BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE 1905: Application of Humble Oil & Refining Company for an oil-oil dual completion utilizing parallel strings of small diameter casing cemented in a common well bore. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its State M-20 Well, located 1930 feet from the North line and 1980 feet from the West line of Section 29, Township 22 South, Range 37 East, Lea County, in such a manner as to permit the production of oil from the Langlie-Mattix Pool and the production of oil from the Drinkard Pool through 2 7/8-inch casing and 4 1/2-inch casing respectively with said casing being cemented in a common well bore.

BEFORE:

Elvis A. Utz, Examiner.

TRANSCRIPT OF HEARING

MR. UTZ: Case 1905.

MR. FLINT: Application of Humble Oil & Refining Company for an oil-oil dual completion utilizing parallel strings of small diameter casing cemented in a common well bore.

MR. BRATTON: Howard Bratton, Roswell, New Mexico, appearing on behalf of the Applicant. I have one witness and ask that he be sworn.

(Witness sworn.)

MR. UTZ: Any other appearances in this case?

J. E. WILLINGHAM

called as a witness, having been first duly sworn, testified as follows:

DIRECT EXAMINATION

BY MR. BRATTON:

Q Will you state your name, by whom you are employed, and in what capacity?

A I am J. E. Willingham, I am employed by Humble Oil & Refining Company as senoir supervising engineer, Midland, Texas.

Q Are you familiar with Case 1905 and the completion well in question?

A Yes, I am.

Q Have you previously appeared before this Commission as an expert witness?

A Yes, sir, I have.

MR. BRATTON: Are his qualifications acceptable?

MR. UTZ: Yes, sir.

Q (by Mr. Bratton) Mr. Willingham, will you state briefly what Humble is asking in Case 1905?

A Briefly, it is a request to make a multiple completion whereby we are running parallel strings with casing; rather than being concentric they are both outside each other, and it could be viewed as making a twin well in one bore hole.

Q This is actually an oil-oil dual completion, one string

to produce from the Langlie-Mattix and one from the Drinkard Pool?

A Yes, sir, that's right.

Q And 2 7/8-inch casing is to be utilized above 5,000 feet?

A Yes, sir.

Q And 4 1/2-inch casing in the formation below 5,000 feet?

A That's right.

Q It is necessary to have the hearing because there is not a dual authorized within a mile of this well, is that correct?

A That's true.

Q And it also utilizes the 2 7/8-inch casing as one of the strings of tubing?

A Yes, sir, that is correct.

Q Now, Mr. Willingham, this has been utilized before, has it not?

A Yes, sir, and that's pointed out by this first sheet we have given. It shows there are fifty-eight mutiple completions my company has made in the United States.

Q Those are tabulated; thirty-six duals, seventeen triples, and five quadruples?

A That's right. You'll notice we have the depth ranges on here to give you the multitude of conditions this could fall under.

Q And what has been the experience of your company with these multipule completed wells?

A It has been excellent. It is a good way to reduce your cost and reduce your future work-over problems. For example, you don't damage one reservoir while you are working on the other one.

Q Turning to Exhibit No 2, the economic analysis as to 2 7/8-inch casing completions, will you state what that shows?

A If you will recall when we had the hearing last year, we had told the Commission that we felt we could save sixteen percent by making single 2 7/8-inch completions, and if you'll notice on the three fields that we've worked in New Mexico, we've had an actual reduction of twenty-three percent showing that this was a realistic method of substantially reducing your cost.

Q Your experience has been bettern than you anticipated?

A Yes, it has, quite a bit better.

Q Refer now to the actual completion equipment methods and procedures and refer to your Exhibit 3 and refer to them as you wish in order to explain what you propose.

A On the third sheet, I'm not going to go into this, this gives you the detail of the wellhead, the tubing head and centralizers, and if I can skip over to the next sketch, it shows you a dual completion, christmas tree, and wellhead assembly. There are a multitude of these assemblies available, and this just happens to be one of the various types. There is nothing that is unusual about this, except you've got your casing hanger, dual hanger. The rest of your equipment is conventional. Skipping to the next sheet, this gives an illustration of one type of centralizer that

you can use too, the problem being when you are putting multiple strippings in one hole and getting the centralizers by each other, and they have been designed so that they are geared, and you can actually thread one centralizer through the other. There are other centralizers you can use, such as rubber centralizers where they will give with force, and you can force one with another one. We feel it is very important, of course, to have your pipe centralized to assure a good primary cement job.

Q Turning now to Exhibit No. 6, is this the procedure that you actually propose in this hole?

A Yes, this will be the procedure that is followed, and we had this illustrated graphically on the last sheet. If we might refer to that, I'll go over -- we'll set 9 5/8-inch surface pipe at 1200 feet, we'll cement that with eight percent jell cement. Then after we drilled our hole to 7,000 feet, we will run a 4 1/2-inch string and 2 7/8-inch string separately. They will not be tied to one another. And we will cement the 4 1/2 string through; we'll cement through that string, and also we'll cement through the 2 7/8-inch string to assure that we have cement. We'll complete the well, we'll complete the 2 7/8 in the Queen formation and the 4 1/2 in the Drinkard.

Q Now, what protection against communication does this give as compared to a standard dual completion in this particular case?

A You'll have 3,000 feet of cement separating the two zones, and being elastic, you have less chance of communication with this

type of completion than you do with a conventional completion because you've eliminated your mechanical communication. If you had a packer leakage, you could be in communication and not know it. And with this method, the only possible communication you would have would be with the primary cement failure.

Q How about producing capabilities? Would it lessen your producing capabilities in any regard?

A I feel that the 2 7/8-inch casing is far more than is needed to produce any present allowable or anticipated future allowable.

Q That would be your production from the Queen?

A From the Queen, right.

Q Is there anything else you care to say about the actual technique involved in this completion, Mr. Willingham?

A Mr. Bratton, what did you do with the Exhibit showing the perforating tool?

Q The Examiner has it. That's Exhibit No. 8. We do not have any extra ones of that.

A Basically, this technique and equipment has changed so rapidly it is hard to keep up to date on it. There has been -- first of all, we have,the problem is if you perforate one of the upper zones, you could perforate into the 4 1/2-inch casing, and you need some sort of tool. Say, a year and a half ago we were doing this mechanically with a recess and 2 7/8-inch casing, and then they came up with a tool where they ran a gamma ray detector down

one string, and you have a signaling device in your perforating gun, and by moving your line up and down you can jack your gun away until it is pointing away from the signal and fire, and that way you don't endanger shooting the other casing string. And about two months ago a new development came out where you don't have to use the gamma ray detector any more, but they can detect the mass of steel with a tool. It is a nuclear device; and use this same type of device to jack the gun away from the other string and fire. This has been used many times and it is a well developed tool. We are not having any trouble perforating our wells with it.

Q Now, Mr. Willingham, I believe the Examiner has Exhibit No. 9, which is a map of the area showing the slim hole 2 7/8-inch completion which you have in the area.

A The red arrow points to the 2 7/8-inch single completion in the area, and the well in which we will make a multiple is in between. That is just to show you that we have been active in that area with 2 7/8-inch completions.

Q Have you had any trouble with any of them?

A Not a bit.

Q Do you have anything else to say about your general experience with this type of completion, either the slim hole as a slim hole dual completion or twin well is actually what it is?

A I believe that the principal picture in 2 7/8-inch completion, both multiple and single, is that this will allow us to use our money and drill additional wells making -- the entire

purpose is to get our cost down so that we can use the money in developing additional production.

Q Has this been your actual experience?

A Yes, it has been. We've been able to drill more wells because of the cost.

Q With the same budget you just get more wells?

A That's true.

Q And in your experience with this technique, do you believe that it is in the interest of conservation, does it prevent waste?

A Yes, sir. Well, I don't say it prevents waste.

Q But no waste results?

A No, no waste results.

Q Anything else you care to say about this particular application?

A Well, I believe now, I think that the technique, it was well covered in our past Exhibits on 2 7/8-inch completion and the main problem has been perforating and centralizing, which we have already discussed.

Q Were Exhibits 1 through 9 prepared by you or under your supervision?

A Yes, sir, they were.

MR. BRATTON: We offer Exhibits 1 through 9 in evidence, and we have nothing further.

MR. UTZ: Without objection, they will be accepted.

(Thereupon, Humble's Exhibits 1 through 9 were received in evidence.)

MR. UTZ: Are there questions of the witness?

MR. PORTER: I have one.

MR. UTZ: Mr. Porter.

CROSS EXAMINATION

BY MR. PORTER:

Q Mr. Willingham, if the cost were the same, would you prefer this method to the old method?

A Yes, sir, I certainly would.

MR. PORTER: Thank you.

MR. ERREBO: I have a question, Mr. Examiner. Burns Errebo, appearing on behalf of Johnston and Shear.

QUESTIONS BY MR. ERREBO:

Q Mr. Willingham, are there several companies which make this particular type of directional perforate tool?

A Yes, sir, two.

Q Did you have in mind any particular type of tool which you represented on your Exhibit which you introduced a while ago?

A Well, I might say that we have to date used Schlumberger on our perforating simply because they came out with the equipment first, and they haven't had any competition till the last two or three months.

Q Are there any other companies that you know of that make the type that you recommend?

A No, sir, but I feel that there will be many companies that have it because it is a tool that is being licensed to other --

Q Do you know whether Lane Wells make such a tool?

A They don't make one similar to this. They make one that I mentioned before, that was developed just recently where they locate the mass of steel, and the advantage to that one is that you don't have to run a signal device in your other well to perforate. In other words, it just makes it that much simpler.

Q Did you state that Humble has made seventeen triple completions?

A Yes, sir, that's right.

Q Do they include gas-oil gas type of completion?

A Offhand, the footnote says that we've just got a multitude of conditions, salt water disposal wells, gas wells, gas injection wells.

Q Chances are, then, it does include that?

A Right.

MR. ERREBO: Thank you. That's all.

MR. UTZ: Mr. Nutter.

QUESTIONS BY MR. NUTTER:

Q Mr. Willingham, what size of a hole will you drill out under your 9 5/8-inch casing?

A This case, it will be -- Mr. Nutter, let me qualify this to say, when you let your contract, generally we give the contractor an option of what hole size he could drill, but in this case

we will drill 8 3/4 because we need the space. In other words, we will drill the largest hole we can drill.

Q Now, when you have your two strings of casing in that hole, is that going to provide an adequate sheet of cement in that casing to separate the two zones?

A Yes, I feel certain it will. We've cemented several wells that way, and very successfully.

Q Do you use the centralizer that you mentioned in your third or fourth set of your Exhibit --

A Yes.

Q -- up and down the entire length of the strings?

A Yes, use it through the producing interval or anywhere we've got possible production we would use them.

Q Now, there would be centralizers located on the 2 7/8, and the 4 1/2 through the Queen interval, is that correct?

A Yes, sir, that's true.

Q And there would be centralizers on the 4 1/2 down through the Drinkard?

A Yes, sir.

Q Would there be any centralizing between there, the 4 1/2?

A I would say normally there would not.

Q How do you anticipate that you will cement the casing in this well? Will you cement down one string or both strings down simultaneously, or what will your cementing program consist of?

A We will cement our 4 1/2 first, and pump our plug down, and we would, in this case we would bring it down 600 feet above our uppermost productive interval.

Q In other words, you would bring the cement to 600 feet above the top of the Drinkard?

A Yes, sir. I don't want to tie myself down to that exact point, but it would be approximately that.

Q And then there would be no more cement on the first stage, then?

A No, sir.

Q And then your second stage of cement would consist of pumping cement down the 2 7/8?

A Yes, and then you would bring the cement up a like amount.

Q Does one cement job immediately follow the other job?

A Yes, they would be simultaneous with the same truck.

Q So by the time your cement comes down the 2 7/8, the cement on the 4 1/2 hasn't set yet?

A That is right.

Q And you would pump enough cement down the 2 7/8 to bring the top of the cement up to approximately 2800 feet?

A Yes, sir, that's true. It would be 600 from 4000 it would be 3400 feet, approximately. See, the 2 7/8 is set at 4000 feet, and you would bring it up about 300, 400 feet above that.

Q You mean you wouldn't use enough cement to bring the

top of the cement to 2800 feet, as indicated on Exhibit 7?

A No. I'm incorrect. It would be at 2800 feet, yes, that's the plan. The reason I was confused, on some of our wells we have not brought it up that high, but the district obviously wanted to cover an interval here is the reason they brought it that high.

Q Mr. Willingham, has Humble had any experience in which they've attempted slim hole completions, using tubing for casing string in areas where there were plastic formations or heaving formations that might tend to collapse the casing?

A Well, let me answer it this way. We have 2 7/8-inch completion in the West Texas-New Mexico area in twenty-six fields, and I believe it covers the range of conditions that you would find to a depth of 5000 feet.

Q In this particular area, the Langlie-Mattix and Drinkard area that is under consideration here, are there any known formations that have a tendency to collapse casing?

A To answer that honestly, I don't know. I've heard that we have had or some operators have had troubles in the salt sections from anhydric ledges breaking off and causing the tubing to collapse. However, I don't feel that there would be any more danger of this happening in 2 7/8 than it would in conventional casing.

Q Would that 9 5/8 surface casing set at 1200 feet go through the salt section?

A I'm not positive of that, but I don't believe so.

Q What is your intention, Mr. Willingham, to run tubing from the 4 1/2-inch casing to produce the Drinkard?

A Yes, sir.

Q What size tubing?

A In all probability, it would be 2-inch.

Q That's standard 2-inch tubing?

A Yes, sir. We have been running inch and 1/2 in our 4 1/2.

Q Would artificial lift be possible in both zones?

A Yes, sir.

Q Mr. Willingham, what means do you have to test, to assure that you have an adequate cement job which is separating effectively the Queen and the Drinkard formations?

A When you get ready to perforate, the zone in which you are not perforating, you'll pressure that zone up to a given amount.

Q With surface pressure?

A Yes, sir, with surface pressure, and then when you perforate the other zone, you observe your pressure on that string, and if you have communication, it will show up instantly.

Q Which normally is the first zone that you perforate, the upper or lower?

A We have done it both ways. I would say normally, though, we perforate lower first.

Q Is there any need for any subsequent test, after the

initial pressure test on perforating the second zone, is there any need for any subsequent test to assure that communication is prevented later on down the road?

A Well, if you had a small leak, it is possible that you wouldn't observe it with the technique that we've just discussed. And I don't want to pin myself down to any specific thing on this well, unless you so designate, but in New Mexico, don't we normally run a packer leakage test?

Q Yes, sir, but we don't have a packer in this well.

A But you could still --

Q You could still run a test similar to the packer leakage test?

A Yes, sir, by having your pressure connection tied in to each string.

Q And this would indicate the presence of tubing, leaks in the tubing or leaks through the casing?

A Yes, sir.

Q And this pressure test could be run annually or whatever would be required to assure that no leakage did occur?

A That's true.

Q Which is considered the more reliable, the method in which you run a gamma ray source in one string of tubing and a detector in the other string, or the method in which you run the source and the detector in a single string and depend on the thing to find the mass in the middle?

A The last I heard, we had not perforated but one well using the new technique, and we haven't had enough experience to say, but we know that this technique which we will probably use because the other tubing isn't available in this area, we know it has been very successful.

Q What is the principle here? You have your detector in place of one string of tubing, and do you rotate the source around and take continuous readings until you find the point at which the maximum reading occurs?

A What you've got, you've got a logging device at the surface, and as you rotate, move your line up and down, it signals on your logging device, and you will know from the logging device. When you are pointed, that shows you are shooting in an opposite direction.

Q Do you make a complete circle and come back to the --

A Yes, sir.

Q You assure yourself that you are at the maximum reading prior to the time that you perforate?

A Yes, you would rotate, say, several times, and make for certain where you were.

Q This type of perforations only gives perforations in a single direction?

A Yes.

Q Is there any evidence to indicate the drainage pattern or the effectiveness of the drainage would be detrimentally affected

by having perforations in one direction also?

A I don't have the data with me, but there is technical data available to the industry that substantiates. if you are going to stimulate your formation, it isn't very important how deep your perforations are as long as you penetrate the cement, or how closely spaced they are together. In other words, if you are going to stimulate, it will not affect your well's productivity. At least, it won't affect it enough to make any difference.

Q And it is your opinion, then, that directional perforations in a single direction and not out in all directions from the well bore will provide as adequate a drainage as the case where you had the perforations in all directions?

A Yes, sir, I would say that emphatically, providing you are going to stimulate.

Q Do you plan to stimulate this well --

A Yes, sir.

Q -- in both zones?

A Yes, sir.

MR. NUTTER: That's all. Thank you.

A Let me say one thing, Mr. Nutter. Of course, if you happen to get an unusually productive well, you might not stimulate, but certainly if you didn't get a good well, you would stimulate.

Q (By Mr. Nutter) Will the perforator that you use in the Drinkard formation be in a single direction or all directions?

A All directions. It would be a conventional perforator.

MR. NUTTER: I believe that's all.

QUESTIONS BY MR. UTZ:

Q Mr. Willingham, is this perforating device on wire line?

A Yes, sir, it is.

Q How do you hold the device in the proper position for fires?

A You have some drag springs, noted right here, and that allows you to move your -- in other words, when you move your wire line up and down, these drag springs hold it, and as a result it has some magnetism that jacks your jack around as you move it up and down. Let's see, there is a thread like device inside of this --

Q Yes, sir.

A -- that rotates inside; yes, a cam type device. It would be very complicated to explain it. In other words, you've got teeth, and when you move up and down, it rotates these teeth around.

Q And this is long enough, I presume, to get 360 degree rotation on your firing device?

A In fact, you can keep rotating around and around again. It doesn't wind up, it is continuous.

Q (By Mr. Nutter) Mr. Willingham, does this device on pulling the wire line rotate it only a certain number of degrees, and each subsequent pull rotates another degree?

A Yes.

Q So, by a series of continuous tuggings on the line, you can make a 360 degree well?

A That's right.

QUESTIONS BY MR. UTZ:

Q In any of the five wells that you have completed by using this device, have you accidentally perforated the other tubing?

A On the first job. We learned the hard way. When we first started out, it was either the first or second job we did, we at that time weren't using this device. However, we were using the mechanical device where we had a recess in our 2 7/8, and what happened, when your tool got in this recess, you were oriented, and you fired, and the tool was mated incorrectly and shot the other string. We went in with a wire pack and packed off the hole and were all right.

Q If you should fire accidentally into another tubing, can you squeeze that off satisfactorily?

A Yes, sir, you can squeeze it off, or you could use pack-off methods also. Recently, they have come up with 2 7/8-inch tool that you can use. We have not used that, however.

QUESTIONS BY MR. PORTER:

Q Who puts that out, the people that do the perforating?

A I believe that's right. However, we haven't been having that trouble.

Q (By Mr. Utz) To your knowledge, what is the fastest rate of injection that you've had to use in frac jobs through 2 7/8-inch slim hole completions?

A Well, they have gene rally ranged from about six barrels a minute up to twelve to fifteen barrels a minute. It varies, of course, according to your depth and your friction loss.

Q Do you feel that's a heavy enough shot to give you a satisfactory frac job in the least permeable formations that you've ever completed in?

A Let me answer that question this way. This was one of the basic objections to 2 7/8-inch casing when we started out, and after we drilled, had drilled a few 2 7/8 and found it did not affect our productivity, we stopped using high frac rates on even our conventional high wells. So, I can say without any hesitation, that we have not been able to find enough difference in productivity with low frac rates.

Q Did you ever drill any wells in San Juan Basin?

A I'm sure that my company has. However, I'm not acquainted with it. I'm not sure, Mr. Utz, really. I'm certainly not familiar with the area.

Q Well, to your knowledge, do all companies agree with your statement that you don't have to frac at a higher rate than this?

A No, sir, there are many companies that disagree violently, particularly the frac companies.

MR. UTZ: Are there any other questions of the witness? If not, the witness may be excused.

(Witness excused)

MR. UTZ: Any other statements to be made in this case? If not, the case will be taken under advisement.

STATE OF NEW MEXICO)
) ss
COUNTY OF BERNALILLO)

I, J. A. Trujillo, Notary Public in and for the County of Bernalillo, State of New Mexico, do hereby certify that the foregoing and attached Transcript of Proceedings before the New Mexico Oil Conservation Commission was reported by me in Stenotype and reduced to typewritten transcript by me, and that the same is a true and correct record to the best of my knowledge, skill and ability.

WITNESS my Hand and Seal this, the 15th day of March, 1960, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Joseph A. Trujillo

My Commission Expires:

October 5, 1960

I do hereby certify that the foregoing is a complete record of the proceedings in the Examiner hearing of Case No. 1905, heard by me on Dec. 15, 1960.

....., Examiner
New Mexico Oil Conservation Commission