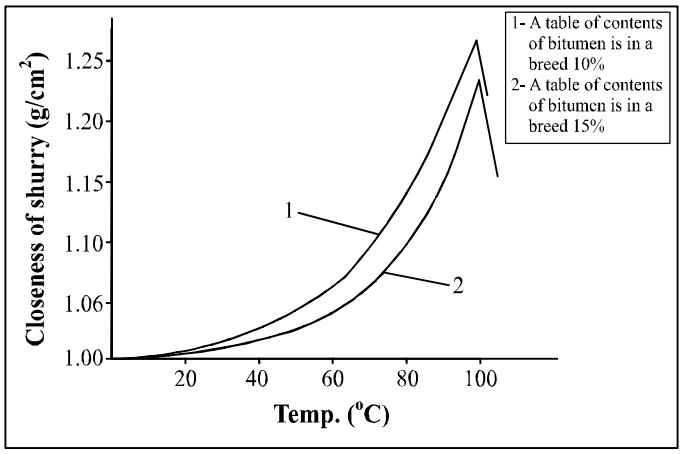

Fig. 4: Change of tightness of hydro mixture depends on hydraulic fluid temperature, 1- the bitumen contents in breed of 10%; 2- the bitumen contents in breed of 15%

The maximum tightness of hydro mixture reaches 1.22 g/sm^3 – 1.26 g/sm^3 that at magnitude of bulk weight of bituminous breeds of 2.0-2.2 g/sm^3 corresponds to ratio firm to liquid on volume 1:4-1:3.

In the second series of experiences, influence on intensity of washout of pressure of hydraulic fluid on mounting attachment of well hydro monitor was studied. The hydraulic fluid temperature thus made 90^{o}C. The pressure on mounting attachment changed in the range of 0.5-1.5 DBa. At each value of pressure to sample piece forced identical amount of hydraulic fluid. After each experiment was defined amount extracted bituminous breeds.

As experiments have shown, magnitude of pressure of hydraulic fluid on hydro monitor mounting attachment makes strong impact on efficiency of washout of breed (Fig. 4). With increase in pressure efficiency of washout is augmented, and the more strongly, than the pressure is more augmented. So, if at increase in pressure with 0.5 to 1.0

DBa the exit bituminous breeds is augmented by unit of volume of hydraulic fluid in 1.5 times at increase in pressure with 1.0 to 1.5 DBa it grows in 3-3.5 times.

The received regularities presented on Fig. 4 and 5 are approximated by analytical dependences of aspect:

$$y = a1 \text{ x } n1 \text{ (g/sm}^3\text{)} \quad \ldots(1)$$

$$z = a2v \text{ n2} + z\,0 \quad \text{(relative units)} \quad \ldots(2)$$

Where y – Tightness of hydro mixture (g/sm^3)

x – Hydraulic fluid is h-temperature (grad C).

z – Exit of bituminous breeds on unit of volume of hydraulic fluid;

v – Pressure on mounting attachment of hydro monitors, a1, n1, a2 and n2– defined ground experiences under formulas:

$$y1 = a1\, x_1^{n1}, \; y2 = a2\, x_2^{n2} \quad \ldots(3)$$

$$n1 = \frac{\ln y_1 / y_2}{\ln x_1 / x_2}; \; a1 = \frac{y_1}{x_1^{n1}}; \; a1 = \frac{y_2}{x_2^{n1}} \quad \ldots(4)$$

$$n2 = \frac{\ln z_1 / z_2}{\ln v_1 / v_2}; \; a2 = \frac{z_1}{v_1^{n2}}; \; a2 = \frac{z_2}{v_1^{n2}} \quad \ldots(5)$$

In formulas y1; y2; x1; x2; z1, z2; v1; v2– characteristic points at the beginning and at the end of experiences.

For reduced graphs (Fig. 4 and 5) parameters (2) and (3) have following values:

n 1.1 = 0.21; n1.2 = 0.188; a1.1 = 0.48; a1.2 = 0.51

n 2.1 = 1.54; n2.2 = 1.45; a2.1 = 0.34; a2.2 = 0.51

In the third series of experiences, influence on efficiency of washout bituminous breeds of expenditure of hydraulic fluid was studied.

Experiments are carried out at hydraulic fluid temperature 90^{o}C and pressureon mounting attachment 1.5 DBa. Hydraulic fluid expenditure changed diameter of mounting attachment of the hydro monitor.

As experiments have shown, change of expenditure of hydraulic fluid makes comparative small impact on efficiency of washout of breed (Fig. 5). So, increase in diameter of mounting attachment twice, i.e. the increase in expenditure of hydraulic fluid four times, augments exit bituminous breeds only by 50-60%.

So, from three factors influencing efficiency of bituminous breed washout is hydraulic fluid temperature, hydraulic fluid pressure on mounting attachment The hydro monitor and hydraulic fluid expenditure through mounting attachment, the temperature and pressure are defined. Fluid expenditure through hydro monitor mounting attachment makes considerably smaller impact on efficiency of washout.

Optimum parameters of well hydraulic technology of working out bituminous breeds. For the operations of working out bituminous breeds method well hydraulic technology along with natural factors (deposit morphology, the contents and bitumen performance in breed; stores bituminous breeds and bitumen in them; character and physic mechanical properties bituminous breeds and breeds, their containing; hydro-geological conditions of deposit) defining technological parameters are following parameters.

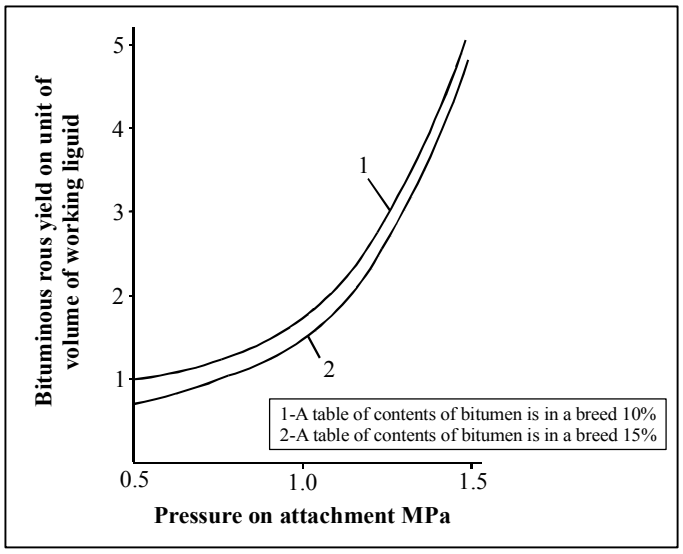

Fig. 5: Dependence of an exit bituminous breeds on volume unit in a hydraulic fluid from a pressure on a hydromonitor mounting attachment (hydraulic fluid temperature 90°C). 1 – the bitumen contents in breed of 10%; 2 – the bitumen contents in breed of 15%

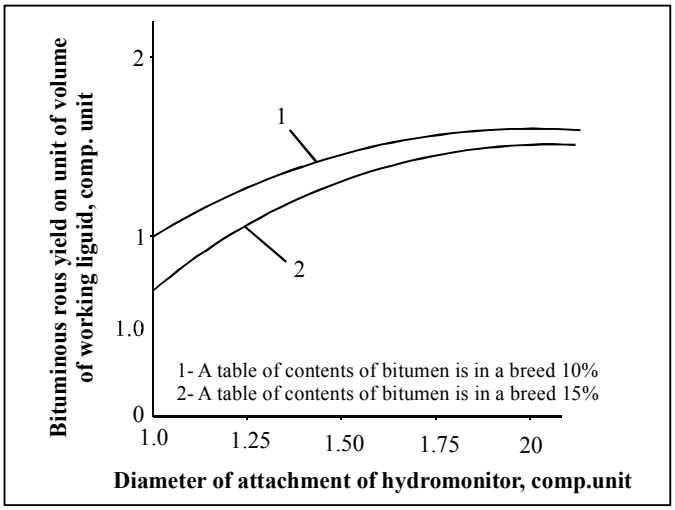

Fig. 6: Dependence of exit bituminous breeds on unit of volume of hydraulic fluid from diameter of mounting attachment of the hydro monitor 1 – the bitumen contents in breed of 10%; 2 – the bitumen contents in breed of 15%

(i) Capacity of the work.

(ii) Mesh of arrangement of slits.

(iii) An amount of simultaneously operating mining and forcing slits.

(iv) Capacity of one mining slits.

(v) Hydraulic fluid expenditure on one low level cell (mining and forcing slits).

Capacity of the operation in all cases is defined by stores of deposit and period of its working off. Capacity on bituminous breed is equal.

$$Ap = \frac{З_{П} \bullet \varepsilon}{T \bullet 100} \text{ (t/year)} \quad \ldots(6)$$

Where Зп – Stores bituminous breeds;

ε – Extraction of bituminous breeds at extraction, %;

T – A period of working off deposit, years.

Capacity on bitumen is equal:

$$Ab = \frac{З_{б} \bullet \varepsilon}{T \bullet 100} \text{ (t/year)} \quad \ldots(7)$$

Where Зb – Bitumen stores in a deposit, т – Zb = Zp • α,

α – The bitumen contents in breed, %

$$Ab = \frac{З_б \bullet \alpha}{T \bullet 100} \text{ (t/year)}$$

The mesh of arrangement of slits defines technological and economic efficiency of well hydro productions.

The distance between mining slits, there is less more effectively and with smaller losses are extracted from bowels of bituminous breeds. At the same time expenditures thus increase by drilling mining and forcing slits.

Generally, cost of the commodity output is received from one low level cell should pay back expenditures for drilling of slits, mounting mining equipment, working costs on extraction and to ensure necessary degree of profitability.

Commodity output cost defined valuable bitumen, stores bituminous breeds, having one mining mesh, the bitumen contents in breed and its extraction from bowels at extraction.

$$T = \frac{Ц \bullet S_d \bullet m \bullet \gamma_p \bullet \alpha \bullet \varepsilon}{100 \bullet 100} \quad \ldots(8)$$

Where Ц – Cost price of 1 t bitumen;

Sd – The deposit area on one mining mesh ($м^2$)

m – Power of deposit (m)

α – The bitumen contents in breed (%)

γp – Bulk weight bituminous breeds (t/m^3)

Total expenditures on commodity output manufacture is developed of expenditures on drilling and the equipment mining and forcing slits and working costs on extraction and processing bituminous breeds, which power up buffer expenditures on installation for preparation, transportation of solutes and processing bituminous breeds.

$$З = Zbu + Zbn + Ze \quad \ldots(9)$$

Then: $$\frac{Ц \bullet S_Э \bullet m \bullet \gamma \bullet \alpha \bullet \varepsilon}{100 \bullet 100} = (1 +) \text{ (the Itch + Zbn + Zd)}, \quad \ldots(10)$$

Where K – factor of profitability, unit fraction.

from here: $$Sэ = \frac{100 \bullet 100(1+K)(З_{бд} + З_{бн} + З_{д})}{Ц \bullet m \bullet \gamma \bullet \alpha \bullet \varepsilon} \ (м^2) \qquad \ldots(11)$$

Knowing the area of the deposit having one mining slit, it is possible to define distance between slits which depends on under what circuit slits are located.

Every mining slit is the center of infinitesimal mining mesh which are powering up also forcing slits – three at arrangement of slits on the triangular mesh, four – at the quadrangular mesh, six – at hexagon. Thus each forcing slit is also a part of next infinitesimal mining meshes.

At the triangular shape infinitesimal mining meshes (Fig. 6) every mining slit is surrounded by three forcing. At the same time each forcing slit is surrounded by six mining. The amount of forcing slits at the triangular shape of low level cell makes twice less amounts mining slits.

At the square shape infinitesimal mining meshes (Fig. 7) every mining slit is surrounded by four forcing. Precisely also each forcing slit is surrounded by four mining. Hence, number of mining and forcing slits at such circuit of their arrangement are equal.

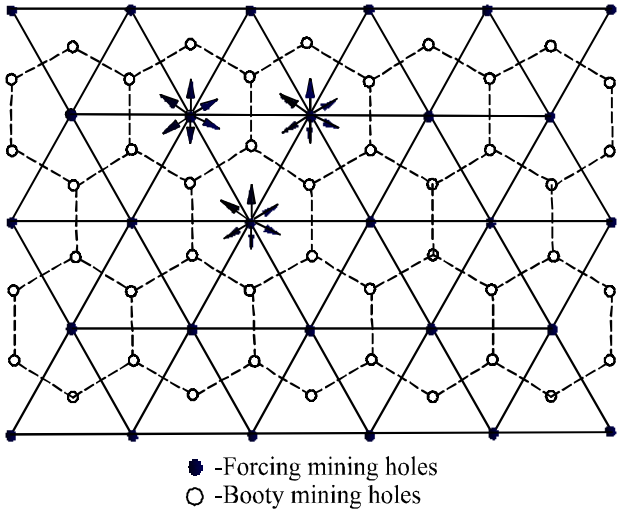

Fig. 7: The circuit of arrangement of slits at the triangular shape infinitesimal mining meshes·- forcing slits, ○ - mining slits

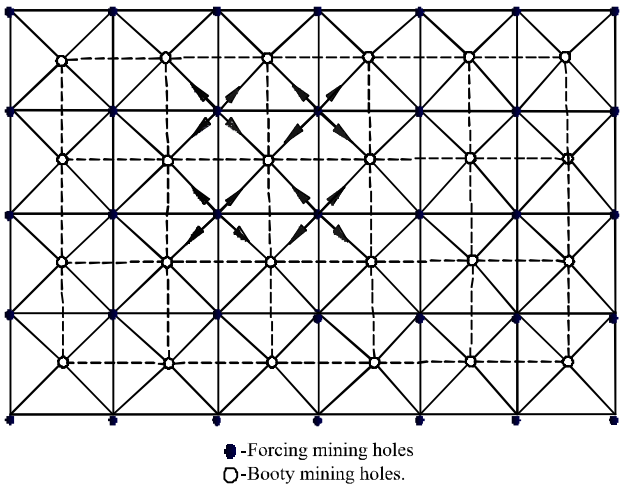

Fig. 8: The circuit of arrangement of slits at the square shape infinitesimal mining meshes

At the hexagon shape infinitesimal mining meshes (Fig. 8), every mining slit is surrounded by six forcing, and every forcing – three mining. Number of forcing slits at such circuit of their arrangement twice more than mining.

The shape infinitesimal mining meshes is defined by the circuit of arrangement of forcing slits.

At the triangular shape the area of one mesh is equal.

$$Sэ = \frac{1}{4} \bullet \ell^2 \sin 60^0 \qquad \ldots(12)$$

Then: $\ell = \sqrt{\frac{4S_э}{\sin 60^0}}$.

At the square shape the mesh area:

$$Sэ = \ell 2;\ \ell = \sqrt{S_э} \qquad \ldots(13)$$

At the hexagon shape the mesh area:

$$Sэ = 3\ell 2 \bullet ctg60^0 \qquad \ldots(14)$$

$$\ell = \sqrt{\frac{S_э}{3ctg60^0}}$$

The shape infinitesimal mining meshes is defined by the circuit of arrangement of forcing slits. Mining slits are drilled in the center of meshes.

The circuit of arrangement of slits defines amount of the hot hydraulic fluid is given to array for its heat-up and weakening of adhesive links of bitumen with breed is manifold block 5.[5]

The minimum quantity moves at triangular mesh of slits, maximum – at hexagon. The more hydraulic fluid moves in an array, the more strongly it gets warm and the more strength of breed decreases.

Hence, the circuit of arrangement of forcing slits on triangular mesh, it is recommended for easily washed away types bituminous breeds, and on hexagon mesh for difficultly washed away. On square mesh, it is possible to recommend arrangement of slits for average conditions.

Knowing the area of one infinitesimal mining meshes and deposit total area, it is possible to define amount of mining slits, which simultaneously are in operation.

$$N = \frac{S_{общ}}{S_{Э}} \quad \ldots(15)$$

Capacity of one mining slits on bituminous is equal to breed:

$$Qp = \frac{Ap}{N \bullet t} \text{ (t/days)} \quad \ldots(16)$$

Where Ap – Capacity of the operation on bituminous to breed (t/year)

t – Number of days of operation of the operation in a year.

Capacity of mining slits on bitumen is equal:

$$Qb = \frac{A_{Б}}{N \bullet t} \text{ (t/days)} \quad \ldots(17)$$

Where Ab– capacity of the operation on bitumen (t/year).

Capacity of mining slits on bituminous to breed defines hydraulic fluid expenditure on breed washout:

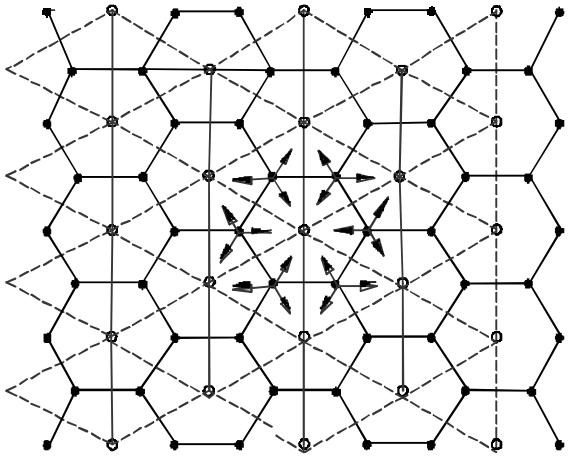

Fig. 9: The circuit of arrangement of slits at the hexagon shape infinitesimal mining meshes- forcing slits; ○ - mining slits

$$Vd = qQп\bullet \ (m^3/days) \qquad \ldots(18)$$

Here q – specific expenditure of hydraulic fluid, m^3/t, it is defined on the basis of the experimental data stated above.

The common expenditure of hydraulic fluid on one infinitesimal mining mesh is equal to the sum of expenditures through mining and forcing slits:

$$Vоб = V_д + nнV_н \ (m^3/days) \qquad \ldots(19)$$

Where nn– number of the forcing slits having on one mining slit.

The hydraulic fluid flown in array bituminous breeds from forcing slit to mining is a filtration flow. Its parameters are defined by the formula of Darsy. From it follows:

$$V = KFJ\bullet\bullet \ (m^3/days) \qquad \ldots(20)$$

Where K – Filtration factor, m/days;

F – The area of section of flow ($м^2$)

J – A hydraulic gradient. $F = ℓm\bullet \ (м^2)$

Where ℓ – Distance between forcing slits (m)

m – Power of a deposit (m).

$$J = \frac{H}{\ell_1}$$

Where H – Pressure in pressure line (m.wat.st.)

ℓ1 – Distance from forcing slit to mining (m)

Then: $$V_H = K\ell m \bullet \bullet \bullet \frac{H}{\ell} \ (m^3/days) \quad \ldots(21)$$

$$V_{об} = qQ_п \bullet + n \bullet K\ell m \bullet \bullet \bullet \frac{H}{\ell_1} \ (m^3/days) \quad \ldots(22)$$

Where n = 0.5 at the triangular shape infinitesimal mining meshes, 1.0 at the square shape and 2.0 at the hexagon shape.

CONCLUSION

(i) The hydraulic technology of working out of bituminous breeds (patent РК № 27096) is developed new well. Experimental researches at the modeling stand have shown that at well hydraulic technology of working out of bituminous breeds use as a clear water hydraulic fluid, even hot, not effectively since it does not disturb adhesive link of bitumen with lean material and collapse particles bituminous breeds does not almost occur.

(ii) At well hydraulic technology in quality of hydraulic fluid for extraction bitumen from bituminous breeds, it is expedient to use the washing water alkaline solution, which composition is developed of D. A. Kunayev.

(iii) Well hydraulic technology of working out bituminous breeds as have shown experimental researches at the large-scale modular stand, is without waste and is directed on deriving of commodity output in the form of pure bitumen or bituminous emulsion.

(iv) Considering that coating breeds of deposits bituminous breeds are usually unstable, and bituminous breeds with temperature increase lose carrying capacity, it is offered to develop such deposits method of well hydraulic technique continuous systems with smooth omitting of coating breeds without their violation. Thus, in process of increase in the area of flute coating breeds under body weight smoothly are lowered, and warmed up and lost carrying capacity bituminous breeds are wrung out from the central part of a developed zone to periphery that promotes heightening of economic efficiency of working out and lowering of losses bituminous breeds.

(v) In basic technological parameters, efficiency well hydraulic technology of working out bituminous breeds the hydraulic fluid temperature, pressure on hydro monitor mounting attachment, hydraulic fluid expenditure through the hydro monitor are defining.

Definition of the specified parameters spent at the large-scale modeling stand, which is powering up: temperature controlled sample piece infinitesimal of mining meshes with four forcing and one mining slits; temperature controlled capacity with hydraulic fluid; the air lift; capacity for hydro mixture gathering; vacuum pump, hot water from the thermostatically controlled chamber.

Experiments have shown that intensity of washout sharply increases at hydraulic fluid temperature 50-60C° and reaches maximum at 90-95C°. At increase in pressure with 0.5 to 1.0 DBa the exit of bituminous breeds increases by unit of volume of hydraulic fluid in 1.5 times, and at increase with 1.0 DBa to 1.5 DBa - in 3.0-3.5 times. Heightening of expenditure of hydraulic fluid in 4 times, augments exit of bituminous breeds only by 50-60%

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