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Research on the Motion Trajectory of the Blade of the Shoe Grinding Tool

Guang Lv

Tianjin Branch of CNOOC China Limited, Tianjin 300450, China

Abstract: ***In view of the low efficiency of washover milling/milling, the new type of lead eye grinding shoe can greatly improve the operation efficiency and shorten the construction period of adjustment well project, so as to achieve the purpose of reducing cost and increasing efficiency. However, the movement track of the blade of the leading eye grinding shoe tool affects the design result of the tool, so the study on the movement track of the blade of the tool is carried out, and the study shows that: when the size of the leading eye grinding shoe righting wing is certain, the maximum size of the leading hole grinding shoe blade is related to the size class of the casing to be processed, and has nothing to do with the size class of the upper wellbore casing.***

Keywords: Collar-eye shoe grinding; Blade movement; Research**.**

1. INTRODUCTION

Compared with the conventional wellbore (7 ", 8-1/2" and 12-1/4 "), the large wellbore refers to the wellbore larger than 12-1/4" [1]. At present, some blocks of Bohai Oilfield have entered the middle and late development stage, and the production and service time of oil and gas wells is long, so it is inevitable that the production will decline or the failure wells will be shut down; At the same time, the number of slots on offshore production platforms is limited, but in order to stabilize and increase production in old blocks, it is one of the effective means to use old borehole sidetracking to arrange adjustment wells;

In the preparation operation of processing each layer of casing to meet the requirements of large hole sidetracking, the conventional cutting and washover process can meet the requirements of processing single layer or processing multiple layers of casing. However, due to the restriction of well conditions, the existing washover tools may cause problems such as backing pressure, casing splitting, casing leakage, conductor leakage, and severe wellhead vibration. In the case of complex well conditions, it can only be milled by multi-blade collar grinding shoes. However, the calculation of the blade motion trajectory of the leading eye grinding shoe tool is very critical, so it is necessary to carry out the research on this subject.

2. OVERVIEW OF LEAD EYE GRINDING SHOES

During the drilling and completion process of oil and gas wells, the drilling and shoe grinding tool is an important downhole operation equipment. It is mainly used for repairing wellbore walls, removing obstacles, and keeping the wellbore unobstructed. In this process, the precise calculation of the blade movement trajectory is particularly crucial, as it directly affects the tool's operational effectiveness and efficiency. Therefore, conducting research on the movement trajectory of the blade wing of the eye grinding tool has important theoretical significance and practical value. Firstly, we need to understand the basic structure and working principle of the collar eye shoe grinding tool. This type of tool usually consists of a main body and one or more extendable blade wings, which are embedded with hard alloy blades and cut the wellbore through high-speed rotation. Due to the complex and ever-changing working environment underground, the movement trajectory of the blade is influenced by various factors, including the shape and diameter of the wellbore, the hardness of the wellbore wall, and the performance of the tool itself. Therefore, in order to achieve efficient underground operations, precise control of the movement trajectory of the blade wing is necessary. To achieve this goal, we need to establish a mathematical model to describe the motion law of the blade wing. This involves complex mathematical calculations and physical analysis, such as kinematic equations, dynamic equations, and finite element analysis. Through these methods, we can simulate the motion state of the blade under different working conditions, predict its cutting effect, and optimize the design parameters and usage strategies of the tool based on this. At the same time, we also need to consider the uncertainty factors in actual construction. For example, changes in underground temperature and pressure may cause deformation of the blade material; The properties of drilling fluid may affect the cooling and lubrication effects of the blade; The unevenness of the wellbore may lead to uneven stress on the blade wings. These factors will all have an impact on the motion trajectory of the blade, so it is necessary to fully consider these practical situations in research to improve the accuracy and practicality of the model.

3. CALCULATION OF BLADE MOTION TRAJECTORY OF 7 ″ COLLAR EYE SHOE GRINDING TOOL

At present, the 9-5/8 ″ casings in Bohai Oilfield are mainly 47 pounds and 40 pounds, and the 7 ″ liners are mainly 29 pounds and 23 pounds; In order to determine the blade size of the 7 "collar sharpening tool and clarify the movement trajectory of the collar sharpening tool, all 9-5/8" casings and all 7 "tailpipes were combined, such as: 47 lb 9-5/8" casings under 7 "tailpipes (29 lb and 23 lb); 40 lb 9-5/8quot; casings under 7" tail pipes (29 lb and 23 lb). Figs. 1 and 2 are 7 "liner under 47 lb 9-5/8" casing (29 lb and 23 lb); figs. 3 and 4 are 7 "liner under 40 lb 9-5/8" casing (29 lb and 23 lb).

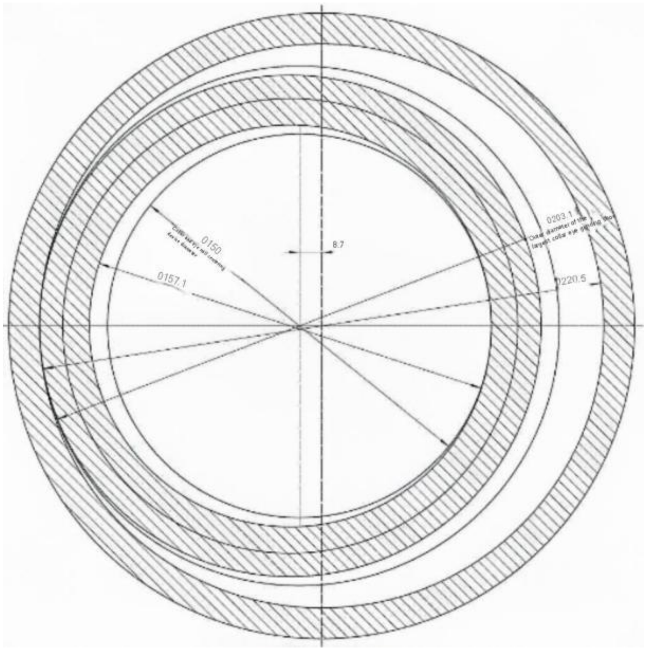

Figure 1: 29lb 7 ″ liner under 47lb 9-5/8 ″ casing

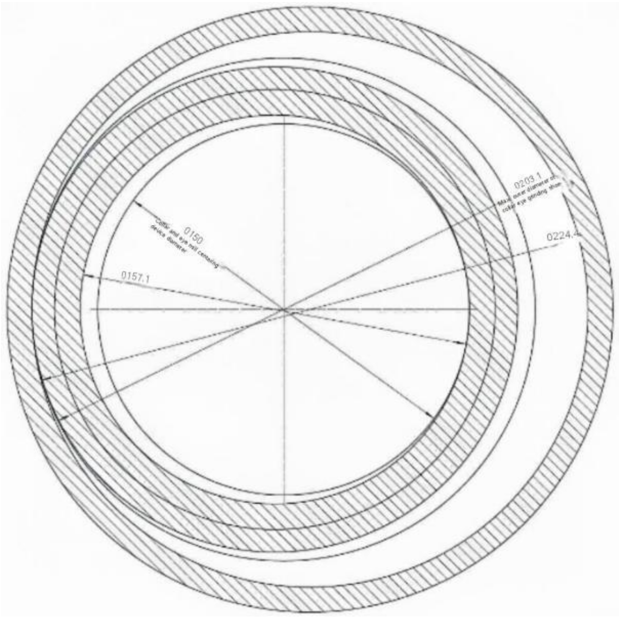

Figure 2: 23 lb 7 ″ liner under 47 lb 9-5/8 ″ casing

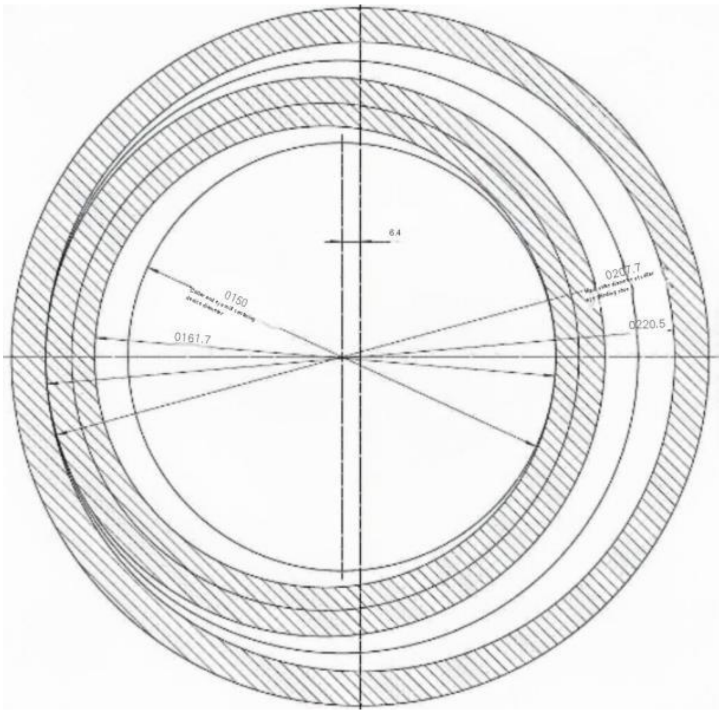

Figure 3: 29lb 7 ″ liner under 40lb 9-5/8 ″ casing

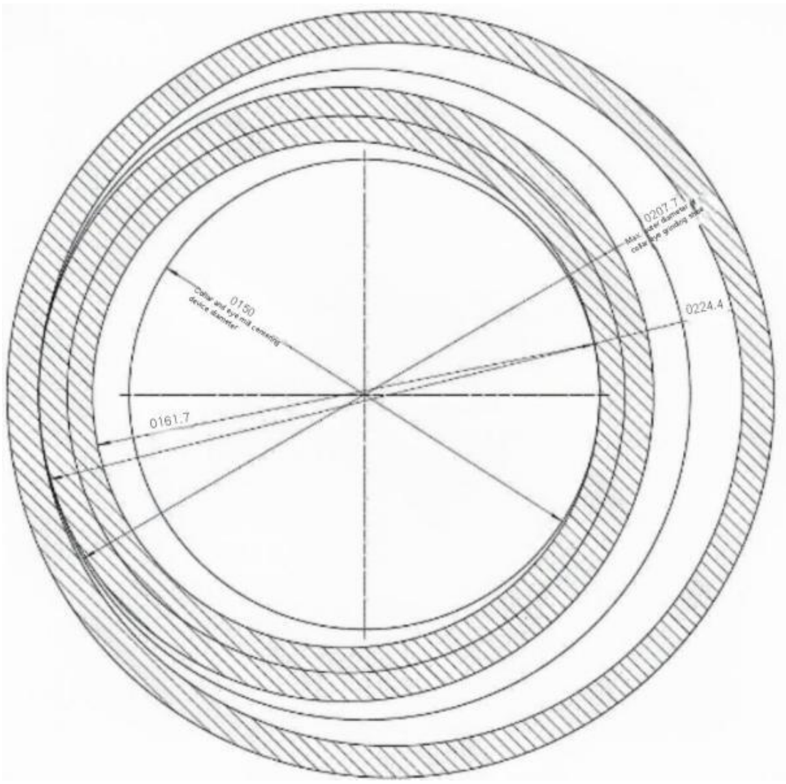

Figure 4: 23lb 7 ″ liner under 40lb 9-5/8 ″ casing

It can be seen from Figure 1 and Figure 2 that when the size of the leading hole grinding shoe righting wing is fixed, the maximum size of the leading hole grinding shoe knife wing is related to the size class of the casing to be processed, and has nothing to do with the size class of the casing in the upper wellbore.

4. CALCULATION OF BLADE MOTION TRAJECTORY OF 9-5/8〃 COLLAR EYE SHOE SHARPENING TOOL

At present, the 13-3/8〃casings in Bohai Oilfield are mainly 68 pounds and 61 pounds, and the 9-5/8〃casings are mainly 47 pounds and 40 pounds; In order to determine the blade size of the 9-5/8 "collar sharpening tool and to clarify the movement trajectory of the collar sharpening tool, all 13-3/8" casings and all 9-5/8 "casings were combined, such as: 9-5/8'under 68 lb 13-3/8'casings (47 lb and 40 lb); 9-5/8〃casing under 61 lb 13-3/8〃casing (47 lb and 40 lb). Figures 5 and 6 are 9-5/8 "casings (47 and 40 lbs.) Under 68 lbs. 13-3/8" casings; Figures 7 and 8 are 9-5/8 "casing (47 and 40 lbs.) Under 61 lbs.

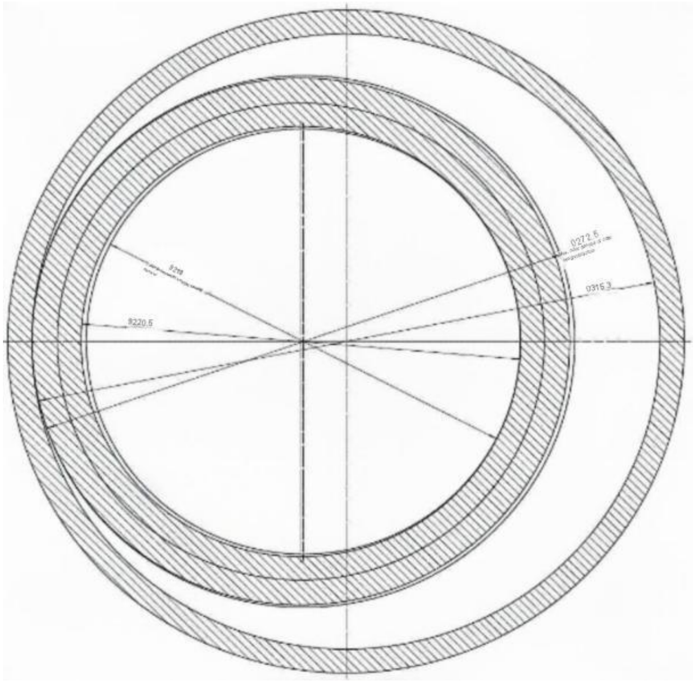

Figure 5: 68 lbs 13-3/8〃Casing Down 47 lbs 9-5/8〃

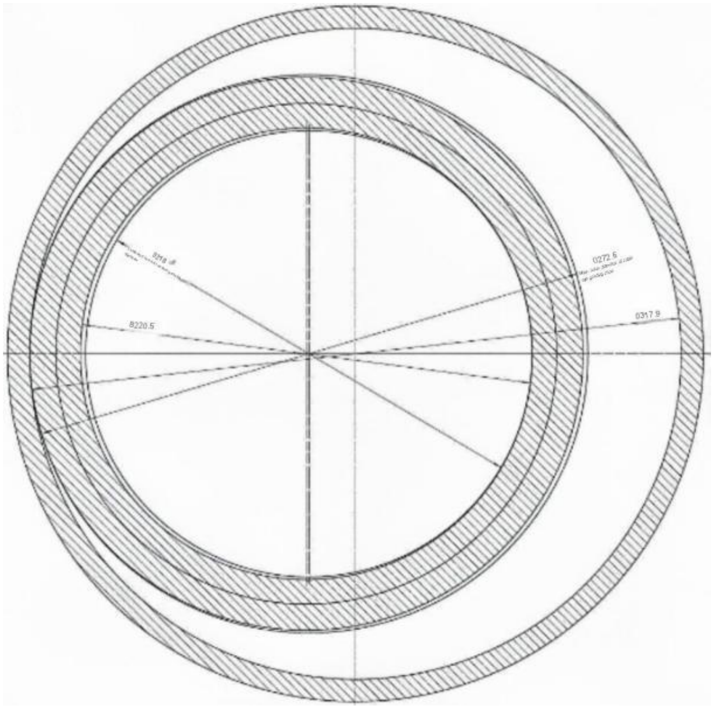

Figure 6: 68 lbs 13-3/8〃Casing Down 40 lbs 9-5/8〃

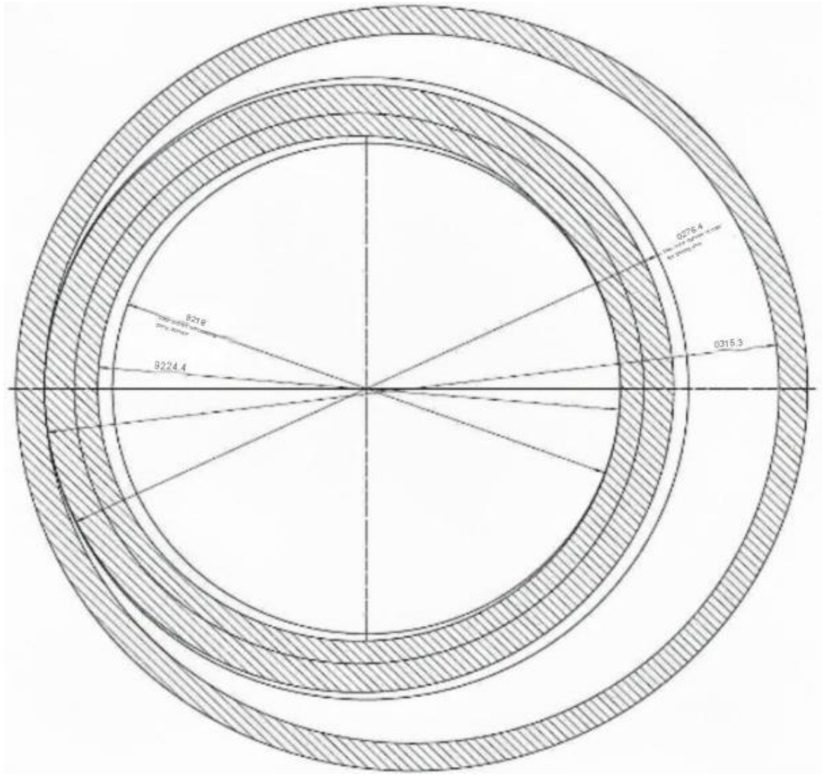

Figure 7: 47 lbs 9-5/8 ″ under 61 lbs 13-3/8 ″ casing

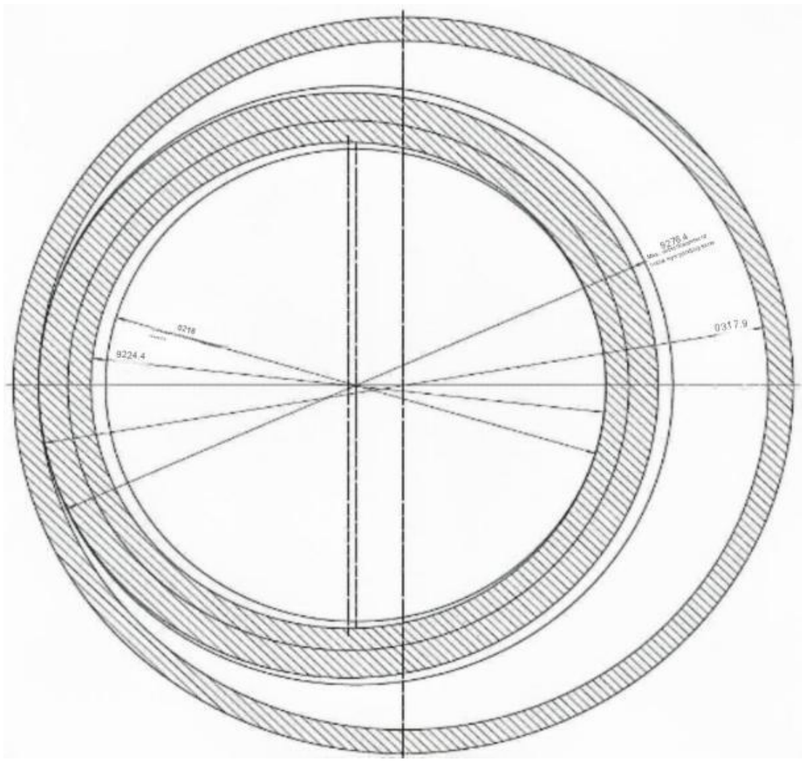

Figure 8: 40 lbs 9-5/8 ″ under 61 lbs 13-3/8 ″ casing

5. CALCULATION OF BLADE MOTION TRAJECTORY OF 13-3/8 ″ COLLAR-EYE SHOE GRINDING TOOL

At present, the 20 ″ riser in Bohai Oilfield is mainly 106.5 pounds and 94 pounds, and the 13-3/8 ″ casing is mainly

68 pounds and 61 pounds; In order to determine the blade size of the 13-3/8 "collar sharpening tool and clarify the movement trajectory of the collar sharpening tool, all 20" risers and all 13-3/8 "casings were combined, such as: 106.5 pounds under 20" risers; 94 lbs 20 ″ Riser Down 13-3/8 ″ Casing (68 lbs and 61 lbs). Figs. 9 and 10 are 9-5/8 " (47 and 40 lbs) under 68 lbs 13-3/8" casing; figs. 11 and 12 are 13-3/8 " (68 and 61 lbs) under 61 lbs 13-3-8" casing.

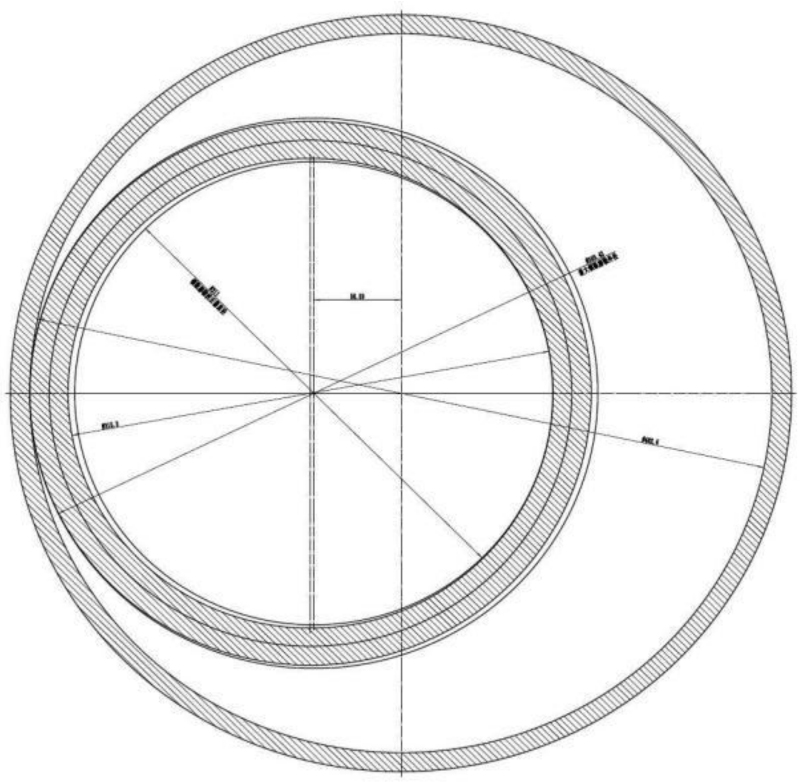

Figure 9: 68 lb 13-3/8 ″ Casing under 106.5 lb 20 ″ Riser

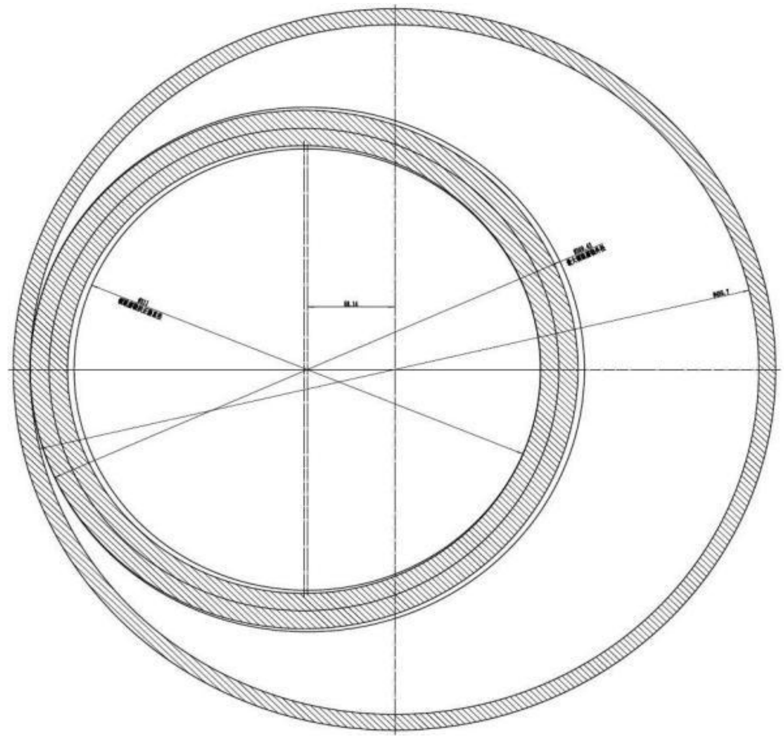

Figure 10: 61 lb 13-3/8 ″ Casing Under 106.5 lb 20 ″ Riser

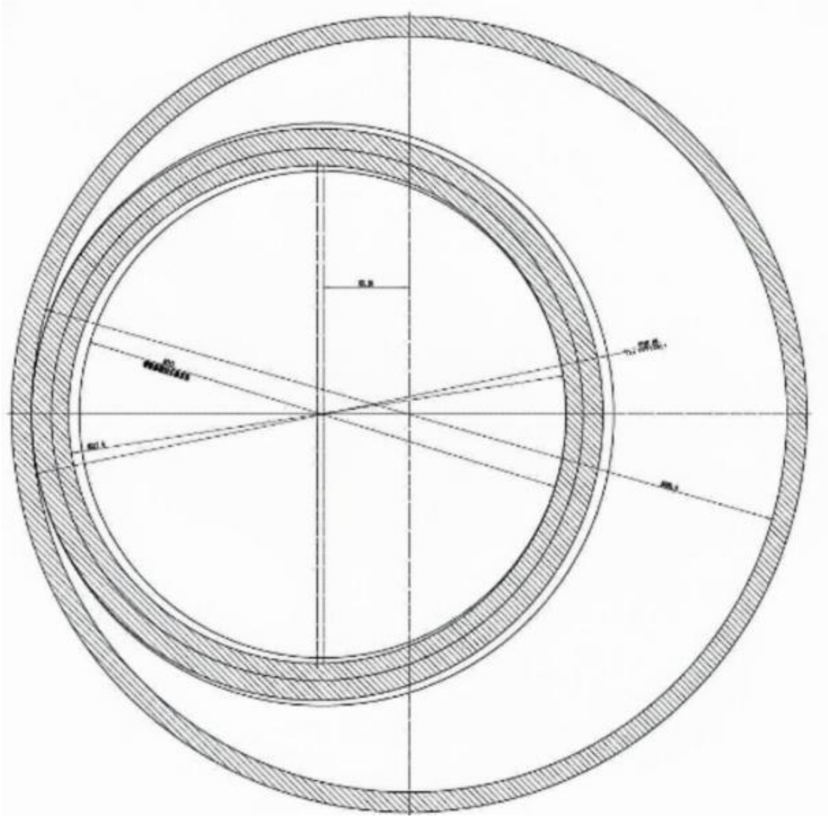

Figure 11: 68 lb 13-3/8 ″ Casing Under 94 lb 20 ″ Riser

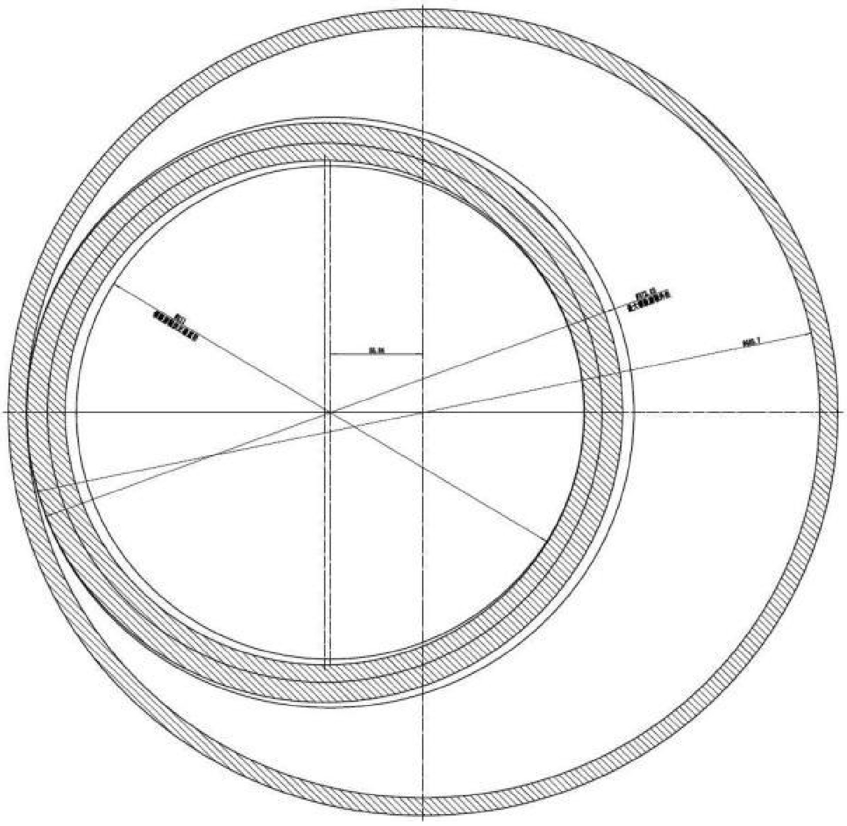

Figure 12: 61 lb 13-3/8 ″ casing under 94 lb 20 ″ riser

6. SUMMARY

The maximum outer diameter of 6 kinds of collar-eye sharpening blade is given when the casing is not in the middle seriously. The maximum outer diameter of collar-eye sharpening blade for 29 lb 7 ″ liner is 203.1 mm, for 23 lb 7 ″ liner is 207.7 mm, and for 47 lb 9-5/8 ″ casing is 272.5 mm; The maximum outer diameter of the shoe sharpening blade for the 40lb 9-5/8 ″ sleeve is 276.4mm; the maximum outer diameter of the shoe sharpening blade for the 68lb 13-3/8 ″ sleeve is 369.43mm; and the maximum outer diameter for the 61-lb 13-3/8 ″ is 372.03mm.

When the size of the leading hole grinding shoe righting wing is fixed, the maximum size of the leading hole grinding shoe knife wing is related to the size class of the casing to be processed, and has nothing to do with the size class of the upper wellbore casing.

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