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Research on Coiled Tubing Drill Plug Technology and Matching Tools

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Abstract: ***With the development of horizontal wells, the process of using composite bridges and cracking is becoming more and more mature, and the corresponding composite bridge plug drilling process has also been greatly developed, and it is widely used in practice. Continuous oil pipe (CT) is one of the most common and effective methods for drilling composite bridges.***

Keywords: Horizontal well; Coiled tubing; Plug drilling

1. Introduction

Coiled tubing drilling is usually divided into cableless coiled tubing drilling and cabled coiled tubing drilling according to whether the downhole drilling system is transmitted and controlled by cable.. In recent years, CT has become the main operating tools of horizontal wells with its advantages of fast drilling, rapid drilling, and inherent well -living well[1].By comparing the operating parameters of traditional oil pipes and continuous oil pipe drilling, the continuous oil pipes have greatly reduced the requirements of the drills, reducing the labor intensity, and have a wider range of application prospects in high -risk wells and deep wells. In the operation of drilling bridge plugs, for wells with complicated strata and high risks of well control, using continuous oil pipe drilling. Although the cost is relatively high, its mature mechanized operation, small labor intensity, debris grind more The characteristics of small and low risk of card diamonds make it more in line with modern operations, reduce human labor, people -oriented, safeguard, and the application range of continuous oil pipe drilling is more widely used.

The prominent problems in the operation of CT diamond -grinding bridge mainly show the following aspects: a low efficiency of drilling; b slow back speed on the abrasive dandruff; c the situation of the horizontal well drilling process is complicated High, easy to encounter special wells.. The key points to solve the above major problems are the improvement of the efficiency of CT diamond grinding operations. It is necessary to systematically analyze the working parameters of the CT diamond grinding supporting tools and the drilling operation parameters to obtain effective technical solutions, thereby greatly improving the operating efficiency.

2. Tool assembly for coiled tubing plug drilling

2.1 Domestic technology overview

The continuous oil pipe grinding diamond has the characteristics of drilling pressure control, the well control conditions, long horizontal sections, and continuous construction. It has been widely used in foreign countries to wash well, sand rinse, and grinding diamond construction. [2] Among them, in the construction of composite bridge plug drills, the 2 -inch continuous oil pipe is the first choice. The single vehicle can carry continuous oil pipe length of 4500m, up to 1000m in the horizontal well section. At the same time , Can meet the need for motor power transmission and abrasive background in the well. In China, continuous oil pipe equipment has been introduced and produced in China, and the operating control performance meets the requirements. The research on continuous oil pipe grinding drilling bridges is widely developed.

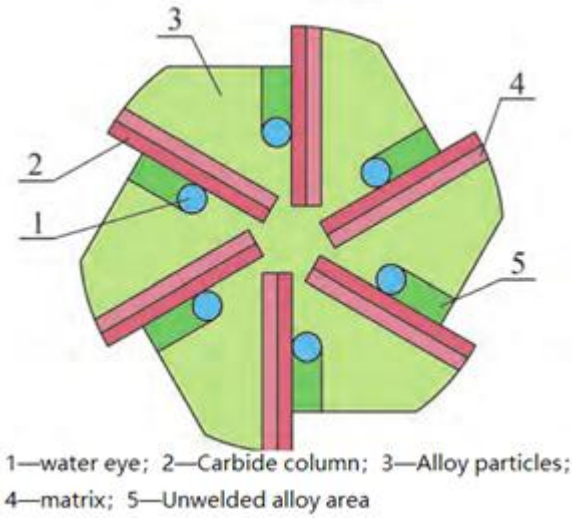

Figure 16: Sharpening mill shoe layout

In the Fuling shale gas field in my country, some wells will first choose a well -sealing well. During the sealing process, the cement plug and the composite bridge are seized. In the later period, in order to repeat the use of the well and increase the oil collection rate, the cement plug and composite bridge plug were reopened. CT diamond grinding is rapid and efficient, and the advantages of CT quickly drilled, quickly drilling, and inherent well -living well capabilities. In the oil field, CT diamond grinding has become a key technology to seize the well. It can provide conditions for subsequent drilling cement plug operations, and finally resume mining and increase the oil collection rate

2.2 Overview of foreign technology

At present, horizontal fracture production is still the main production method of the shale layer. Most of the wells use the "Fracture Bridge Crowth Horon Operation" method to complete [3]. This method requires that after the fracture operation is completed, the connection pipe with a motor or a continuous oil pipe drill composite bridge is used. It is estimated that the number of drilling composite bridges in the United States only reaches 100,000 to 14,000 each year. At present, the most common operation of the United States continuous oil pipe device is composite bridge grinding milling. More than 10,000 such tasks may be completed every year [4]. The composite bridge plug (or fracture) is mainly set in horizontal wells to isolate the crack stage [5]. In this industry that is cherished, after using motor and mill or drill bit to fracture production, operators usually rely on the continuous oil pipe (CT) device instead of a well -repairing machine to remove the composite bridge. [6] Energy companies have been seeking to remove the maximum number of bridges at a faster drilling speed. However, energy companies are increasingly aware that high mechanical drilling speeds will cause large blocks to block fragments after removal. These fragments will pollute the ground equipment or interfere with subsequent oil well operations. Therefore, the removal of the blockage should be aimed at the maximum overall efficiency, rather than the shortest blocking time. As the oil company finds a way to reduce costs, the field of well has become the main goal of change. Continuous oil pipe operations reduce production costs through eliminating the demand for well -repairing machines in certain applications. The use of continuous oil pipe device can work faster and more economical. If proper plans before the operation, drilling bridges can become a high -cost operation[7]. Multi -zone fracturing technology is widely used in the oil and gas industry, which effectively improves oil and gas output. Multi -layer fracture is different from other fracturing methods, because it needs to use a layer isolation device during the production of production, which is usually called a composite bridge plug. After the fracture is increased, these cement rings must be removed for operators for traffic testing, and then oil wells are put into production. The most effective method is to use a continuous oil pipe (CT) to grind a composite bridge from the well tube [8]. This method has been applied and proved in many cases.

In order to help reduce drilling time, increase economy, minimize risks, and reduce the fatigue of the CT system, PDC drills of five to six leaflets are recognized as the best choice in this case [9]. This type of drilling machine has acceptable drill speed (ROP), and there will be no risk of losing motion components, and minimize motor stalls. When the diameter difference between the pipe tube is correct, the PDC drill of the five to six -leaf pads can also minimize the dandruff size [10], which helps reduce the risk of the card well and increase the subsequent oil well output.

At present, the most mature mastery of shale gas exploration and development technology is the United States. Two experiences have been formed in the process of commercialization of shale gas abroad: one is the development horizontal well, increasing the discounted area, and the other is to transform the storage volume [11]. Among them, the most commonly used technology renovation of reservoir volume is to fracture horizontally in horizontal wells. The bridge is divided into septum barrel space, and the shooting holes and fracture construction are performed layerly one by one. This technology can fracture the specific oil and gas display layer, the fracture and cracking position is accurate, and it can quickly achieve the smooth flow of the well in the well. The continuous oil pipe drill segmentation technology studied in the application project assumes the role of rapid dredging the well in the well after section fracture construction [12].

3. Casing Study

After many increasing production operations recorded by the case, the composite bridge plug is used for regional isolation strata. Each well finished well and milling cycle is about one month[13]. The bridge is placed in the well and is exposed to the conditions of pumping, back wheeing, and wells. Each operation is a degradable manifold, dandruff capture, and similar well -bottoming tool components to ensure the safe monitoring of the abrasives in the well. These three wells are in different areas, but the well conditions are similar to depth.

In August 1998, a pipe of the pipe was 4.5 inches (line weighed 11.6 pounds/feet) and the inner diameter was 3.875 inches. The underlying pressure BHP is about 5000 PSI, and the depth of the shooting hole is 8508-8760 FT. The top is set at 8900 FT, below the top of the top is 9260-9262 FT, and the bottom is set at 9366FT. The bottom is from 9608 to 9781 FT, with a total depth of 9835FT. Each bridge is fixed and 10FT thick cement is placed above. The operation is equipped with a 1-3/4-inch continuous oil pipe device, a water conservancy pump and a ground reflux device. The underlying drill combination (BHA) consists of a 2-7/8-inch sleeve, connector, back pressure valve, hydraulic disconnection, mud motor, and 3-5/8-inch five-leaf milling cutter. Water containing lubricants is used as a grinding liquid for planning. A pressure test was performed on the anti-spray. The continuous oil pipe was transported in the well to 75-100 in/min, and the fluid passed the oil pipe speed of 0.25 BBL/min. The first bridge plug/cement was marked, and the tail slurry rate increased to 2.0 BBL/min The average diamond pressure (WOB) is 2000 pounds. After 20 minutes, the top of the top grinding and milling was completed, and then the oil pipe was run to the bottom bridge. The bottom plug/cement has been marked and after 15 minutes, it is grinded and milling at a rate of 2.0BBL/min slurry and an average drilling pressure of 2000 pounds. CT is used to circulate the interior space of the eye. After the drilling solution is pumped, the CT is proposed from the well, and the circular well continues.

Table 2: Data comparison of CT drilling and tubing drilling plug in Ø124.26mm horizontal wellbores in the same block

String type	Pipediameter /mm	Displacement /L · min^{-1}	Drill plugs /d	Pipe cost /m· ton^{-1}	Equipment cost/m	Tool fee /m	work cost /m· d^{-1}
Coiled Tubing	50.8	400~450	3~5	3.5	>1200	>65(import)	>7
Tubing	73.02	750~800	2~3	2.2	<100	<10(domestic)	<3.5

Multi -level production operations using bridges are becoming a common industry practice. The case describes the process of quickly removing the bridge. Although the operating environment is different, the milling efficiency is excellent. The average milling time of a single bridge is only 20 minutes. Through appropriate plans, CT grinding milling efficiency can be greatly improved. The following standards can improve efficiency: a Select appropriate ground equipment, such as reflux manor and dandruff capture to allow continuous milling. b Select a grinding machine with a diameter of 92 % -95 % in diameter [14]. This will ensure a good penetration and completely remove the bridge. c Select the appropriate undercut tools, such as oil pipe joints, back pressure valves, hydraulic separators, mud or pneumatic motors. When a higher cycle rate is required or not recommended to pass the nitrogen cycle through some BHA composition tools, the circular connector can be used. d Choose a fluid with small motorcycles. e When using nitrogen in the grinding fluid, it may be difficult to identify motor stalls [15], resulting in a decrease in milling efficiency. f Select the CT device that maximizes the mud rate to obtain the required circular flow rate. g Multiple weight inspections should be performed during milling to ensure that the tools or pipelines are not stuck. h When preparing drilling operations, make sure that the information about the fatigue life of the CT diamond pillar is accurate and available. Record and view the detailed information of all wells, such as depth, bottom pressure BHA, and previous work information in the well. This information will help plan the grinding and milling process and predict the possible problems.

These guidelines do not always prevent drilling efficiency. However, appropriate plans and discussions will greatly increase the opportunity to grind milling. Under normal circumstances, a single bridge plug milling time ranges from 40 minutes to a few hours[16]. If there are multiple cast iron bridges in the well, the milling operation may take a few days. This can be attributed to the material of the bridge plug and the situation of local grinding and milling. In most cases, if multiple cast iron bridges must be milled, hydraulic well repairing operations are faster than the CTU.

4. Innovative Research

The density of the composite bridge is small, and the abrasive at the bottom of the well will not quickly precipitate. Compared with the advantages of strong diamonds and high drilling efficiency of metal bridge, it is also avoided by problems such as the difficulty of abrasion. Major oil companies at home and abroad have done a lot of research on composite materials bridge plugs and composite material bridge plug drilling technology. In recent years, the Fast Drilling Plug technology developed by Harribton Company can be used for a variety of well -sized wells. After sealing the bridge, there is no need to start the pipe column or cable to continue the ejection work. Clear the composite bridge. The Quik Drill fast drilling bridge developed by Berkuz Corporation uses composite materials to make bridges. Compared with other products, it has stronger high temperature resistance and high -pressure performance.

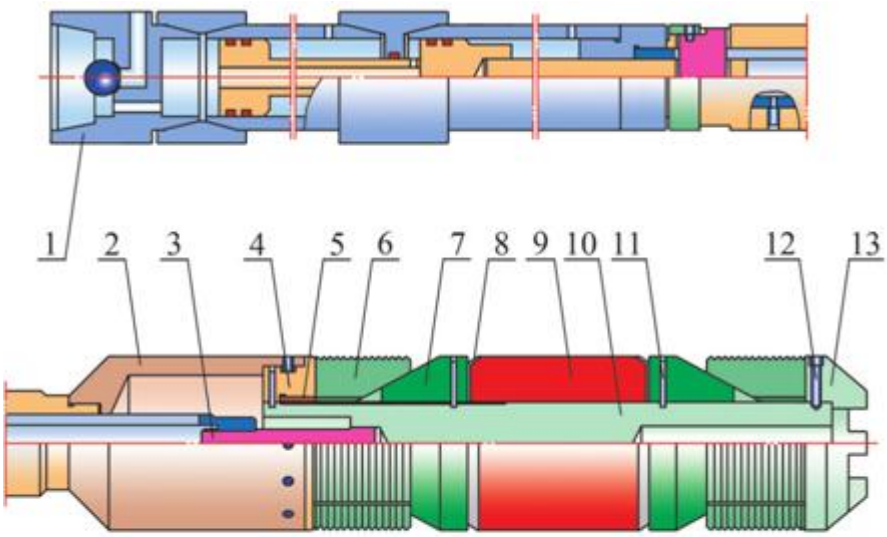

Figure 2: Schematic structure of open hole bridge plug

At present, many domestic scientific research units have invested in the research and development of composite bridges. The structural components of composite bridges, the sealing performance of the composite bridge plug, and the

drilling performance of the composite bridge plug. Yuan Fa Yong et al. (2014)[17] Make bridges with composite materials to achieve "no metallicization" by bridge plugs. Xing Hongxian et al. (2014)[18] uses a low -density composite material to design and manufacture bridges, and completes the drilling bridge jams under the mortar milling test to determine the drilling and milling time of a single bridge plug. Anjie et al. (2015) independently developed the YQY composite bridge, preferably carbon fiber enhanced epoxy resin composite materials, and optimized it in structure. The test shows that the pressure can resist 70MPa in the 120 ° C environment. reduce.

5. Conclusion

Due to the relatively late introduction of the continuous oil pipe drilling process and technology, the ability to independently produce supporting tools is not yet available. Domestic horizontal wells drilling composite bridge operation still relies on foreign companies to provide technical services. Compared with the conventional oil pipe drilling operation, the CT has a high sealing performance without the sealing performance, has high pressure construction pressure, does not need to be stood up, has strong mobility, shorten the construction cycle, reduces workers' labor intensity, and reduces operating costs. It is suitable In the next tube column drilling multi -stage bridge, no drill is required, and the construction efficiency is high. In addition, with the widespread application of multi -level reservoir transformation technology, the use of CT and screw diamond diamond drilling composite bridges has become the main technical means of oil and gas well drilling sedifier. As the depth of mining continues to increase, the difficulty of CT drilling has continued to rise, and the efficiency continues to decrease. Due to the unable to be drilled by composite mills, the difficulty of subsequent construction technology has increased.

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