Case No.

1453

Application, Transcript, Small Exhibits, Etc.

1453-A/O

CASE 1453: Magnolia Petroleum Co. pplicatio for order authorizing dual completion of its Stephens Estate #1 well, Lea Co.

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

IN THE MATTER OF:

CASE NO. 1453

TRANSCRIPT OF HEARING

DEARNLEY - MEIER & ASSOCIATES
INCORPORATED
GENERAL LAW REPORTERS
ALBUQUERQUE, NEW MEXICO
3-6691 5-9546

May 28, 1958

BEFORE THE
OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO
MAY 28, 1958

IN THE MATTER OF:

CASE NO. 1453 Application of Magnolia Petroleum Company for an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Stephens Estate No. 1 Well, located in the NW/4 SW/4 of Section 24, Township 21 South, Range 37 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Terry-Blinebry Pool and Wantz-Abo Pool.

BEFORE:

Elvis A. Utz, Examiner

T R A N S C R I P T   O F   P R O C E E D I N G S

MR. UTZ: The next case on the docket will be Case 1453.

MR. PAYNE: Application of Magnolia Petroleum Company for an oil-oil dual completion.

MR. SPERLING: J. E. Sperling, Modrall, Seymour, Sperling, Roehl and Harris of Albuquerque, representing the applicant. We have one witness, Mr. John Sanders.

(Witness sworn)

JOHN L. SANDERS,

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

DIRECT EXAMINATION

BY MR. SPERLING:

Q Will you state your name, please?

A John L. Sanders.

Q By whom are you employed and in what capacity?

A Magnolia Petroleum Company as petroleum engineer.

Q Have you testified before this Commission on previous occasions in an expert capacity?

A Examiner hearings,yes.

Q You were found to be a qualified witness on those occasions?

A On those occasions, yes.

MR. STERLING: Are the witness' qualifications acceptable?

MR. UTZ: They are.

Q Mr. Sanders, would you refer first, please, to what has been marked as Exhibit No. 1,and describe for us the location of the particular well to which this application is referrable?

A The Magnolia Stephens Estate No. 1 is located in the northwest of the southwest of Section 24, Range 37 East, Township 21 South.

Q The well is located in the northwest of the southwest of 24 as indicated on the Exhibit, is that correct?

A That's right.

Q Will you describe the present zone from which the well is producing?

A The well is presently producing from the Abo formation, the

Wantz-Abo Field, with perforations from 7000 to 7108.

Q What do you propose to do? In other words, what authority are you seeking in this application?

A We are seeking authority to dually complete the Terry-Blinebry zone from 5684 to 5897.

Q Does Exhibit 2 indicate the zone of present completion and the proposed zone of completion with the cement program and the casing program?

A It does. Exhibit 2 shows that we have ten and three-quarter inch casing set at 329, with 300 sacks; it shows we have seven and five-eighths casing set at 3145, with 2510 sacks; shows that we have a five and a half inch liner set at 7481, 660 sacks, plugged back at 7149. The present completion is indicated, and the proposed new zone is indicated.

Q Can you describe for us the present producing gas-oil ratio and other pertinent factors insofar as present production is concerned?

A Present production from the Abo formation is 21 barrels of oil, no water, with gas-oil ratio of 2667 to 1.

Q Now, what specifically do you propose with reference to completion in the Blinebry formation?

A We propose to use a Mandnel type dual completion head, a Model D Packer, at approximately 7000 feet, an oil master pump, and a dual zone cross over assembly to produce this formation. We plan on setting a retrievable bridge plug between the formation, perforate the proposed interval, and treat as necessary to complete as an oil well.

Q Now is the map which you have just described, indicated on this seismic diagram which is identified here as Exhibit 4 and which I believe you have displayed on the board over there?

A Yes, it is. Exhibit 4 shows the down hole pump arrangement for the dual zone pumping, with one string of two inch EUE and one string of one inch EUE tubing to segregate the production from the two zones. Now, the proposed program production from the upper zone will enter a pump through the upper zone standing valve, as indicated, into the upper zone pump, and be produced up the two inch tubing. The lower zone production will enter at the bottom below the packer, come into the lower zone pump, be transmitted up the two inch tubing to a cross over assembly where it will be crossed over to the one inch, and that's up to the surface.

Q What information do you have concerning prospective production from the Blinebry with reference to pressures and gas-oil ratios?

A Referring to Exhibit 1, Guld's Stephens No. 2 is the offset well to the north. It's presently completed in the Terry-Blinebry Field. It is producing 29 barrels a day with a ten thousand four hundred and twelve ratio; gravity is 40.7. Casing pressure in this well is 6,600 pounds. It presently has a pump unit installed.

MR. UTZ: Was that a surface pressure or bottom pressure?

A Surface pressure.

Q What is the interval -- the anticipated interval between the present Abo production and the Blinebry -- the anticipated Blinebry production at the location referred to in this application?

A There is a 1138 foot difference between the two zones.

Q Now, has the information that you have just testified about, that is, as to the two formations, is that substantiated by well logs?

A Yes. Exhibit 3 has the indicated proposed zones marked showing the displacement of the two. I have indicated in red on the electric log the proposed perforations for the new interval.

Q How do you propose to insure against communication as between these zones?

A Referring to Exhibit 4, we have the Model D packer which will separate the two zones and serve as a seal around the tubing. The upper zone pump has a seal -- cross-over seal to insure that production in the upper zone is sealed here. We have a polished -- a pack-off assembly on a polished rod to insure seal here; the one inch tubing fits into a setting arrangement which seals off there.

Q What tests will you be able to conduct with this proposed arrangement to detect any communication as between zones?

A We'll be able to tell from the difference in gravity of the two zones and difference of gas-oil ratio and pressures on the surface. We will also be able to shut in the production from the two inch tubing, and if we don't built up pressures, we know that we will have leakage in one of our seals.

Q Would you explain to the Examiner what differentials you have present with reference to the two zones?

A The estimated Terry-Blinebry bottom hole pressure is 2000 pounds. The estimated Abo pressure is less than 500 pounds. The present casing pressure on the Abo Well is 15 pounds. Therefore, any increase in pressure on theproducing side for the Abo would indicate communication.

Q What differentials do you have in gas-oil ratios?

A We have 2667 for the Abo and 10,412 for the offset well. We anticipate that the ratio will be high, whether it will be 10,000 or less. It should be at least 5,000 or more.

Q And what gravity differentials do you have?

A The Abo gravity is 43 -- 42.3, and the Blinebry is 40.7.

Q So you anticipate you have three or four different and distinct checks against communication, is that correct?

A That's right.

Q Will you explain again how that pressure builds up, in other words, assuming that you shut in the Blinebry oil side, producing side, at the surface?

A If this Blinebry oil side is shut in, the pump will exert pressure to the surface. If that pressure does not show at the surface, we have a leak here or here, or our standing valve is leaking. If we have a leak at the cross-over seal or pack-off assembly, we will immediately get an increase in pressure on our inch tubing in the surface, and an increase in production.

Q Well now, by leak, what do you mean, to what extent would such a leak indicate communication as between zones, if it would at all?

A Any passage of fluid under this test would show up.

Q And what proportions might you anticipate that that passage of fluid would assume?

A Well, under the initial installation, there would be no passage, and at any time when we receive indications that we were getting passage, we would have to repair the tubing.

Q Now, what assurance do you have, while those repairs are being made, that there is no further communication?

A Well, when you are pulling the tubing on both zone pumps, you unlatch here. You leave a lower standing valve to make sure that there is no communication from the upper and the lower zones. The gas bypass also has a standing valve which insures no passage.

Q Would you explain in a little more detail the function of the gas bypass and what it is designed to do?

A The gas bypass is designed to allow any separated gas to enter above the pump on the down stroke so that you can prevent gas lock in the pump. The standing valve in the one inch assumes the load of the hydrostatic head of the lower pump on the down stroke, that leaves it free here for this valve to open, if the gas pressure has reached sufficient amount to overcome what pressure would be in here on the down stroke. That would allow us to bypass any gas up into our pump, and on the up stroke then, that would be compressed and shoveled into our one inch, thus preventing gas lock of our pump.

Q Would you explain the function of your production packer and also the packing around your polished rod assembly there, between the upper and the lower zone pumps?

A The packer is utilized to form a seal in the casing around the tubing or the latch-on assembly as it is lowered into the packer to seal between the two zones. The cross-over assembly allows a packer between the -- inside the tubing between the two zones using the cross-over seal here and the pack-off seal here. Exhibit 4-A shows in detail the cross-over seal and the pack-off assembly. The upper seals on the cross-over seal are your seals for your upper pump. They, in effect, serve the same function as the seal over your lower pump does here. That is your normal sitting cups. The lower seal seals your two inch tubing, seals off your upper zone and your lower zone within your two inch tubing there. Your pack-off assembly consists, in this case, of a machine-precision polished rod with a liner to a one-thousandths clearance 36 inches long to assure a seal below your cross-over seal inside your rods to allow you to transmit your participating motion to your lower pump. Three types of seal are available for this pack-off assembly. We have metal to metal, testlon and Hi-Car. The latter two are both packing material. The metal to metal gives you a positive seal over 36 inches. The other two are 18 inch seals. Testlon is a hydrocarbon derivitive similar to plastic. It is inert to hydrocarbons. Hi-Car is a rubber carbon product used in packers.

Q Now, you spoke of one-thousandths clearance insofar as this assembly is concerned. How does that compare with your clearance in your ordinary pump assembly?

A An ordinary pump assembly may have clearances as low as three-thousandths and as high as eight-thousandths. This seal is a lot closer than they normally use in a pump.

Q Now, in the metal to metal seal, what actually constitutes the seal as between the metal and the metal?

A Friction. The resistance to fluid flow due to friction.

Q You anticipate that would constitute an adequate seal insofar as this assembly is concerned?

A Yes, I do. We have proof that our thermo cards that we ran on any number of wells, that metal to metal pumps do seal. We've taken, stopped our thrimometer and taken what we call a thrimometer check, which also checks your fluid passage on your plunger and we have detected no leakage. We weren't anticipating at that time -- at the time of those tests, any further use of the cards other than to check the pumping ability of the individual well, but I know that after five minutes, in cases, we still don't have any leakage through our metal to metal plungers.

Q And with the clearance of what extent, or to what extent in those instances?

A From three-thousandths to as much as six-thousandths.

Q In the event it is necessary to make pump repairs, how do you anticipate that that will be done, or can it be accomplished to both the upper and bottom zones?

A Any time pump repairs are necessary, both pumps will be removed, and when the pumps are removed, we will repair both pumps and the cross-over seal.

Q Do you know of instances where this arrangement has been used in other installations?

A The principal of the cross-over assembly has been accepted by the industry for a number of years. In 1954 Mr. Taylor and Mr. Robins with Otis pressure control gave a paper on subsurface pumps, zone pumps, at the West Texas Oil Short Course In Oil Lifting Methods in 1954, and at that time Otis had installed a number of -- quite a number of these type of installations, utilizing a cross-over assembly. Mr. Van Horn, with Cities Service, reported in the World Oil of May, '58 on their installation -- dual installation utilizing this cross-over assembly in the Goldsmith Field. They had some seven or eight installations operating that had been operating for a year and a half to two years. If I am not mistaken, he also presented his paper at the West Texas Oil Short Course In Oil Lifting Methods this year, in 1958. Also in January, '56, in the Petroleum Engineer, Mr. Mener, with Anglo American Exploration Limited in Canada, reports on pumping dual wells in Canada utilizing the same cross-over assembly.

Q Now, these publications and papers that you made reference to, eal with the same type of assembly that we're discussing here?

A They utilized the basic cross-over seal and pack-off assembly. Some of them have used the parallel string and others have used an upper packer which allowed the production from the lower zone to be crossed over into the annulus and produced to the surface. We do not propose to use the upper packer because the upper zone has such a gas-oil ratio that we will be able to hit pump efficiency to produce it, if we use it at the installation.

Q Is it feasible to use a two rod string in this well in order to accomplish the dual completion?

A In order to use two and a sixteenth inch parallel strings, we would require that a string of one inch Hydril "CS" be run to vent the gas from the lower zone. There wouldn't be sufficient clearance for extrapolation of any smaller size. Therefore, it would have to be an independent string. That is the only string within a string that could stand the depth. We would end up with a landing arrangement for our one inch to vent the gas, and we would have so small a clearance throughout the full length from the three thousand foot, referring you back to Exhibit 2, where the five and a half starts, we would have to -- below the upper zone, we would have such a small clearance that any fishing job would probably result in a junk hole.

Q You have an example there of what your clearance is insofar as this casing is concerned?

A Prior to leaving Hobbs, this is the only one I had. It is the small clearance that you have between the two strings, two and a sixteenth inch strings, and with any casing, it would make a very complicated fishing job, and the risk involved of a junked hole which would require abandonment of the well are such that we feel like the proposed method which has only one spot of increased possibility of having trouble -- in other words, the clearance at this point is tied for one spot instead of the 2,600 feet. We feel like we will reduce the risk considerably enough to warrant this installation over two string installation. Another disadvantage of the two strings installation is the additional cost, although the one inch could be removed separately to pull the lower two and a sixteenths inch because of the landing arrangement. The one inch would require the resking of the upper zone tubing past three thousand feet to allow clearance for the landing assembly to be recovered from the hole, so it would be in effect -- we would be back to increased cost.

Q Would you -- going back to this packer assembly again, would you explain to us exactly what differentials you have as between the two zones at actual operating pressures?

A The hydrastatic head pressure exerted at this point by this here is 1975 pounds. That means that there has to be 1975 pounds to raise this valve. That means that there is that much exerted here. We estimate 2000 pounds upper pressure, so that would be 2000 pounds exerted here. It is 1975 here.

Q You have mathematically, then, 25,000 pounds differential, is that correct?

A At puming operation.

Q Do you propose to operate these pumps continuously or at intervals?

A They will be sized so that they will be in continuous operation. We presently are producing the lower zone on that basis because it takes that way to get its allowable, it comes in slowly instead of building up.

Q What arrangement would be made, other than pump size that you speak of, for one zone making its allowable prior to another zone, or vice versa?

A Of course, you already mentioned the arrangement of the pump sizes to allow the amount of production you want. We anticipate the upper zone reaching its production first, and it will be so sized, and we will bypass back into the annulus any production from the zone, overporduction from that zone. There is also a production tool, I call it production regulator, which you fit above on to the top of your plunger. It serves as your travel valve. It is spring loaded so that when you reach your production, you shut in the string, the flow line, and as the pressure builds up, it activates this spring and causes the valve to stand open and allows the pump to reactivate without producing. It would be applicable only in the lower zone. If applied in the upper zone, we wouldn't be able to shut in our flow line to test our packer assembly.

Q That is to accomplish the test that you mentioned earlier on pressure buildup and that sort of test, is that right?

A That's right. The most accepted way which we will use first is sizing the pumps to where the upper zone will produce its allowable first and bypassing it back down. We anticipate having to pump the upper zone because the offset operator has already installed a pump. Out of the one hundred wells in the Terry-Blinebry Field, only twenty-two pump. There is a chance there that the upper zone might flow.

Q Which, of course, would mean at least the temporary dispensing with the upper zone pump?

A That's right, and we would be able to shut in at any time without worrying about the pumping cycle.

Q Now, I call your attention and that of the Examiner's to Exhibit No. 5, and ask you to identify it and explain what those figures represent and what was taken into consideration with reference to the economics -- the operation of these two zones either by two wells or under the proposed system.

A Exhibit 5 is an oil reserves and economics of the Stephens Estate No. 1. It shows the reservoir information for the Blinebry that was used to figure the stock standing barrels in place and the oil reserves, recoverable reserves and the profit or loss from a single well in the Blinebry versus a dual completion in the Abo and the Blinebry. The factors used in computing the Blinebry reserves are those used in accepted engineering practice for volumetric calculation of oil in place. We show that the Blinebry has 267 stock barrels of oil per acre foot; recoverable reserves 40 acres, 45,000 barrels, estimated 45,000 barrels with 450,000 MCF of gas. The Abo reserves are estimated at 19,000 barrels as of January 1st, 1958.

Q What conclusion did you reach as a result of making this study?

A A single well would show a loss of $5,262 before income credit, while the dual completion should show a profit of $80,719, provided that my recoverable reserves are accurate.

Q Is it your opinion that your company's lease is presently being drained by offset operators?

A Yes, it is. The operator to the north, Gulf in this case, has produced -- as of March 1st -- has produced 11,602 barrels from their No. 2 -- Stephens No. 2.

Q That's the offset well directly north?

A That's right.

Q Is your company drilling any other wells in this area?

A Since preparation of this map, we started a well in the southwest of the southwest of Section 24, one location south of the well in question. We drilled it to the Blinebry and the Tubb as a proposed dual completion. A meeting offset to the offset of the Stephens Estate Well No. 2.

Q Well, now you spoke of dual completion. So far as that well is concerned, do you propose at this time to make an application for the use of the same sort of program insofar as that well is concerned?

A No, sir. We anticipate a dual completion in that well and have set seven-eighths casing to permit the running of two strings of tubing.

Q Why was that?

A Well, the -- at the time this Stephens Estate 1 was drilled, we were meeting Abo offsets, and that was the only production in the area. We drilled usually a minimum program. In order to cut cost at that time, we set five and a half inch casing liner, and in the new well, we, in order to insure a better dual completion, we set two strings. We anticipated it and set it up for that.

Q Now, again, with reference to the economic question insofar as this well is concerned, particular well, could the failure to produce from the Blinebry under the proposed arrangement result in premature abandonment of the present well?

A Yes. If we are unable to dual complete this well, the royalty owners have informed us that we have to meet the Blinebry oblication, and if that is the case, it will mean the abandonment -- either the abandonment of 19,000 Abo reserves or the paying of compensating royalty until such time as we produce these reserves.

Q That would result not only in economic waste but physical waste as well, is that correct?

A That's right.

Q Again with reference to the same subject, do you anticipate that more oil will actually be produced from the lower formation as the result of the use of this program than would be produced as a result of production from two wells?

A As a result of this program, the lifting cost will be spread between two zones instead of one. Therefore, we should have the same or lower per barrel cost, lifting cost, that we now have. With a lower lifting cost, we will be able to produce the lower zone longer than we would if we had a single completion.

Q Do you have -- again, with reference to the assembly itself, do you have any appreciable paraffin or corrosion problems?

A We have no corrosion problems in the Abo and none anticipated in the Blinebry. The offset operators have not experienced any. The paraffin problem, we don't have any paraffin problem in the Abo and the offset operators have not experienced any in the Blinebry to our knowledge. It is possible to limit your paraffin problems by installation of scrapers on your upper portion of your rod strings. The one inch tubing can be treated with a wire line knife arrangement, or by hot oiling the upper zone, and can also be treated by pumping hot oil down the annulus.

Q Now, I call your attention to Exhibit 6 which appears to indicate the present status of offset wells.

A Exhibit 6 was prepared to show the status of offset wells of the wells shown in Exhibit 1. This is a multipay area, and because of that, each operator will get the maximum he can from each well. The Gulf, on their Stephens lease to the north of Magnolia's lease, Section 24, operate three wells in the Terry-Blinebry. They are presently producing 29, 29 and 24 barrels per day. The Sinclair Sarkey No. 3 in Section 23 offsets Magnolia Stephens Estate No. 1 is presently producing 63 barrels a day. Wait a minute, that's four barrels a day. The other one was their Barton No. 3. The Olson Sarkey lease in Section 25, their No. 2 is presently completed as a Tubb well and my understanding is that they also have made application for dual completion in the Blinebry. Their No. 2 is making 14 barrels a day from the Tubb.

Q On the basis of this information, to some extent, at least, you have projected your economic study as well as what might be anticipated so far as drainage and other pertinent factors are concerned?

A That's right. As of the 1st of the year, as of January 1st, Magnolia had only produced some 49,000 barrels from their Stephens Estate No. 1, which was hardly enough to pay for it. The dual completion of this well will allow us to offset and complete payout of this well. The Gulf wells to the north in the Blinebry Field have produced cumulative -- No. 1 has produced 14,000 barrels; No. 2 has, as I previously stated, 11,602, and their No. 3, 24,502. That was as of March 1st.

MR. SPERLING: We would like to offer Exhibits 1 through 6 at this time in evidence.

MR. UTZ: Without objection they will be received.

MR. SPERLING: That's all the questions at this time. I neglected to mention Exhibit No. 7, so it will be 1 through 7.

MR. UTZ: It will also be accepted.

Q (By Mr. Sperling) You made reference, Mr. Sanders, to some publications, and I believe the Short Course On Oil Lifting Methods.

It is my understanding that you have only one copy of each available, but that you could provide copies to the Commission upon request.

A I can if they wish them. I can submit them later.

Q And your reference in one case was to World Oil, May of 1958, and to the proceedings of the West Texas Short Course On Oil Lifting Methods sponsored by the Department of Petroleum engineering Texas Tech. College April 22, 23, 1954, Lubbock, Texas?

A That's right.

Q And you also made reference to the Petroleum Engineer January, 1956, concerning the use of similar installations in Canada?

A That's right.

Q And they can also be made available upon request?

A That's right.

MR. SPERLING: That's all at this time.

MR. UTZ: Could you furnish copies of those articles?

A Just as soon as I get copies I will send them out.

MR. UTZ: All right, if you will, please.

MR. SPERLING: That is all.

CROSS EXAMINATION

BY MR. UTZ:

Q Mr. Sanders, what was the gravity of the Abo Section?

A 42.3 at 60 degrees Fahrenheit.

Q The bottom hole pressure was 500 pounds?

A Or less. We have to estimate that. Our well has not --

has been pumping for a considerable length of time and there has been no pressure taken of the offset wells. Sinclair Sarkey No. 3 had a pressure taken in '56, and was 1283 pounds, if my memory serves me correct on that, and last year at survey time it was on the pump and they didn't take the pressure.

Q And the pressure on the -- anticipated pressure on the Terry-Blinebry is 2,000?

A 2,000. Original pressure was 2400 pounds in the Terry-Blinebry.

Q When was this well completed?

A Completed in July of 1952.

Q Five and a half inch line set at that time?

A It was, and circulated.

Q You do not know whether you anticipate dualing that well at that time?

A No, sir. At the time we drilled our well we were offset to the north, the northwest, and to the west with Abo wells. And then we drilled a well to that zone not anticipating any further production.

Q Mr. Sanders, referring to your Exhibit No. 4, how many points of seal do you have to have in order to have a sure complete separation between the two zones?

A We have to have five points of seal.

Q There are five?

A Two on the parallel strings, two in the cross-over assembly --

excuse me, that's six -- one at the -- where your tubing goes into your packer and the packer itself.

Q Right here?

A Yes, the packer itself is two, two in the parallel strings, and two in the cross-over assembly.

Q One is at the landing head?

A And one beyond the landing head. There is two seals in the one inch tubing, there is an upper seal and a lower seal.

Q Now, in an ordinary two string dual completion, how many points of leakage are there?

A In an ordinary string it doesn't require a gas vent. There are two, both located at the packer; packer seal against the casing, and the seal on the tubing. A parallel installation with a gas vent has three.

Q So this type of completion does offer a lot more possibilities for communications?

A It does offer possibilities of communications. The sitting arrangement on the one inch tubing are the standard sitting cups used on pumps. Those pumps have proven themselves to seal. We have used them throughout the industry for a number of years as sitting cups for pumps. We know that they hold, because when we start out pumping units, we get a delivery of production. On the first reciprocation of the rod strings, if they weren't holding, we would have leakage and we would have to pump the well up.

Q Are there any abrasives of any nature in the fluids from the Abo formation?

A No, sir, not as such. There is no sand problem and there is no partial problem in that formation.

Q Are there any abrasives that you know of that will be possible in the Terry-Blinebry formation?

A Not to my knowledge.

Q So you don't feel that abrasive action in the packer assembly with the reciprocating rod would be a problem?

A No, sir, I don't. We feel like using metal metal pumps, that we are using, that the water on the pumps will be as fast or faster than the pack-off assembly, and that will require pulling the pump for repair prior to any leakage to the pack-off assembly.

Q Do you intend to use metal to metal in this --

A We anticipate using metal to metal at the beginning. If we have any difficulty with that we will -- in other words, if the life of the pack-off assembly is such that it requires the installation be pulled from the pack-off assembly, we will test the other two types of packing, and in the end use the one that gives us the best service. We are using metal to metal pump pluggers, and we feel that we would get as good a life with the metal to metal, and then, too, the manufacturer in this case supplies metal to metal principally.

Q And that assembly is 18 inches long with one-thousandths clearance?

A No, it is 36 inches long with one-thousandths clearance, the packing assembly where you use the other two materials is 18 inches.

Q What diameter is the tubing at this point?

A I believe that's an inch and an eighth.

Q With the one-thousandth clearance on an inch and eighth rod, 36 inch bearing surface, isn't that a pretty close tolerance for that length of varying surface in regard to alignment to prevent bending?

A It will be precision fit. The manufacturer's specifications are what it will be fit to, and it gives you room enough for an oil seal for oil to be supplied throughout the length of it. I don't think it will bind. In fact, there is enough weight below on the lower pump to insure straight string up or down, whichever the case may be whenever this action is taken, when the head of the pumping unit is going up.

Q In case it should bind, that would probably cause excessive wear?

A That's right. If it would cause excessive wear, we would get an indication of communication and would have to pull it.

Q I believe you stated that you were not sure whether or not the Terry-Blinebry zone would flow?

A That's right, sir. The offset well flowed for -- I am not sure how long it flowed, but it did flow for a while and they now have a pumping unit over the well to cause it to flow, or have to pump it all the time, I don't know.

Q If it did flow, you would not install the upper pump assembly?

A That is right. If it does flow, we will not install the upper pumping unit.

Q Mr. Sanders, have you investigated all other types of pumps toward the end of using twin string pump equipment in this well?

A I investigated the use of a small pump in each zone, utilizing the two and a sixteenth Hydril "CS." We can pump it by taping our strings above our two and a sixteenth after we get out our five and a half liner adding on two inch EUE. We can get a supply hole challenger inch and a quarter pump that can be run. The gas problem that we have in that pump in a formation that has 2,667 to 1 ration, is that it would result in gas locking the pump unless a gas vent is provided.

Q It is necessary to put the gas vent in the third string?

A It has been our experience that it has been necessary to provide a gas vent.

Q Do you feel that that type of completion would be a practical type of completion aside from economics?

A I feel like this is a most practical application for producing these two zones under these conditions. I've investigated the use of gas lift. Magnolia, to my knowledge, doesn't have any of these installed, but the industry, as a whole, has sufficient installation of these cross-overs to prove that they will operate. We feel like if we had any other method, we wouldn't ask for it this way, but we are faced with poor low pressure, poor lower zone that will not rise sufficiently to allow us to use two packers and gas lift. Normally, our installations have utilized gas lift in cases such as this.

Q If you were drilling this well over at this time, knowing that you had to dually complete it, would you recommend this type of completion?

A I would recommend setting seven inch casing in this well.

Q Then, you are recommending this type of completion only because the well is now completed in the small five and a half inch liner?

A Right, because we have such a small casing that we feel this is the most practical method of producing.

Q And you wouldn't recommend this type of completion for a new dually completed well?

A Starting from design of the installation, looking at the economics of it all, I don't believe I would. It might be economic -- the economics of running seven inch might be such that this might be the most economical way to be able to pay the well out, and it may be attractive under those conditions.

Q You consider this somewhat of a salvage operation?

A That is right. We only produced 49,000 barrels from the Abo; we only anticipate 45,000 from the Blinebry, providing it will produce that much. Therefore, we feel like it is salvage.

Q You wouldn't recommend this type of installation under any other circumstances except a salvage operation?

A That's right.

Q Now, on your Exhibit No. 5, I note that you have calculated the Abo reserves on the basis of decline.

A We have drilled in 52, and I hesitate to use the word marginal, but it has been a limited capacity well quite a bit of that period. We have an excellent decline curve on it, the well was reconditioned, worked over in December of '57 to assure that we would be able to produce all of the recoverable reserves, and on the basis of the decline curve, why that's our estimation of the reserves.

Q What was the original Abo pressure bottom hole?

A I am just afraid I don't know exactly what it was.

Q Can you give me an idea of what the decline was?

A Well, I know the offset well in '56 had 1,283. I would anticipate it was probably in the neighborhood of 22,500.

Q At the time you drilled this well?

A Yes.

Q So, your decline was from around 22,500 to 500 pounds?

A Yes, 2500, not 22,500.

Q 2,500?

A In other words, we have had a decline of over 2,000 pounds with the production of only 49,000 barrels of oil.

Q That's for 40 acres?

A That's for 40 acres. Of course, the estimate is independent of the acreage, it is based strictly on the producing capacity of the well and how it has declined over the period of years.

Q Your fifty-five dollars is for --

A Low pressure gas.

Q Mr. Sanders, did I understand you to say that you had several of this type of equipment in operation in Texas?

A I say Magnolia doesn't. I say we have been fortunate enough in that when we had a poor zone it was the upper zone and we were able to use gas lift installation. Therefore, we weren't bothered with having to vent the gas. We would use the packer arrangement and gas in the annulus for both zones.

Q Magnolia itself hasn't had any experience --

A We have no experience with this type of installation.

Q Do you know how long this type of equipment has been used by other companies?

A Eight to ten years. This type of a cross-over has been on the market for that long, Otis has been selling it for that long.

Q Do you know of first hand knowledge how practical it's been --

A Just from my research into publications and trying to find out what the best method was to dually complete a well such as this.

MR. PAYNE: What do those publications indicate?

A They indicate that this method is successful. I can read you conclusions of Mr. Robinson's article. "Dual pumps have proved that dual wells can be produced without commingling the fluids from two separate horizons after the well ceases to flow. The successful operation of this equipment has served to produce two horizons without the expense of drilling two wells.

There should be little doubt as to the initial savings made in drilling one hole and dually completing a multiple zone well. It is believed that the era of dual pump wells actually is in its infancy and will grow to take its place among the other standard producing methods in the petroleum industry." This was in '54.

Q Unless you are allowed to dually complete this well in this manner you feel there will be waste of oil, that is, waste of oil left in the ground?

A We feel like there will be oil left in the ground.

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

(Witness excused)

MR. UTZ: Are there any other statements in this case? If not, the case will be taken under advisement. And let's take five and let the Reporter rest.

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 1st day of July, 1958, in the City of Albuquerque, County of Bernalillo, State of New Mexico.

Joseph G. Trujillo
NOTARY PUBLIC

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. 1453 heard by me on May 28, 1958.
_______________, Examiner
New Mexico Oil Conservation Commission

OIL CONSERVATION COMMISSION
P. O. BOX 871
SANTA FE, NEW MEXICO

July 11, 1958

COPY

Mr. James E. Sperling
P.O. Box 466
Albuquerque, New Mexico

Dear Mr. Sperling:

On behalf of your client, Magnolia Petroleum Company, we enclose two copies of Order R-1216 issued July 11th, 1958, by the Oil Conservation Commission in Case 1453.

Very truly yours,

A. L. Porter, Jr.
Secretary - Director

bp

BEFORE THE OIL CONSERVATION COMMISSION
OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION OF NEW MEXICO FOR
THE PURPOSE OF CONSIDERING:

CASE NO. 1453
Order No. R-1216

APPLICATION OF MAGNOLIA PETROLEUM
COMPANY FOR AN OIL-OIL DUAL COMPLETION
IN THE TERRY-BLINEBRY POOL AND WANTZ-
ABO POOL IN LEA COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This cause came on for hearing at 9 o'clock a.m. on May 28, 1958, at Santa Fe, New Mexico, before Elvis A. Utz, Examiner duly appointed by the Oil Conservation Commission of New Mexico, hereinafter referred to as the "Commission," in accordance with Rule 1214 of the Commission Rules and Regulations.

NOW, on this 11th day of July, 1958, the Commission, a quorum being present, having considered the application, the evidence adduced and the recommendations of the Examiner, Elvis A. Utz, and being fully advised in the premises,

FINDS:

(1) That due public notice having been given as required by law, the Commission has jurisdiction of this cause and the subject matter thereof.

(2) That the applicant, Magnolia Petroleum Company, is the owner and operator of the Stephens Estate No. 1 Well, located in the NW/4 SW/4 of Section 24, Township 21 South, Range 37 East, NMPM, Lea County, New Mexico.

(3) That the applicant proposes to dually complete the said Stephens Estate No. 1 Well in such a manner as to permit the production of oil from the Wantz-Abo Pool through 2-inch tubing up to a cross-over assembly thence through 1-inch tubing to the surface and to produce oil from the Terry-Blinebry Pool through a parallel string of 2-inch tubing, and that the applicant proposes to equip the well with a dual-zone pump operated by a single pump rod.

(4) That communication between the Wantz-Abo Pool and the Terry-Blinebry Pool would cause underground waste.

(5) That the use of the proposed dual-zone pump operated by a single rod string would greatly increase the risk of communication between the two pools.

Case No. 1453
Order No. R-1216

(6) That there is danger that the proposed dual completion will cause underground waste and that the application should, therefore, be denied.

IT IS THEREFORE ORDERED:

That the application of Magnolia Petroleum Company, in Case No. 1453 be and the same is hereby denied.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

E L Mechem

EDWIN L. MECHEM, Chairman

M E Morgan

MURRAY E. MORGAN, Member

A L Porter Jr

A. L. PORTER, Jr., Member & Secretary

ir/

BEFORE THE OIL CONSERVATION COMMISSION OF THE STATE OF NEW MEXICO

IN THE MATTER OF THE APPLICATION OF MAGNOLIA PETROLEUM COMPANY FOR AUTHORITY TO DUALLY COMPLETE ITS STEPHENS ESTATE NO. 1 LOCATED IN THE $NW\frac{1}{4}$ OF THE $SW\frac{1}{4}$ OF SECTION 24, TOWNSHIP 21 SOUTH, RANGE 37 EAST, IN THE TERRY BLINEBRY POOL AND THE WANTZ ABO POOL, LEA COUNTY, NEW MEXICO.

CASE NO.______

A P P L I C A T I O N

TO THE HONORABLE OIL CONSERVATION COMMISSION OF THE STATE OF NEW MEXICO:

COMES NOW Magnolia Petroleum Company, Applicant herein, and respectfully alleges and states as follows:

1. That it is the owner and operator of an oil and gas lease covering the $SW\frac{1}{4}$ of Section 24, Township 21 South, Range 37 East, Lea County, New Mexico.

2. That it has drilled and completed its Stephens Estate No. 1 in the $NW\frac{1}{4}$ of the $SW\frac{1}{4}$ of said Section 24, and has completed same at a plugged back depth of 7,149 feet. Said well has 7-5/8 inch casing set at 3,145 feet with 2,510 sacks of cement and a 5-1/2 inch liner set from 3,000 feet to the original total depth of 7,481 feet with 660 sacks of cement.

3. That said well is presently producing oil and gas through perforations in the Wantz Abo reservoir found at an approximate depth of 7,035 feet.

4. That it is proposed to dually complete this well by perforating the 5-1/2 inch liner within the approximate interval of 5,684 feet to 5,897 feet in the Terry Blinebry formation and setting a production type packer below these perforations at approximately 7,000 feet. Oil from the Wantz Abo formation will be pumped from below the packer up two-inch tubing to a cross-over where it will be routed through a one-inch parallel string to the surface. The Terry Blinebry oil will be pumped to the surface through the two-inch tubing.

R-610

5. That Rule 5 of the Terry Blinebry oil rules prohibits the dual completion of a well to cause said well to be classified as an oil well in the Terry Blinebry oil pool and an oil well in any other oil and gas pool; and that an exception to said rule is hereby requested.

6. That the method of dual completion proposed herein is in accordance with good engineering and production practices, will prevent waste, protect the correlative rights of all parties concerned and will prevent the migration of fluids from one formation to the other.

7. That attached hereto and made a part hereof is a plat, labelled Exhibit "A" showing the area surrounding the Stephens Estate

lease and showing offset wells on offset leases. Also attached is a schematic diagram of the proposed dual completion which has been labelled Exhibit "B".

WHEREFORE, Applicant prays that this Application be set for hearing, that notice be given as required by law, and that upon the evidence adduced at such hearing, this Commission issue an order granting Applicant approval to dually complete its Stephens Estate No. 1 in the Terry Blinebry and Wantz Abo oil pools.

DATED this 22nd day of April, 1958.

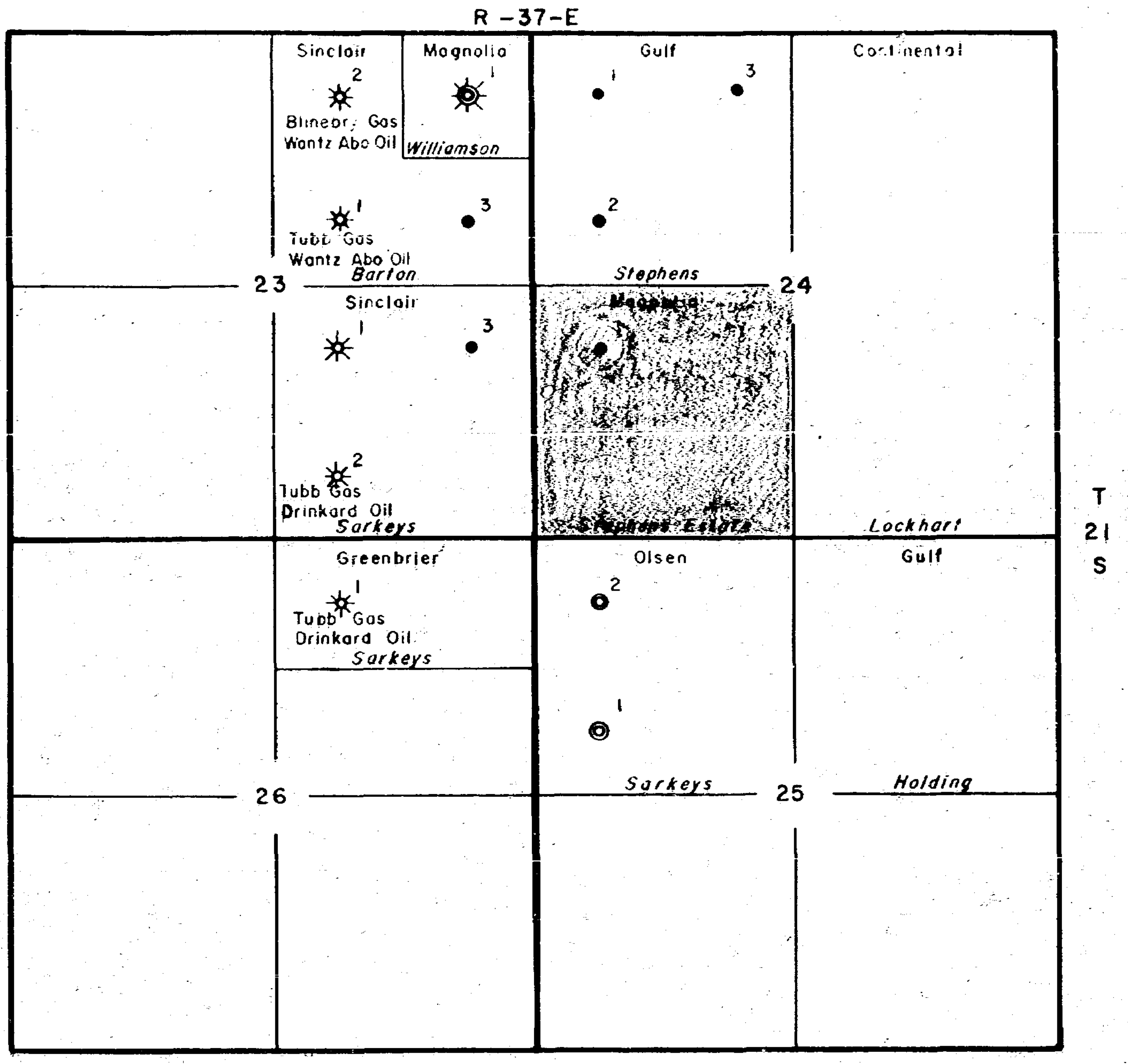
MAGNOLIA PETROLEUM COMPANY

By MODRALL, SEYMOUR, SPERLING, ROEHL & HARRIS

By James E. Sperling
James E. Sperling
Its Attorneys
P. O. Box 466
Albuquerque, New Mexico

EXHIBIT A

X-6645



LEGEND

- ● Wantz Abo Oil Well
- ● Terry Blinebry Oil Well
- Blinebry Gas Well
- Blinebry-Tubb Oil Well
- Blinebry-Tubb Gas Well

MAGNOLIA PETROLEUM COMPANY PRODUCING DEPARTMENT DALLAS - TEXAS DISTRICT - LEA STEPHENS ESTATE AREA	SHEET NO. 1 SCALE: 3.3" = 1 Mile DATE - 3/7/58 DRAWN gee CHECKED APPROVED C.J.C. REVISED

Magnolia Petroleum Company
A Socony Mobil Company
P. O. Box 2406
Hobbs, New Mexico

June 3, 1958

New Mexico Oil Conservation Commission
P. O. Box 871
Santa Fe, New Mexico

Reference: Case No. 1453

Dear Sirs:

Attached please find copies of the references cited in Case 1453 as requested by Mr. Elvis A. Utz.

Yours very truly,

MAGNOLIA PETROLEUM COMPANY

C. T. Evans JLS
C. T. Evans
District Petroleum Engineer

JLS:kb

Sub-Surface Two-Zone Pumping

By Donald F. Taylor, Jr.
and Kenneth W. Robbins

Otis Pressure Control, Inc., Dallas

Economics

Many dually completed oil wells are flowing and may be expected to continue flowing for many years. The flowing life of other dual oil wells is relatively short for one or both pays. Some dual oil wells never flow and require artificial lifting equipment at the time of completion. Pumping equipment that would lift well fluids separately and simultaneously from dual wells was developed in 1947.

This pumping equipment was developed with two purposes in mind. First, it is designed to provide a means by which the operators of dually completed oil wells can pump one or both producing formations without co-mingling fluids. Second, it is designed to provide a means by which the operators of singly completed oil wells can recomplete their wells as dual producers. Great economic advantage can be obtained in many fields by producing two pays simultaneously through one well bore. The practical possibility of pumping two producing formations simultaneously offers substantial investment and operating savings compared with twinning wells, or producing a lower pay to depletion.

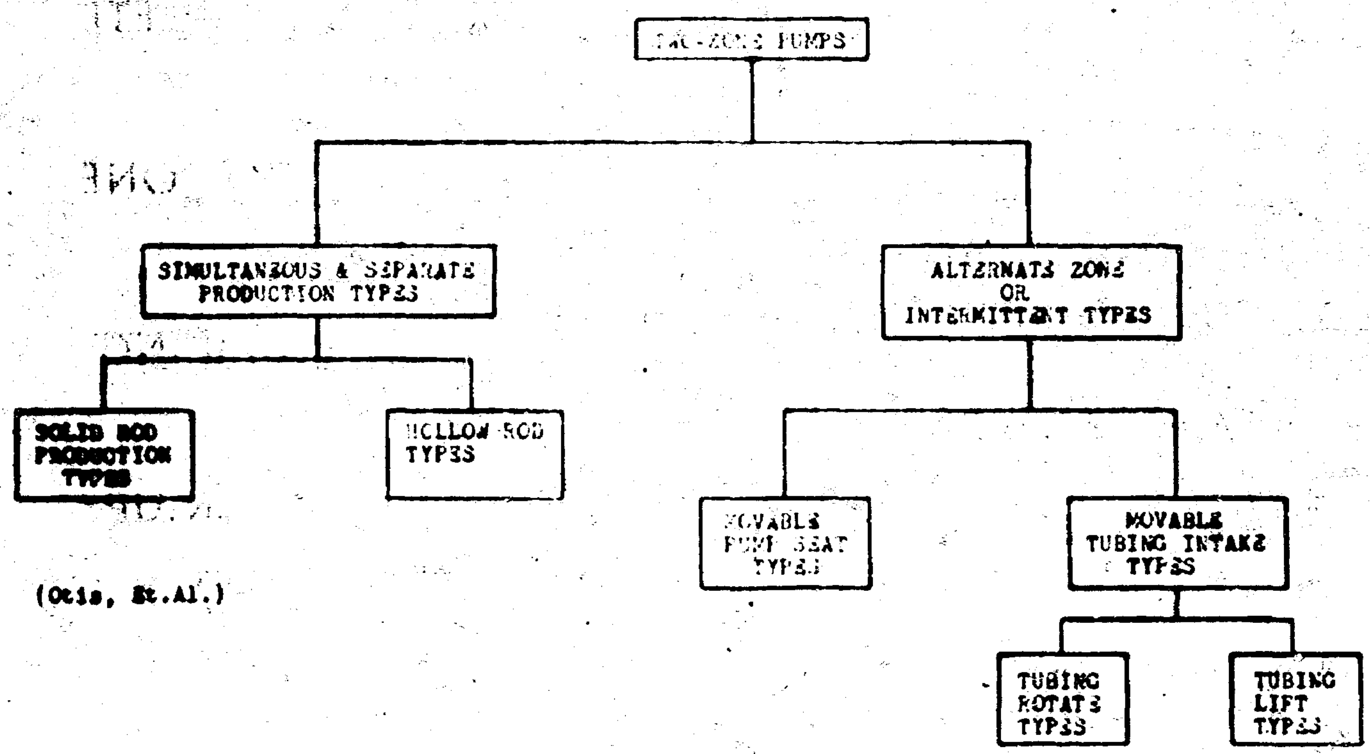
Present-day methods for the practicable and profitable production of dually-completed oil wells have progressed to such a degree that, as a matter of practical economics, operators are virtually compelled to review the possible advantages of two-zone production before starting additional drilling programs. This is logically evident when it is considered that usually, a second, known formation can be produced at a small percentage of the cost of drilling and completing a new well. A dual-completion, where possible, naturally eliminates the need for an additional outlay for pipe, rods, tubing, a pumping unit, pumping engine, and other capital equipment. Too, the development of another pay horizon by re-completing a single-zone well ofttimes is more desirable than re-drilling to deeper pays or drilling twin wells. These observations do not apply to new, flowing wells alone; for instance, even if a well is on the pump, the use of the sub-surface equipment described herein does not, as a general rule, entail the installation of any additional surface equipment or the use of additional rods, etc. A second flow line fitting must of course be made up at the casing outlet, but the operation of the Otis Two-Zone Pump does not require an additional stuffing box, polished rod, or pumping jack, nor are there any flexible lines, hollow polished rods, or other special fittings that require additional installation and maintenance.

There are a sufficient number of dual pumps in operation to prove that this sub-surface equipment will pump fluid from two horizons. Thus, when additional sub-surface equipment only is considered, it can readily be seen that the small per-well increase in operating costs is of little importance when compared with the great saving realized in the drilling and completion costs of two wells. This equipment is one of the most important recent production developments offered to the industry.

"What does it cost to produce a barrel of oil?" This is a question in the mind of every operator. The actual cost attributed to that barrel of oil many involve such costs as seismograph work, geological studies, land fees, drilling, completing, office and field operating costs, and many others. With the present trend in rising costs of both finding and producing oil, the oil companies must operate efficiently in order to maintain a fair profit. Each new tool or service offered must reduce costs or increase net profits, or both, to be successful. These are the primary objectives of the dual pump assembly. Not only does the dual pump meet these requirements, but it also conserves vital material such as casing, sucker rods, pumping units, engines, and other equipment.

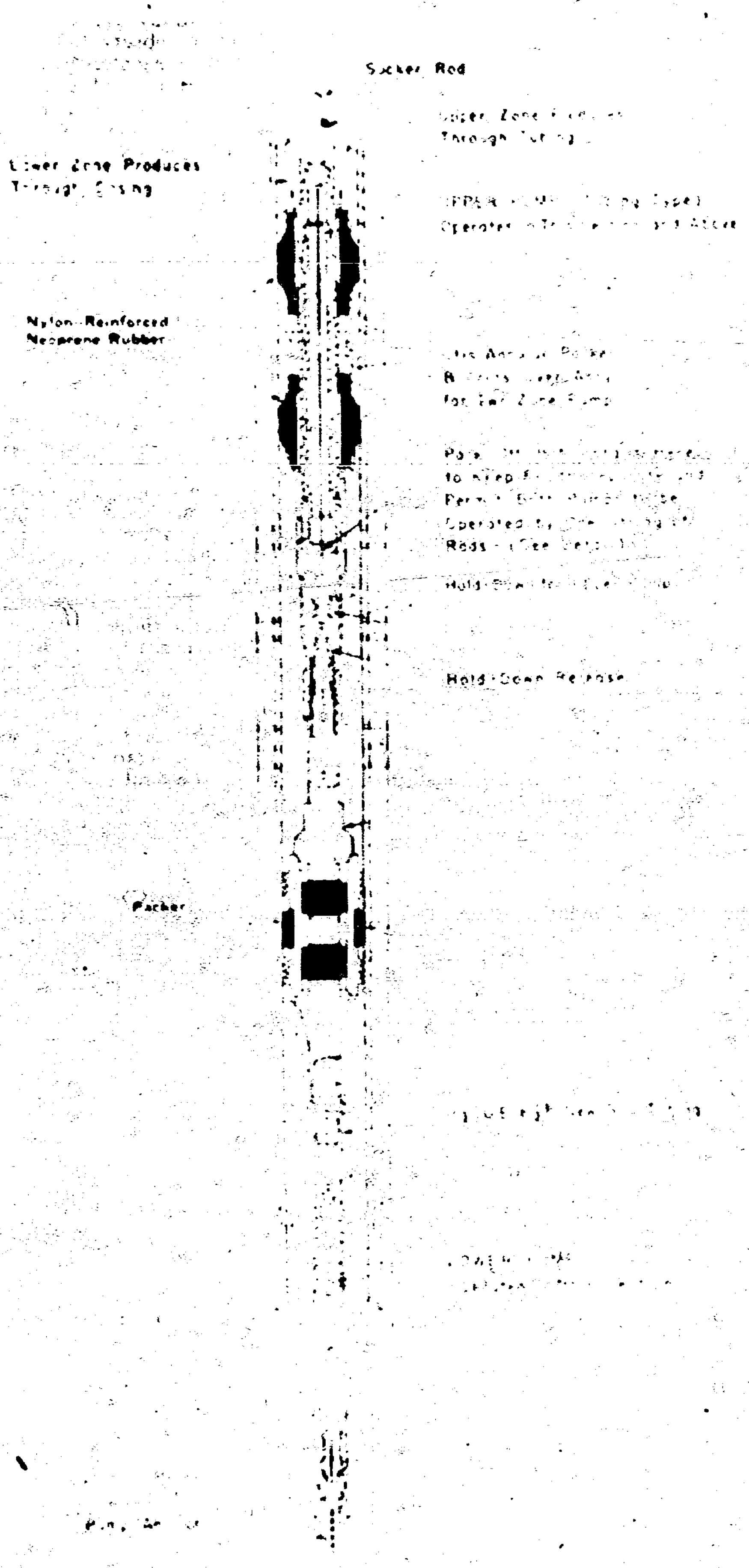
Structures

There are several possible structures of equipment available today. These structures differ in their basic operation. However, all mentioned here use a conven-



(Otis, Et.Al.)

CHART 1



VIEW SHOWING

COMPLETE

TWO-ZONE

PUMPING

HOOK-UP

CHART II

ILLEGIBLE

tional pumping jack and a rod string to operate the sub-surface pumps. These two main structures [illegible] (Please refer to Chart I)

1. Intermittent type: Employs one oil well pump [illegible] alternately produces one zone at a time by means [illegible] suitable sub-surface equipment.

2. Simultaneous and separate zone production type: There are two main sub-structures commercially [illegible] able at the present:

A. Hollow Rod Type: This structure employs a string of hollow sucker rods to produce one zone and [illegible] the tubing-casing annulus or the tubing rod annulus to produce the alternate zone.

B. Solid Rod Type: This structure employs a standard string of A.P.I. sucker rods and the tubing to produce one zone while the alternate zone is produced from the tubing-casing annulus.

This structure is by far the most practicable and it is here that the greatest use has been experienced. This structure will also be the basis upon which additional major developments of "dual pumping" will be based. It is, as a matter of fact, the type with which we will be concerned during the remainder of this article. All of the Otis Two-Zone Pump types fall under the Solid Rod Method of production.

There are four main assemblies of the Otis dual pump: (Please refer to Chart III) (1) A positive [illegible] placement pump to produce the upper pay, (2) a cross-over device within an annular style packer that has separate passages for the fluids from the two pays, the lower zone being crossed over into the tubing-casing [illegible] the upper zone taken directly into the [illegible] attached to the upper plung- [illegible] pump and a pack-off unit [illegible] within the tubing, and (4) [illegible] pump to produce the lower pay. [illegible] packer must be used in all dual wells [illegible]. Although this packer is not con- [illegible] of the pump proper, it is very important [illegible] packer have certain mechanical features in [illegible] effective in dual pumping. These may be [illegible] as follows: (1) No part within the [illegible] during the pumping cycle, (2) The [illegible] should set positively with very little [illegible] from the tubing string; (3) [illegible] should have a large contact area, and (4) [illegible] I.D. of the packer should not be less [illegible] the tubing I.D.

The Otis Two-Zone Pump will produce oil from two separate oil sources and keep the two sources separated [illegible] the entire production cycle. A solid rod string is used throughout the pumping equipment. The lower zone production is pumped out of the tubing-casing annulus and the upper zone production is pumped [illegible] the tubing at the surface through a regular pumping tee.

The stroke may be any length that is desired, including strokes up to 20 feet long. There is no practical dimensional length restricting the rod string as to the placement of the intake of each zone. Installations with 40 feet between the seat of each pump have been made; likewise, an installation has been experienced

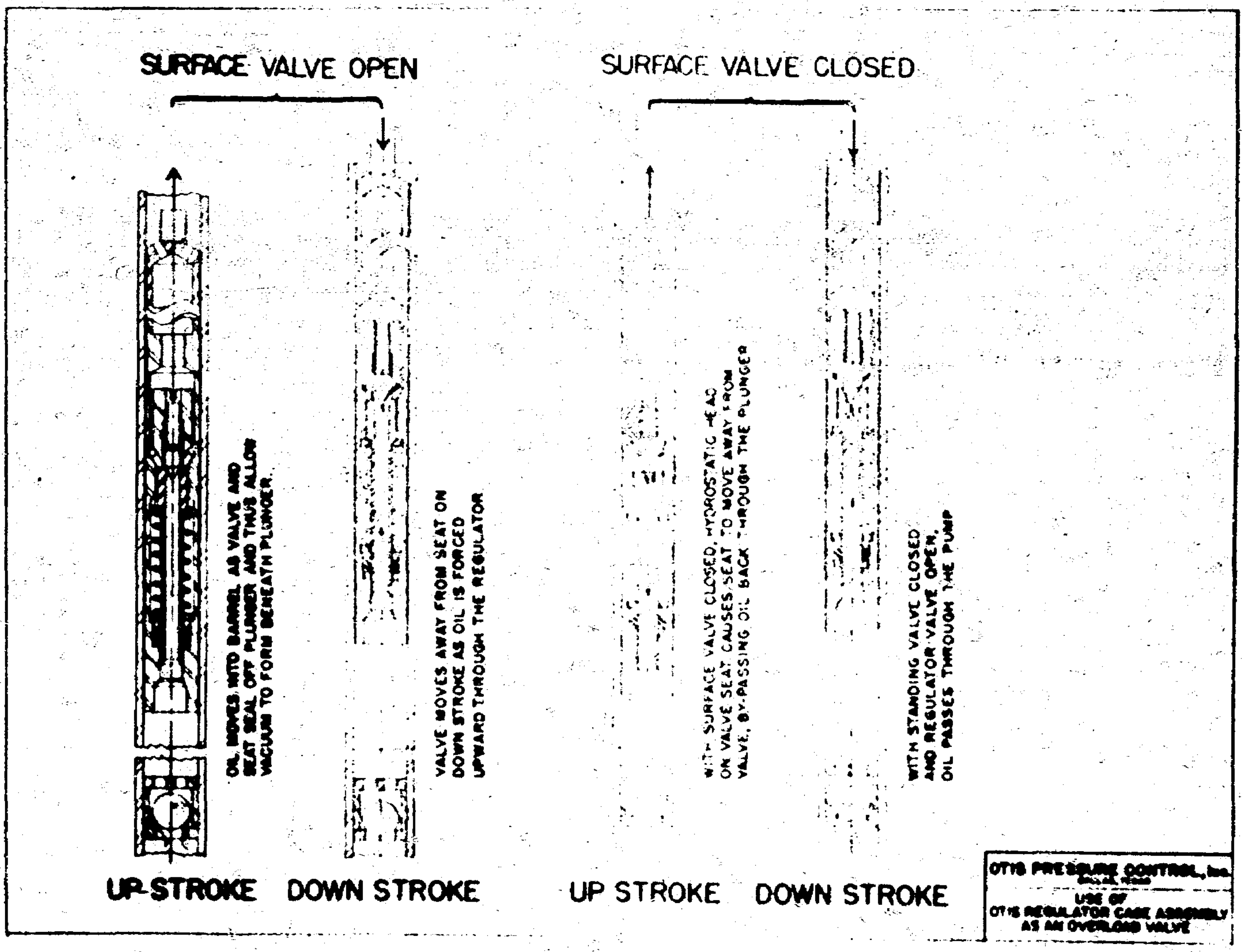
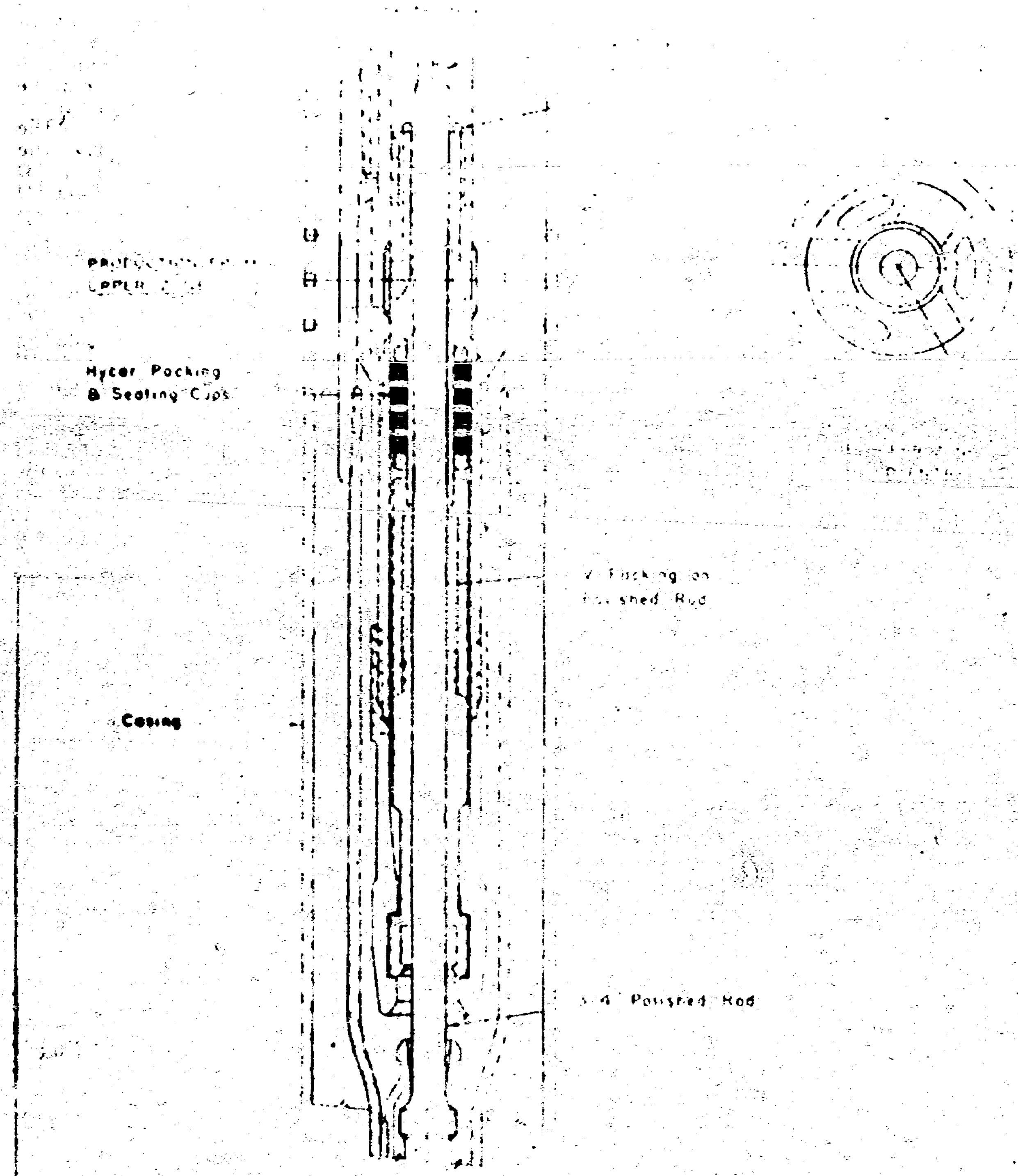


CHART III

ILLEGIBLE



SCHEMATIC DETAIL OF PACK OFF
UNIT BELOW ANNULAR PACKER

CHART IV

ILLEGIBLE

CHART V
DUAL PUMP PLUNGER COMBINATIONS AND CRITICAL DATA

	Minimum Tubing I. D. (Nominal)	2½"	2½"	2½" or 2"	2"	2"
Upper Plunger	O D	2-1/4"	2"	1-3/4" - 40	1-1/2"	1-1/4"
	Area, Sq In.	3.976	3.142	2.513	1.767	1.227
	Displacement Area, Sq. In.	3.536	2.700	2.061	1.325	0.785
	Displacement Diam., In.	2-1/8"	1-55/64"	1-5/8"	1-19/64"	1"
	Available Pump Type	Tubing	Rod	Tubing or Rod	Rod	Rod
1-3/4" Lower Plunger	Area, Sq In	2.405	2.405	2.405	2.405	2.405
	% Capacity of Upper Plunger	68.1	89.2	116.1	182	352
	Available Pump Type	Tubing	Tubing	Tubing	Tubing	Tubing
	Otis Type Designation for Upper Plunger	A or B	G or H	A or G	G or H	G or H
1-1/2" Lower Plunger	Area, Sq In	1.767	1.767	1.767	1.767	1.767
	% Capacity, Upper Plunger	50.8	65.4	85.2	133	225
	Available Pump Type	Rod	Rod	Rod	Rod	Rod
	Otis Type Designation for Upper Plunger	C or D	E or F	C or D	E or F	E or F
1-1/4" Lower Plunger	Area, Sq. In.	1.227	1.227	1.227	1.227	1.227
	% Capacity, Upper Plunger	34.7	45.4	59.2	92.5	156
	Available Pump Type	Rod	Rod	Rod	Rod	Rod
	Otis Type Designation for Upper Plunger	C or D	E or F	C or D	E or F	E or F
1-1/16" Lower Plunger	**Area, Sq. In.**	**0.887**	**0.887**	**0.887**	**0.887**	**0.887**
	% Capacity, Upper Plunger	**25.1**	**32.4**	**42.8**	**66.9**	**113**
	Available Pump Type	**Rod**	**Rod**	**Rod**	**Rod**	**Rod**
	Otis Type Designation for Upper Plunger	**C or D**	**E or F**	**C or D**	**E or F**	**E or F**

ILLEGIBLE

with a distance of some 2,180 feet between pumps.

Main Assemblies of Otis Two-Zone Pumps

The Otis Two-Zone Pump consists (as we have said) of four main assemblies. This is true for nearly every type of two-zone pump manufactured.

These assemblies employ, wherever possible, conventional pump parts made according to A.P.I. specifications. Because of the very theory of using two pumps and because the API specifications were not drawn to include two-zone pumps, there are a few parts with specifications other than A. P. I. This means that new connections of adequate strength had to be designed, and new materials of adequate strength and performance had to be adapted to meet deep well pumping conditions.

Deep--Well is defined as a single zone well pumping any quantity from below 7,000 feet, or a well producing 500 barrels of fluid from between 5,000 feet and 7,000 feet of depth.

When considering the loads encountered in pumping two zones at 5,000 feet or greater depths, you will readily understand that each two zone pump installation at or below these depths constitutes a deep well. To satisfy deep-well conditions, the Otis Two-Zone Pump has sufficient strength and durability to pump fluids within the limits imposed by the use of present day sucker rods.

The upper positive displacement type pump connects directly into two of the main assemblies. This upper pump may consist of one of two basic types of oil well pumps: It may be either a tubing type or a rod type of pump. These pumps always use metal plungers. The tubing type of pump may use either a common working barrel or a tubing liner barrel. The rod type may consist either of a regular barrel tube or a liner barrel, and for the present time, the barrel is stationary with top and bottom seals and hold-downs.

The annular packer employs synthetic rubber cups to seal against the casing and prevent flow past the packer under very low or high pressure differentials. Likewise, this packer is designed structurally to withstand very high pressure differentials either internally or externally. It has built into it a cross-over device in the metal parts of the packer. This cross-over consists essentially of a horizontal tube arranged to by-pass a vertical tube. Attached below the cross-over is a nipple arranged internally to allow a pack-off unit to come to rest within it. Beneath this nipple is a set of outer clutch prongs for properly locating the pack off unit.

The solid down-the-hole polished rod that connects the upper pump to the lower segment of sucker rods is 3/4" in diameter. Surrounding the rod is a standing valve and pack-off unit that uses A.P.I. sealing cups on the outside to separate the two pays within the internal nipple. Beneath the seating cups and located inside the pack-off is the packing which seals against the polished rod and forms a down-in-the hole stuffing box. This inside, or rod, packing is a self adjusting type of V-Packing of a composition suitable for withstanding very high pressure differentials at elevated temperature for prolonged periods. Beneath this pack-off unit is a special, square-shouldered hold-down which is designed to come to rest in the recess of the outer clutch prongs. Above this pack-off unit is placed the annular ring-type standing valve for the upper pump. This valve has the unique feature of operating around the down-hole polished rod and is run and pulled on the rod string, and thus forms a true upper zone standing valve.

The lower pump may either be a tubing type of pump, or a rod type pump. The tubing type of pump may be as described earlier. The rod type of pump, with certain modifications made externally, may be a rod stationary barrel, a rod traveling barral, and is always equipped with a bottom lock hold-down.

Equipment Selection

Having discussed the design and construction of the Otis dual pump, the next phase will touch briefly on equipment selection and application. When considering the use of a dual pump, several factors enter into the economic study of the operation which will affect the operator's decision to dually complete a well. These factors will usually be the same with the exception that one factor differs only in new-well and old-well practices. Some of these are outlined in Chart IV.

Chart IV
Economic Factors Influencing
Dual Completions

1. Completion practice (involves materials and services):

A. New-Well Completion:

(1) Landing the casing, or "oil string" on top, or through the lower zone.

(2) Effecting a positive seal between the selected zones outside of the casing.

(3) Testing the casing, and the cementing operations encountered while accomplishing the first two operations.

B. Old Well Re-completion:

(1) Deepening to a new zone.

(2) Re-completing up the hole into a previously passed-up productive zone.

(3) Re-opening a previously non-commercial productive zone which may be produced commercially with the use of a dual pump.

C. Operations applicable to both new and old-well re-completions:

(1) Testing each zone independently for oil, water or gas production (This may be done in the drilling stages, or the re-work stages; however, the subsequent (interim) operations may have had an adverse effect on the productive zones. Therefore, it usually is advisable that this operation be performed after the casing is landed, said formation treatments, etc.)

(2) Sand-face or formation treatments. (This may be feasible prior to the productive testing, or at any time desired during the completion phase).

(3) Well bore clean-up may involve several operations, however, this operation is important for the successful operation of any dual completion, pumping or flowing.

2. Tubular program required for dual pumping.
3. Sucker Rod program required.
4. Surface equipment required:
   A. Pumping Unit, Gear Box, Engine, etc.
   B. Flow Lines required.
   C. Tankage and metering facilities required.
5. Operating practices which apply to the area.

These factors may actually be resolved into cost. Offsetting this cost, and affecting the application also is the expected return in terms of barrels of oil and cubic feet of gas, which may be converted into dollars and cents. This may be termed "additional pay out." After all, you, as production men, are accustomed to frequently looking at the size of the pot in a small, friendly game of poker during off-duty hours, are you not? Especially when some of your money is already in it, eh?

Now if we have studied the factors mentioned above and we have determined:

1. That a dual pump is feasible.
2. The depths at which we must pump.
3. The size of tubing available.
4. The size and weight (nominal) per foot of casing in which the packers must land.
5. The quantities of oil, gas, and water to be produced from each zone.

ILLEGIBLE

6. The surface equipment available
7. The tubing sizes available for pumping
8. The rod sizes available for operating the pumps

Then we may select a two zone pump (Chart V)

We have now arrived at that point wherein we become involved in the calculations of a pumping well. I quote the **Practical Petroleum Engineer's Handbook** by Mr. Sobo and Mr. Doherty, third edition, 1949: "Lifting of well fluid by sucker rod pumping is a complex mechanical problem." This is true. However, the addition of a second oil well pump onto the rod string does not complicate our "complex mechanical problem." It merely causes us to abandon all of our convenient single pump charts (which have been carefully devised for us) and to revert back to the basic equations and use slightly different numbers in our calulations (i.e. the equations have not changed--only the numbers!)

In order to select equipment in a logical manner, it is necessary to predict, with a reasonable accuracy, the loads and stresses which may be expected while operating a two-zone pump. The calculated loads placed on the polish rod will determine the size of the pumping unit to be installed. The practicing theory is to install the largest unit with the longest stroke that will ever be needed to obtain the desired production from that individual well. The effective areas of the two plungers affect the loads placed on the rod string. These areas, for load purposes, may be added. The weight of the rods influence the load on the polished rod at the surface. The same consideration in regard to stress loads, peak torque, and other limiting factors will apply to dual installations. The capacity of the pump for the upper zone is reduced by the amount of the area of the rod which follows the upper plunger on each up-stroke. This "effective" displacement capacity of the upper plunger, for convenient calculation purposes, may be stated as an equivalent plunger diameter, and as such, may be used to calculate volumetric production. (See Chart V.)

Installation

Having decided upon the proper equipment, the well must be prepared for the dual pump installation. Once the well has been perforated or by other means opened to the pay zone, it is good practice that the well be cleaned thoroughly of any sand, scrap formation material, or other matter that it is possible to have removed. Also at this time, each zone should be accurately tested for productivity. As an added precaution, it is advisable that the operator scrape the pipe to remove any sedimentary deposits of drilling mud, cement, slurry mix, jell, bullets, burrs, or slag steel resulting from the use of a casing perforator. This is good, sound oil field practice regardless of the type of packer used. This is desirable because the operator is placing quite a financial burden on any packer, regardless of its cost, to assure a seal between the formations, and thus assure the producing success of his dual well.

A dual pump must be accurately and carefully installed. For instance, the distance between pump seats in the tubing string must be measured accurately and the correct length of rod string installed. The installation of a pump is described briefly as follows. It may be run inside 5" O.D., or larger, casing. Tubing of 2" diameter or larger may be used in the well. The upper pump seat, annular packer, cross-over fitting, tubing segment between the upper and lower pumps, and the lower pump seating shoe are made up in the tubing string and lowered to the desired depth in the casing. The lower packer is set, and a predetermined amount of weight is placed on the packer. The weight should be slightly greater than amount of force that the tubing string will be relieved of on the upstroke of the pump plungers. After the tubing is landed, preparations are made to run rods and the remaining portions of the two pumps.

The lower pump (or plunger) is attached at the lower end of the sucker rods. The length of the sucker rods to be run between the pumps must be tallied so that the upper and lower plungers will be spaced properly in each barrel. A special coupling is attached to the upper end of this segment of rods. The function of this coupling is to join the solid polished rod with the lower segment of sucker rods and to carry the rod pack-off unit and upper pump standing valve into their proper seat. The top of the polished rod is joined to the upper plunger or pump by means of a special cage. The top of the upper pump plunger connects to the sucker rods, which extend to the surface.

As the rods are lowered into the tubing, the lower pump passes through the upper pump barrel (or seat) and the clutch prongs of the hold-down unit. The pack-off unit and upper pump standing valve also pass through the upper pump barrel. As the special coupling passes the outer clutch prongs, the square shoulders of the special hold-down are stopped. This correctly positions and anchors the pack-off unit and the upper pump standing valve. As the rods are lowered further to the bottom of the normal down-stroke, the upper and lower pumps are landed in their seats. After the installation of a conventional stuffing box and polished rod at the surface, the dual pump is ready for operation.

Production

Production from either zone may be accurately controlled. This may be accomplished by various methods in addition to varying number and length of strokes:

1. Variation in relative sizes of pump plunger. (See Chart V.)

2. Actual disconnection of the lower pump by manipulation of the rod string.

3. Regulation of production below that of the pump capacity. The use of an overload valve has been adopted for pumps to provide a variable control over the volume of fluid produced through the pump. This traveling overload valve allows the produced fluid to be by-passed through the plunger on the upstroke and through the pump on the downstroke when the surface valves are closed. Under this arrangement a high potential zone can be completely shut in after it has produced its allowable.

Protection Against Paraffin

As a protection against an accumulation of paraffin in the tubing and in the annulus, paraffin scrapers are installed on the sucker rod string and a valve is placed in the tubing below the paraffin belt so that warm oil may be circulated at intervals as may be found necessary. The use of hollow sucker rods for the circulation of warm oil has been successful in some areas.

Well Servicing

Generally speaking, the frequency for pulling the rods for a dual pump is about the same as for single pumps. A pump work-over job takes a little longer than for a single pump, but only because two pumps must be serviced.

It has been considered advisable by some operators to leave the derrick in place so that the sucker rods can be hung in the derrick when the well is serviced. This practice makes it easier to keep the rods, tubing, and pump parts clean and free of sand and dirt.

Conclusions

Dual pumps have proved that dual wells can be produced without co-mingling the fluids from two separate horizons after the wells cease to flow. The successful operation of this equipment has served to

(Continued to bottom of page 32)

ILLEGIBLE

Operation and Maintenance of Mechanical Prime Movers

By J. Taylor Hood

Lufkin Foundry & Machinery Company
Lufkin, Texas

Part 1

Introduction

This paper is divided into two sections—the first covering a discussion of the types of prime movers used in the oil fields, their cooling systems and ignition. The second part covers fuel systems, lubrication and general maintenance items.

Almost all types of prime movers have been used at one time or another in the oil fields. Some of these have proven satisfactory, but many others have been discarded in favor of more acceptable types of equipment. Before we can properly operate and maintain oil field prime movers it is necessary that we understand the basic operation of the engine or motor.

There are four basic types of prime movers used in the oil fields:

(1) Electric motors.
(2) Four cycle high speed multi-cylinder engines.
(3) Four cycle slow speed engines.
(4) Two cycle slow speed gas engines.

Electric Motors

Electric motors are entirely different from internal combustion engines. It is not within the scope of this paper to cover electric motors completely. Normally, 900 and 1200 RPM AC motors are used in oil fields. The motor operates at a constant speed and its speed cannot be changed. Voltage required for operating these motors is usually 220 or 440 volts alternating current. There are both single and three phase motors. However, the single phase motor is usually applied to small jobs up to approximately 7½ HP and are used on REA lines where three phase current is not available. Starting of electric motors is usually directly across the line, i.e., the switch is thrown and the starting current is high but the motor obtains its speed very quickly and the current returns to normal for the motor.

Maintenance on electric motors is very simple. They should be kept clean and free from oil on and around the windings. The bearings may be either grease packed or oil lubricated. These should be checked according to the manufacturer's recommendation. All terminals should be made tight and breaker points on starters kept in good condition. Heaters are used as an overload device whereby if the load on the motor is too great a small bi-metal strip is heated until it trips and opens the line switch. This is protection for the motor. The heater should be installed large enough to accommodate the expected load of the motor, but not too much greater so as to provide protection of the motor and the pumping equipment.

Engine Cycles

To understand the operation of an internal combustion engine we must first understand what takes place to turn the air and gas fuel into power. There are two types of cycles used on engines. We will discuss the four stroke cycle and then the two stroke cycele in order to understand the difference in the types of engines.

A four stroke cycle engine, normally called a four cycle engine, requires a piston connection to the crankshaft. Push rods are used to push the intake and exhaust valves open at the proper time. A spark must occur at the spark plug at the exact time to develop power.

Let us follow through the four strokes of a four cycle engine and see what takes place. The strokes of a four stroke cycle engine are:

(1) Suction
(2) Compression
(3) Power (Expansion)
(4) Exhaust

Now looking at Figure (1a) we note that the piston is moving away from the cylinder head and that the intake valve is open. This movement of the piston pulls into the cylinder through the mixer, or carburetor, an air and gas mixture. In Figure (1B) we notice the piston has reached the bottom of its travel and is moving toward the cylinder head; you will note that the intake valve is closed. This piston moving up compresses the air and gas mixture until it reaches the end of the stroke nearest the head where the magneto causes a spark to jump the plug gap and ignite the compressed mixture. The third stroke (1C) is away from the head and is called the expansion, or power stroke, because the pressure of the burning and expanding gases push the piston downward. As the piston reaches the end of this stroke (1D) the exhaust valve is opened and the momentum of the engine pushes the piston back toward the head, forcing the burned charge out through the exhaust valve, thus completing one cycle of the four stroke cycle engine.

Now we see that four strokes are necessary to complete the cycle and that the crankshaft has made mode two complete revolutions for one power stroke.

A two stroke cycle engine, normally called a two cycle engine does not have valves in the cylinder head, but ports cast in the cylinder walls. The piston passing over these open and close the openings. The intake ports carry the fresh fuel charge into the cylinder and the exhaust ports carry the burned charge away. It is necessary that a magneto deliver a spark through the spark plug at the exact moment required when the piston reaches the head end.

Now let us follow through the events of the two stroke cycle. The strokes of a two stroke cycle engine are:

(1) Compression and suction.
(2) Power and exhaust.

Referring to Figure 2a, we find that the piston is moving toward the cylinder head, thus compressing the charge in the cylinder.

At the same time, a vacuum is created on the under side of the piston which pulls in through lightly loaded strip valves the fresh charge. This area into which the fresh charge is pulled is known as the scavenging chamber. The scavenging valves are away from the heat of combustion and operate by a difference of pressure inside and outside the scavenging chamber.

As the piston reaches the end of its stroke nearest the cylinder head, the compressed charge is ignited by the spark plug.

The piston then moves downward on the power stroke caused by the burning and expanding of the charge just ignited by the spark plug. This is shown in Figure

Sub Surface Two Zone Pumping, cont'd—

produce two horizons without the expense of drilling two wells.

There should be little doubt as to the initial savings made in drilling one hole and dually completing a multiple-zone well. It is believed that the era of dual pumping wells actually is in its infancy and will grow to take its place among the other standard producing methods in the petroleum industry.

ILLEGIBLE

First Successful Installation in Saskatchewan

EXCLUSIVE

Pumping Dual Wells in Canada

Possibilities in Western Canada: 18 fields have multiple productive horizons

Jack Menneer
Anglo American Exploration Ltd.
Calgary, Alberta, Canada

THE first successful dual zone pumping well in Saskatchewan was put "on the beam" in August, 1955, when new specialized equipment for dual pumping was installed for the first time in Canada. Anglo American Exploration and its affiliate, Gridoil, recently made dual completions in their Gull Lake field. Production is from the Middle Vanguard and the Upper Shaunavon at 3500 ft and 3700 ft respectively. Both zones are now being pumped by means of a single surface pumping unit. Subsurface pumps are interconnected and utilize a single rod string. The lower zone is pumped through the casing and the upper zone is pumped through the tubing to prevent co-mingling of the produced fluids. This is accomplished by means of an upper and lower packer and crossover assembly. These dual completions have substantially reduced capital expenditures and have proved quite successful.

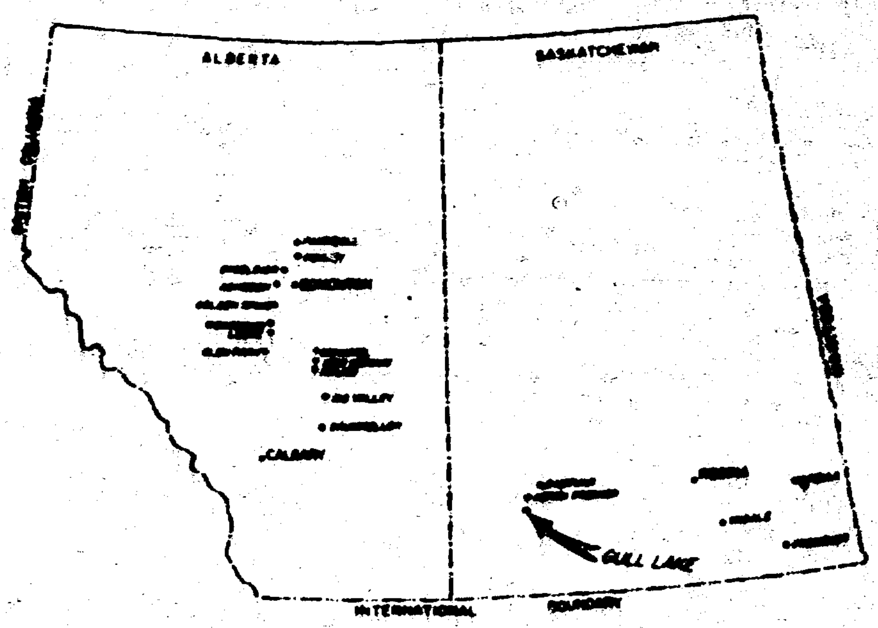
Gull Lake well 1-26A was the first successful dual producer in the Province of Saskatchewan when the installation of dual equipment was completed in August, 1955. Gull Lake well 2-26A was similarly completed the following month to substantiate and compare operating results.

Gull Lake field is in southwest Saskatchewan about 300 miles east of Calgary, 200 miles west of Regina and [illegible] miles north of the Canadian-US border. Some 40 wells produce 2000 bbl daily of 18-24 deg API gravity crude.

Problem: The problem was to produce dually the Middle Vanguard ([illegible] ft) and the Upper Shaunavon ([illegible] ft) by means of subsurface pumps and powered by a single surface pumping unit. For comprehensive [illegible] purposes, two offset wells were selected for completion in this manner.

Well 1-26A was to be completed with a tubing pump for the upper zone and an insert-type pump for the lower zone, together with a retrievable cup-type upper packer and a retainer production packer. The second well, 2-26A, was to be completed with two

FIG. 1. SUCCESS OF DUAL PUMPING WELLS at Gull Lake (arrow) indicate potentialities in 18 fields in Alberta and Saskatchewan



Canadian Dual Zone Possibilities

Alberta		Saskatchewan	
Field	Zones	Field	Zones
[illegible]	Bas. qtz., D2, D3	[illegible]	[illegible]
Big Valley Stettler	D2, D3	[illegible]	[illegible]
Drumheller	D2, D3	Gull Lake	[illegible]
[illegible]	D2, D3	Midale	[illegible]
[illegible]	[illegible], D3	[illegible]	[illegible]
[illegible]	D2, D3	[illegible]	[illegible]
Glen Park	[illegible], D2, D3		
Golden Spike	D2, D3		
Leduc Woodbend	Bas. qtz., D2, D3		
[illegible]	[illegible], D2, D3		
New Norway	[illegible], D2, D3		
[illegible]	Viking ss., [illegible]		

ILLEGIBLE

insert pumps, together with a retrievable [illegible] and a retainer production [illegible].

The Upper Zone

The Middle Vanguard sand occurs in the entire Gull Lake area at approximately 3500 ft. The sand has a fairly uniform thickness of 18 ft. Average [illegible] is 15 ft, average porosity is 24 per cent, and permeability ranges from 636 to 1560 md. Water saturation is 40 per cent, and the shrinkage factor is .93. Recovery is estimated at 250 bbl per acre-foot. Initial bottom-hole pressure was 1420 psig at 116 F. Bubble point is 1406 psig at this same temperature. To the north, there exists a gas cap, and an oil-water contact may exist. The producing horizon was drilled with treated native mud with a low water loss of 4 cubic centimeters on API test.

The Lower Zone

The Upper Shaunavon formation is a blanket deposition in southwest Saskatchewan, and is either a sand or a sandy limestone. Rapid lithological variations occur from south to north. In Gull Lake, the 50 ft thick Upper Shaunavon is topped at 3700 ft and it is a calcareous sandstone. The net pay averages 20 ft, and has a water saturation of 25 per cent, a shrinkage factor of .97, a bubble point of 170 psig, and the initial bottomhole pressure was 1611 psig at 114 F. Average porosity is 25 per cent, and permeability ranges from 200 to 700 md. Gravity of the crude is 24 deg API. Recovery is estimated at 230 bbl per acre-foot. This horizon was drilled with a similar mud as was used to drill the upper horizon.

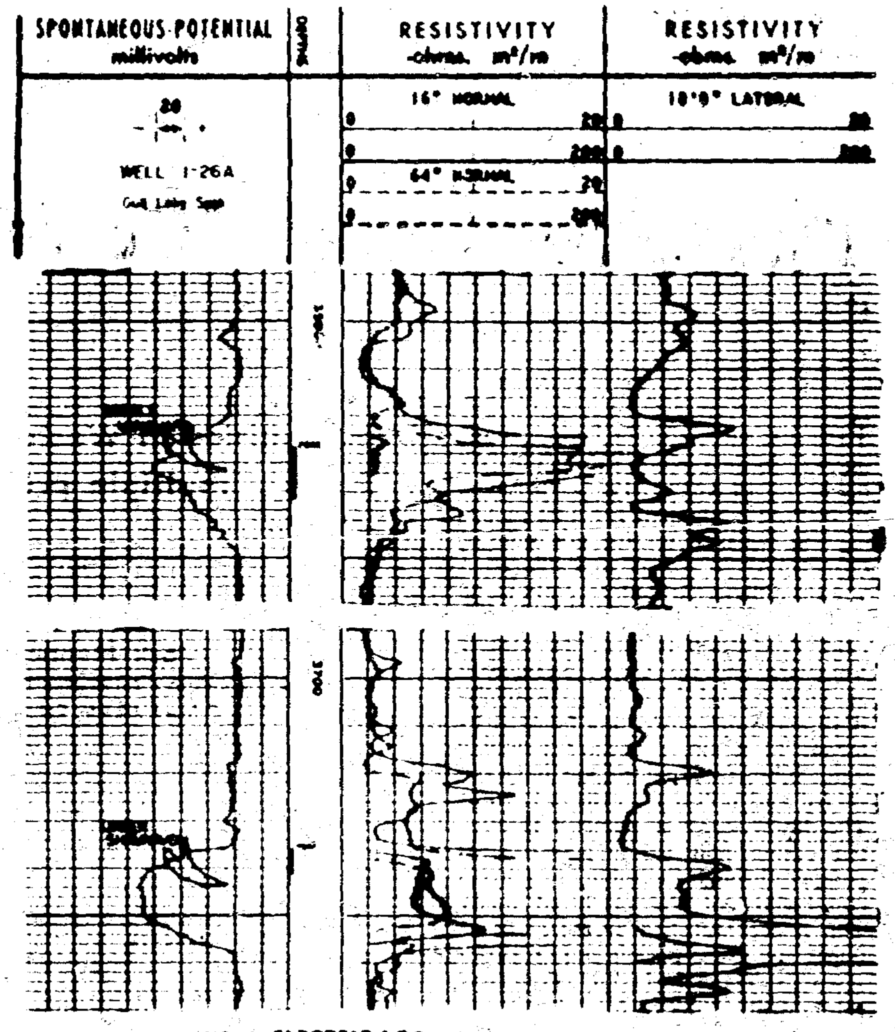


FIG. 2. ELECTRIC LOG of the Middle Vanguard and the Upper Shaunavon zones in Gull Lake Well 1-26A.

Engineering Considerations

To evaluate fully both the dual production behavior of the Middle Vanguard-Upper Shaunavon reservoirs, and various dual zone equipment, two almost identical offset wells were chosen, Gull Lake wells 1-26A and 2-26A.

Completion mechanics for the two dual wells were essentially as follows: A permanent type drillable packer was set between the upper and lower pays. Above the upper zone, a special retrievable packer was set, which is a part of the tubing string. The tubing was landed on the lower packer, which has special tubing sealing nipples. Tail pipe, of reduced diameter, can be incorporated below the bottom packer. The two pumps are coupled and are run on, and actuated by, one rod string. The lower zone production initially enters the tubing and is then transferred, just above the upper packer by means of a crossover assembly, to the casing-tubing annulus. The upper zone is produced into the crossover and thence through the tubing.

Although the two methods were similar, differences occur in actual equipment installations, except, of course, for the main (lower) retainer production packer. Well 1-26A has dual pumping equipment in 7 in. casing, 2½ in. EUE tubing, and ¾ in. rods. Well 2-26A has dual pumping equipment in 5½ in. casing, with same size tubing and rods as for Well 1-26A.

In Well 1-26A, the upper packer is a special hookwall type. The polished rod pack-off has 32 chevrons (16 up and 16 down). The upper pump is a tubing type, and the lower an insert

TABLE 1—Well 1-26A data.

Casing	Size inch	Weight pounds	Grade	Depth feet	Cement sks
	[illegible]	28.75	H 40	332	200 + 2% CaCl₂
	7	20 & 23	J 55	3765	125 + 6% Gel

Horizons	Interval feet	Net pay feet	Av. porosity per cent	W/S per cent	Perfs feet	Type perfs
Mid Van	[illegible]-41	13	24	40	3827.5-3837.5	4 - ½ in. bullets per ft
Up Shaun	[illegible]-[illegible]	14.4	26	25	3726-3741	3 - ½ in. bullets per ft

Production	Pre dual: Mid Van	Pre dual: Up Shaun	On dual: Mid Van	On dual: Up Shaun
BOPD	70	[illegible]	60	41
WC per cent	13	4	11	0
[illegible]	[illegible]	—	—	60 (PBS basis)
[illegible]	[illegible]	—	15	—
[illegible]	[illegible]	25	[illegible]	26
[illegible]	3	—	2	—
[illegible]	1¼" x 48" x 14	1½" x 48" x 10	1¾" x 48" x 8½	1½" x 48" x 8½
[illegible]	[illegible]	[illegible]	—	—
[illegible]	—	[illegible]		—

Authorized MPR[illegible]
Mid Van 77 BOD
Up Shaun [illegible] BOD

ILLEGIBLE

type pump. The tubing pump was selected for overcoming any sand sloughing from the upper zone and to cope effectively with any gas surgance. The lower packer is 50 ft (approximately) below the Middle Vanguard perforations (upper zone), and 126 ft of 2 in. EUE 8rd thd tubing is below the packer. The bottom pump is 98 ft below the lower packer and 58 ft above the Upper Shaunavon perforations (lower zone). The upper pump is 104 ft above its productive horizon. Pumps are 265 ft apart, and packers 160 feet apart.

In Well 2-26A, the upper packer is a compression type, which permits the tubing to be anchored at both pump seats. There is no danger of seal movement in the lower retainer production packer due to pump impulse loading. Furthermore, the tubing does not require rotation for setting the packer. Packoff is by compression. Swabbing effects would be nil on pulling the packer out.

Perforated nipples form part of the crossover assembly, and an upper seal is installed. Metal-to-metal seals pack off the polished rod. Both pumps are insert types. The lower packer is 100 ft (approximately) below the upper zone perforations, and carries one perforated joint of production tubing below it. The bottom pump is just above the bottom packer, that is 97 ft above the lower perforations, and the upper pump 96 ft above its horizon. The pumps are 190 ft apart, and packers 203 feet.

It is to be noted the two types of equipment were set at different depths, to provide a better operational comparison.

Co-mingling of the two crudes within the well is prohibitive, and 800 psi pressure tests were made on the equipment when installed in the well.

The formation breakdown pressure for both Middle Vanguard and Upper Shaunavon is 1800 psi, and the two zones were open to perforations. Bleed-away would be negligible at 800 psi surface pump pressure. Therefore, 800 psi was selected as a reliable test pressure.

Dual Completion, Well 1-26A

In December, 1954, Well 1-26A was drilled through the Upper Shaunavon to a total depth of 3769 ft. The 7-in. casing was cemented 1 ft off bottom with 125 sacks cement and 6 per cent gel. The well was chosen as an initial test for Middle Vanguard production evaluation, and the zone was perforated from 3527.5 ft to 3537.5 with four ½ in. bullets per foot. The Upper Shaunavon remained cased-off. A 1½ in. x 12 ft traveling barrel pump with a bottom friction hold down was run

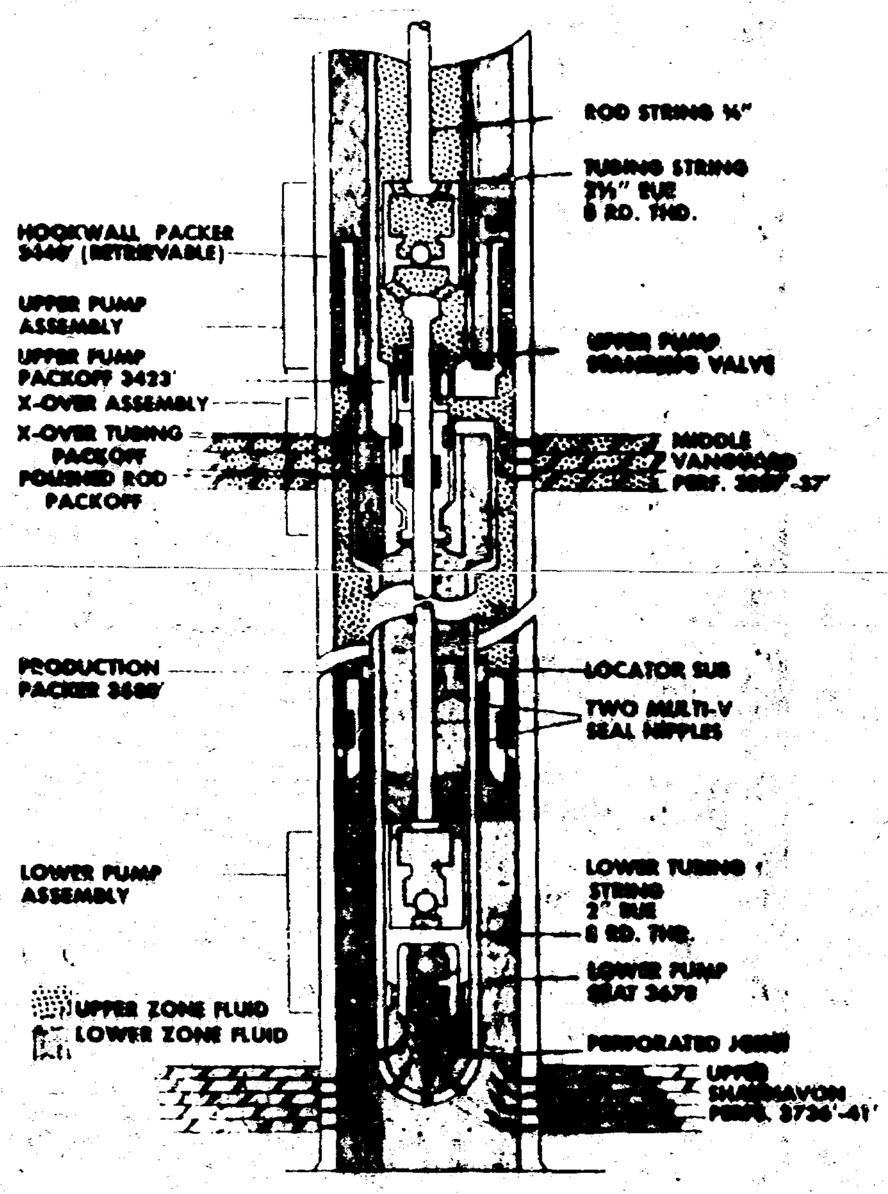


FIG. 3. DUAL PUMP COMPLETION of Well 1-26A, showing schematic cross section of lower insert pump and upper tubing pump.

TABLE 2.—Well 2-26A data.

Casing	Size inches	Weight pounds	Grade	Depth feet	Cement sxs
	10¾	[illegible]	H 40	[illegible]	[illegible] + 2% CaCl2
	5½	[illegible] 15.5	J 55	[illegible]	[illegible] + 6% Gel

Horizons	Interval feet	Net pay feet	Av. poros per cent	WS per cent	Perfs feet	Type perfs
Mid Van	[illegible]	16	[illegible]	[illegible]	[illegible]	[illegible] bullets per ft
Up Shaun	[illegible]	17	[illegible]	[illegible]	[illegible]	[illegible] jets per ft

Production	Pre-dual		Up dual	
	Mid Van	Up Shaun	Mid Van	Up Shaun
BOD	[illegible]	[illegible]	[illegible]	[illegible]
BW per cent	13	—	[illegible]	[illegible]
CP	[illegible]	—	[illegible]	[illegible]
TP	[illegible]	—	[illegible]	—
GOR	[illegible]	[illegible]	[illegible]	[illegible]
Sand per cent	2	—	—	—
Pump (spm)	[illegible]	[illegible]	[illegible]	[illegible]
Pump depth	[illegible]	[illegible]	—	—
Packer	[illegible]	—	—	—

Authorized MPBD
Mid Van [illegible] BOD
Up Shaun [illegible] BOD

ILLEGIBLE

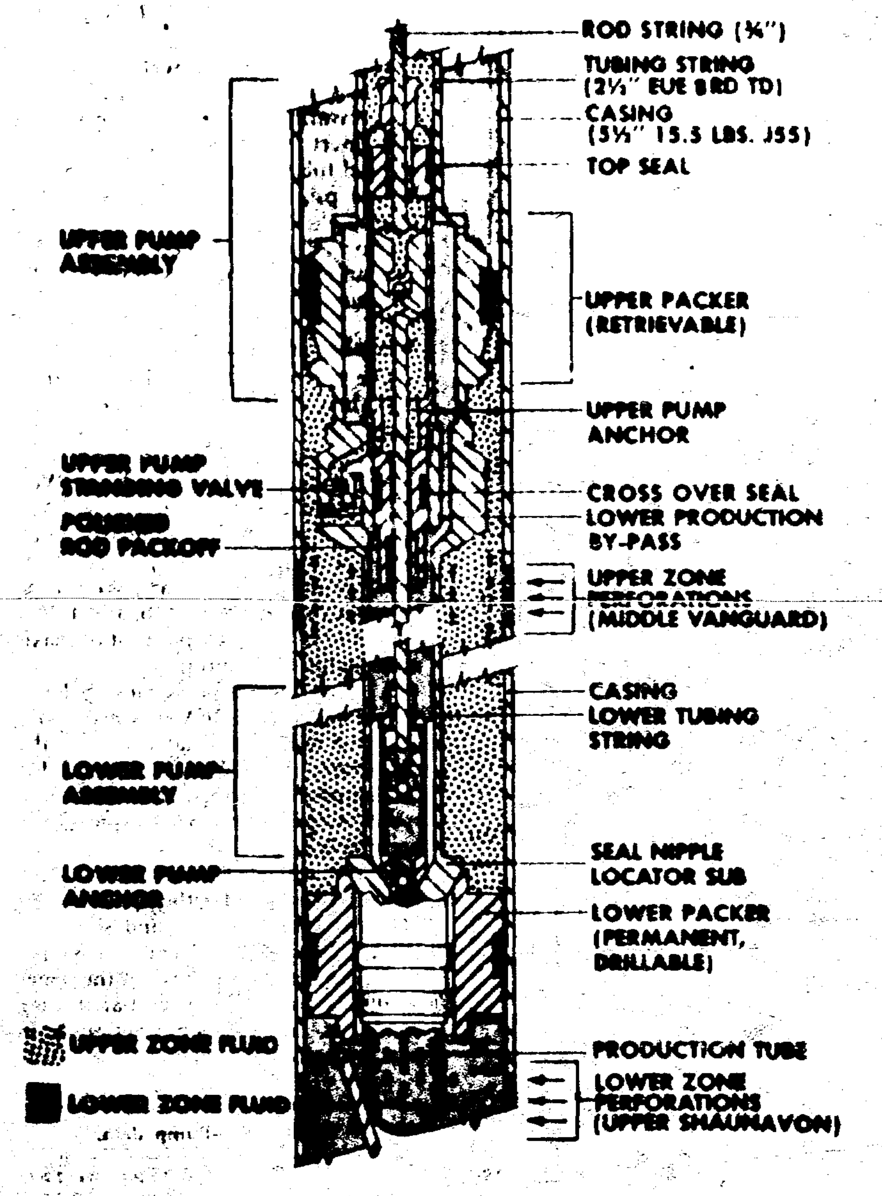


FIG. 4. RETRIEVABLE PACKER was employed at the upper seal in Gull Lake Well 2-36A to permit the installation of two insert type pumps. This is a schematic cross section of the dual pump completion.

and seated at 3531 ft opposite the perforations. Due to an unconsolidated sand, sloughing occurred during the early production period. It was found that no sand trouble persisted when the pump was raised 100 ft above the perforations.

The Middle Vanguard was test-produced for 7 months with a daily average production of 70 bbl oil per day, water-cut [illegible] per cent, and a gas-oil ratio of [illegible] cu ft per barrel.

In July, 1955, the Upper Shaunavon was perforated from 3736 ft—3741 ft with three ½ in. bullets per foot. The Middle Vanguard was packed-off to test produce the Upper Shaunavon, which yielded 90 bbl oil per day, water cut .4 per cent, and GOR of 25 cu ft per barrel.

In late August, 1955, operations were commenced to produce dually the Middle Vanguard and the Upper Shaunavon. The program included:

1. Pull rods and pump.
2. Unseat packer at 3709 ft.
3. Lower tubing to 3748 ft approximately (that is, just above top of cement), and circulate with oil for 16 hr at least. (A long circulating period was stipulated, as a prerequisite of dual completion is that the well be thoroughly clean.)
4. Pull out.
5. Run in with casing scraper (very important).
6. Circulate for at least 2 hours on bottom.
7. Pull out.
8. Run production packer on wire line and set electrically at approximately 3580 ft.
9. Run and land sealing nipples on 2½-in. tubing.
10. Pressure test packer, above and below at 800 psi, through casing and tubing, respectively.
11. Pull tubing and seal nipples.
12. Run 7 in., 20 lb element, retrievable cup-type upper packer and crossover assembly for setting at approximately 3430 ft. (Four joints 2 in. EUE 8rd thd tubing to be below lower packer.) Due to mechanical difficulties, a special 7 in. dual zone hookwall packer was run instead of the cup type. The polish rod pack-off assembly was installed, and was to be retrieved with an overshot.
13. Set upper packer.
14. Test, separately, at 800 psi through casing and tubing, for seal-off above and below packer respectively.
15. Retrieve polish rod assembly.
16. Run pumps and assemblies.

TABLE 3.—Well 2-36A
Tubing String Assembly From Bottom

		Feet
1	3 in. Perf nipple	[illegible]
1	Seating [illegible] for [illegible] packer	2 [illegible]
1	Locator sub w/ 2½ in by 2 ft tubing pup joint	3.[illegible]
1	2½ in. EUE 8rd thd tubing [illegible]	.75
1	2 in. EUE 8rd thd [illegible] coupling [illegible]	.72
6	Joints 2 in. EUE 8rd thd tubing	184 [illegible]
1	2 in. by 2½ in. EUE 8rd thd tubing [illegible]	.79
1	2½ in. EUE 8rd thd safety joint	1.13
1	Joint 2½ in. EUE 8rd thd tubing	[illegible]
1	Crossover [illegible] upper by-pass [illegible]	11.64
1	Dual zone [illegible] packer	3.72
1	Upper [illegible] sealing nipple	5.15
1	2½ in. by 4 ft EUE 8rd thd tubing pup joint	4.04
		[illegible]

TABLE 4.—Well 2-36A
Sucker Rod String Assembly From Bottom

		Feet
1	2 in. by 1½ in. by 12 ft Valve [illegible] pump	13.[illegible]
1	¾ in. by 6 ft Pony rod	6.[illegible]
1	¾ in. by 4 ft Pony rod	4.00
1	¾ in. by 2 ft by Pony rod	2.00
6	¾ in. by 25 ft Sucker rods	[illegible]
	Polished rod and seal pack-off assembly	[illegible]
	Upper pump assembly 2½ in. by [illegible] ft by 17 ft.	[illegible]
		[illegible]
	¾ in. Sucker rods	To surface

ILLEGIBLE

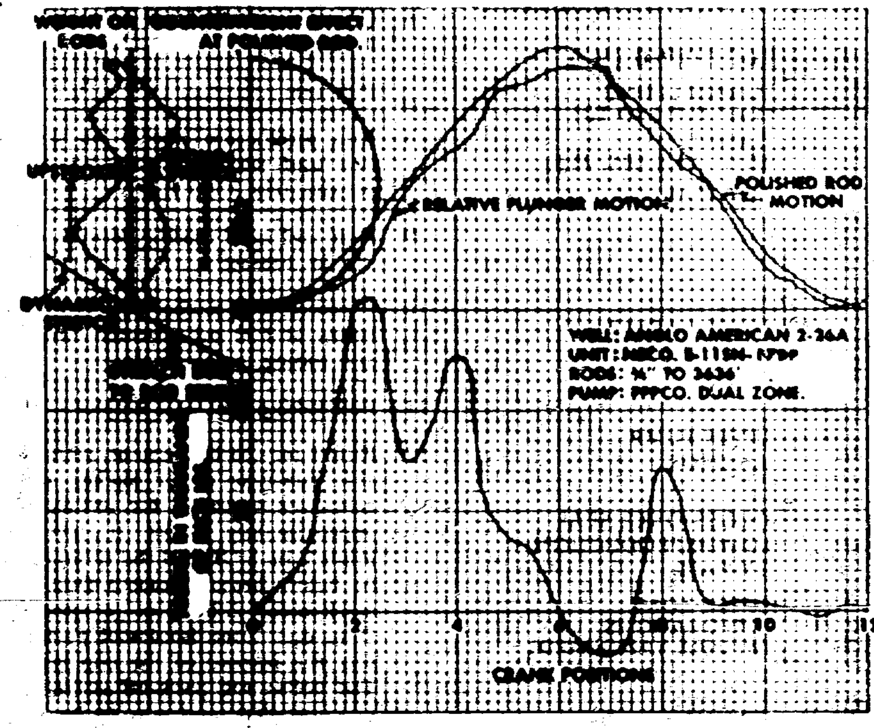


FIG. 5. DYNAMOMETER ANALYSIS of dual pumping Well 2-26A.

Dual Completion, Well 2-26A

Since original completion, the Upper Shaunavon in Well 2-26A had produced continuously for 18 months at its allowable of 97 bbl oil per day. Prior to dual completion in September, 1955, the Middle Vanguard was test produced for a short period at 75 bbl per day, WC 13 per cent, and a gas oil ratio of 328 cu ft per barrel. (The Middle Vanguard had been cased-off for two years, and a 500 gal mud acid job was required to bring the pay on to production.)

Program items 1-7 as listed in Well 1-26A, were carried out in a similar manner, but the dual completion equipment was a different type and is described hereunder.

The main packer was wire line set, and pressure tested satisfactorily at 800 psi above and below. Tubing was run up to the crossover shoe, (Tables 3 and 4) and then set in the slips, and the lower pump and rods were run to seat the pump—this point was marked on the rods. The rods and pump were pulled out. This procedure was for a trial spacing of the pumps on the surface and not to rely absolutely on tape line measurements. (By tubing, the seat tallied 186.87 ft, and by rods 186.85 ft. Thus, the trial spacing avoided any possible error.)

Next, the tubing assembly and remainder of tubing was run. When the locator sub (that had been already on the retainer production packer) touched down on its seat in the retainer, the proper tubing subs were installed so as to locate the surface equipment in the desired position. The upper packer had to be set. Thus, by setting 4000 lb tubing weight down on the locator sub of the main packer, the snap ring in the upper packer collapsed. Then, additional 5000 lb tubing weight was applied to secure the upper packer seal.

After landing the tubing, the lower insert pump, six sucker rods, and the upper pump assembly were installed. The remainder of the rods were run, and the pumps seated.

Tests for effective seal-off on the dual zone installations were performed by pressuring-up with the down-the-hole insert pumps. Separately, the casing and tubing pressures were built-up to 800 psi, which were test held for 15 min.

The well was placed on dual production, and the job had taken only 27 hr rig time.

The Author

Jack Mennear is head of the petroleum engineering department of Anglo American Exploration, Ltd., at Calgary, Alberta, Canada. He was born and educated in England and qualified at the Camborne (Cornwall) School of Mines. He served 6 years with the Royal Engineers in the European theater during World War II. As an exploitation engineer with the Shell Group, he worked in Colombia and Venezuela, South America, and was with Magnolia (Mobil Oil) in the Gulf Coast Division, Texas. Prior to joining Anglo American, Mennear was drilling and producing editor for The Petroleum Engineer.

Pumping Mechanics

The two wells had a dynamometer test when dual production had stabilized and in general, both wells were pumping satisfactorily.

Maximum working load in Well 1-26A was 8200 lb, or 72 per cent maximum permissible. Similarly, Well 2-26A was 8750 lb, or 79 per cent. Unit 2-26A was operating near peak torque permissible at 60,500 in. lb, and 1-26A at 38,400 in. lb, or 63 per cent of maximum permissible torque.

A small increase in counterbalance weight for Well 2-26A was necessary. The two inflections that occur on the dynograph chart, Well 2-26A, are due in all probability to a slightly fast pump speed. A reduction from 10 spm to 8 is preferable.

Pump efficiencies in Well 1-26A were 103 per cent for the upper and 84 per cent for the lower, and similarly, Well 2-26A 117 per cent and 89 per cent. The "over efficiency" of the upper pumps is caused by a partial flowing condition, and the pump action is, in part, an agitation.

TABLE 5.—Pump data.

	Well 1-26A	Well 2-26A
Min. working load (lb)	[illegible]	[illegible]
Max. working load (lb)	[illegible]	[illegible]
Max. permissible load (lb)	[illegible]	[illegible]
Av. upstroke load (lb)	[illegible]	[illegible]
Av. downstroke load (lb)	[illegible]	[illegible]
Actual counterbalance (lb)	[illegible]	[illegible]
Polished rod hp	[illegible]	[illegible]
Peak torque, working (in. lb)	[illegible]	[illegible]
Max. permissible peak torque (in. lb)	[illegible]	[illegible]
	Well 1-26A	Well 2-26A
Pump efficiency		
Upper	103 per cent ([illegible] in. by 42 in. by [illegible] spm)	117 per cent ([illegible] in. by [illegible] in. by 10 spm)
Lower	84 per cent ([illegible] in. by 42 in. by [illegible] spm)	89 per cent ([illegible] in. by [illegible] in. by 10 spm)

Economics

Successful dual completions avoid the drilling of an additional hole, reducing capital expenditures considerably. To complete a single zone Gull Lake well the cost breakdown would be thus:

Drilling	15,600
Casing & Equipment	18,000
Portion battery cost	2,000
	$35,600

ILLEGIBLE

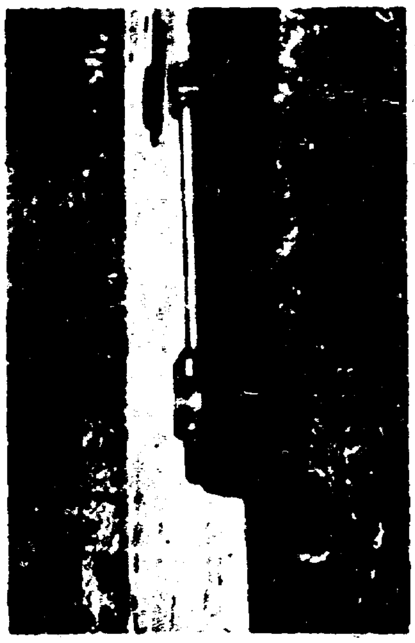
Photos show equipment for well 2-26A

DRILLABLE PRODUCTION PACKER being prepared for running on wire line.

RETRIEVABLE PACKER with ports at top to permit lower production into the casing annulus.

CROSSOVER ASSEMBLY. Fluid from upper zone flows through ball and seat strainer nipples. Lower zone fluid is channeled internally.

BOTTOM OF POLISH ROD PACK-OFF. Perforated nipple above sealing cups allows upper zone fluid to enter upper pump.



POLISH ROD PACK-OFF shown beside pencil, and is a metal-to-metal seal.

BOTTOM MECHANICAL LOCK for lower insert pump.

Cost for Dual Completion:

Dual pumping equipment (including upper and main packers and two pumps)	2,100
Service rig time	500
	$2,600

For Gull Lake, a dual completion costs approximately $2600 per well, and saves an approximate $32,000 capital expenditure for drilling and completing an additional well. Payout for the dual completion would be one month, which is obviously a favorable investment. Such is particularly the case where an operator is confronted with relatively thin productive formations.

Acknowledgment

The author is grateful to Anglo American Exploration for permission to publish this paper. Thanks is expressed for supervision of the dual completions to R. Armstrong, D & R Pumps; Cliff Taylor, Baker Oil Tools; J. Clements, Fluid Pack Pumps; especially to H. Palmour, who came up from Fluid Pack Pumps, Fort Worth, Texas; the Production Department, Anglo American Exploration, and to G. Manson, National Supply Company, for dynamometer tests. ◆ ◆ ◆

ILLEGIBLE

Tandem rod pump installations are successful

Operation of two pumps by a single sucker rod string provides a unique method of artificial lift for parallel string dual completions.

By K. B. Van Horn
Cities Service Oil Company,
Odessa, Texas

Cities Service Oil Company has recently installed tandem rod pumps in eight deep, dually completed West Texas wells. Good results were obtained from this attempt to find an [illegible] method of artificially lifting parallel string duals. A unique, downhole crossover assembly and proper equipment and operating considerations contributed to the success of the operations.

Production of dually completed oil wells by various methods of artificial lift has presented increasing problems for several years. Realizing the conditions and approaching them through correct design of equipment is of primary importance. The most prominent problems are well depths, application of surface and subsurface equipment, casing sizes, and clearances in the case of parallel tubing strings.

Cities Service Oil Company was faced recently with the necessity of artificially lifting dual wells completed with 5½-inch casing to a depth of 12,300 feet. To Feb. 1, 1958, eight dual wells had been converted to artificial lift using tandem rod pumps on a common sucker rod string. Two independently run tubing strings were used as the conductors for the two zone's fluids. Experience gained in these installations is offered as an approach to the solution of efficient and economical dual artificial lift.

In a parallel tubing string installation, clearances are the primary consideration. Pump depth and fluid

This article presented as a paper at the West Texas Oil Lifting Short Course, Texas Technological College, Lubbock, Texas, April, 1958.

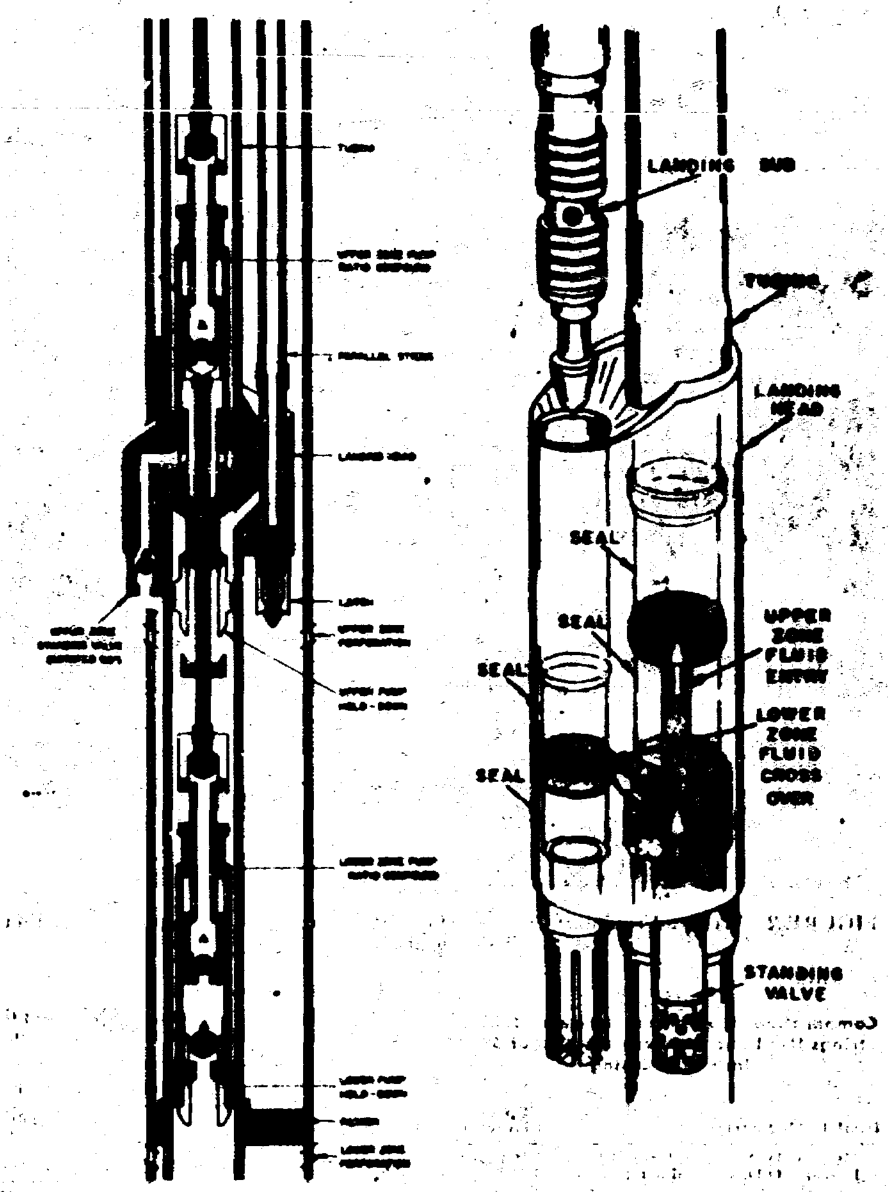


FIGURE 1—Illustrated above are the pumps, hold-downs and pack off assembly in position in the crossover assembly. The crossover is [illegible] so that wire line tools may be used to selectively pump or flow either or both zones. The flexibility of this equipment will permit a well to be produced by natural flow and artificial lift without a major equipment change. A variation of this assembly allows the addition of a bypass line for lower zone gas relief.

ILLEGIBLE

One approach to the solution of efficient dual artificial lift . . . .

FIGURE 2—Wellhead equipment required for surface control of the tandem installation is shown above.

withdrawal rate determine the rod string design, which, in turn, determines the size of the main tubing string. Pump depths in these installations range from 7,900 to 10,100 feet. At this depth, anticipated peak rod loads are of a magnitude to require a three-way tapered sucker rod string consisting of 1-inch, ⅞-inch, and ¾-inch sucker rods. The main tubing string was tapered with 2⅞-inch O.D. API EUE integral joint tubing, to accommodate the 1-inch sucker rods, and 2⅜-inch O.D. API EUE tubing.

The parallel string was an external upset 1.315-inch O.D. integral joint tubing. This combination of tubing strings permitted a clearance of 0.121-inch in 5½-inch O.D. 17-pound casing as shown in Table 1. This clearance appears to be rather small for installing the parallel strings; however, no difficulties were encountered in completing the eight installations. One installation was completed in a well equipped with 2,000 feet of 5½-inch O.D. 17 pound extreme line casing with a running clearance of only 0.007 inch.

Equipment selection. Major points considered in selection of equipment were flexibility and adaptation to the conditions involved. Surface pumping equipment consisted of a 192-inch stroke, air counter balance pumping unit with a 640,000 inch-pound gear box and powered by a 70-hp single cylinder gas engine.

Necessarily, the bottom-hole pumps

TABLE 1

Comparative Clearances Between Tubing Strings Used and Different Weights of 5½-inch O.D. Casing

Dual Tubing Strings	Upset Diameter
2⅞ In. O.D. API EUE Integral Joint	3.094
1.315 In. O.D. Integral Joint	1.552
Total Diameter @ Connections	4.646 Inch

Casing O.D. Inches	Weight Lbs./Ft.	Drift I.D.	Clearance Inches
5½	14	4.887	0.241
5½	15.5	4.825	0.179
5½	17	4.767	0.121
5½ Extreme Line	17	4.653	0.007

TABLE 2—Type of Pumps, Setting Depths and Production Tests of Cities Service's Successful Tandem Rod Pump Installations in West Texas

WELL	Lower Zone Pump: Size and Type	Lower Zone Pump: Depth	Lower Zone Production Bbls. Day: Oil	Lower Zone Production Bbls. Day: Wtr.	Upper Zone Pump: Size and Type	Upper Zone Pump: Depth	Upper Zone Production Bbls./Day: Oil	Upper Zone Production Bbls./Day: Wtr.
A	2"x1¼"x26'x30' *P.D.	8497'	45	30	2"x1½"x28' P.D.	[illegible]	144	3
B	2"x1¼"x26'x30' **C	8566'	122	Trace	2"x1½"x28' P.D.	[illegible]	64	6
C	2"x1¼"x26'x30' C	10008'	185	72	2"x1½"x28' P.D.	[illegible]	80	3
D	2"x1¼"x26'x30' C	10067'	322	77	2"x1½"x28' P.D.	8973'	47	10
E	2"x1¼"x26'x30' P.D.	8044'	135	Trace	2"x1½"x28' P.D.	7962'	***	..
F	2"x1¼"x26'x30' P.D.	8531'	141	60	2"x1½"x28' P.D.	8436'	***	..
G	2"x1¼"x26'x30' P.D.	8551'	***	..	2"x1½"x28' P.D.	8400'	***	..

* P.D. denotes positive displacement type pump.
** C denotes conventional type pump.
*** Production test not available at this date.

ILLEGIBLE

had to be of sufficient length to accommodate a 192-inch surface stroke and the crossover equipment of the type to permit independent installation of the dual tubing strings. All pumps were of the insert type: all mechanisms retrievable on the rod strings. Various combinations of these pumps involved applications of the positive displacement type and the conventional type. The former being used to provide for better volumetric efficiencies in zones where gas was a factor.

In all cases, the positive displacement type pump was used as the upper pump to provide a double standing valve arrangement. All pumps consisted of regular pump parts, except the hold-down and pack-off assembly on the upper pump. A six-cup type hold-down was substituted for the conventional three cup hold-down in this case. With this alteration, the hold-down serves a threefold purpose: upper pump hold-down, upper zone fluid intake port, and a fluid separation device. The fluid packoff assembly between the pumps consist of a 7/8-inch precision fitted machined rod in a metal liner section with a tolerance of 0.001 inch. This machined rod is connected to the upper pump plunger and reciprocates through the liner section actuating the lower zone pump. The packoff assembly is anchored in the tubing assembly with a mechanical lock to prevent a pressure differential from unseating the upper pump (see Figure 1).

Special equipment used to complete the installation included a parallel string tubing hanger and a control valve for the 1.315-inch O.D. tubing. The tubing hanger flange was threaded to receive the 2⅞-inch O.D. integral joint tubing, and the 1.315-inch O.D. tubing was supported on slips. Three split type packing rubbers and a threaded sleeve produced the seal around the tubing. The body of the control valve was recessed to provide clearance for its installation in a vertical position beside the 2⅞-inch O.D. pumping nipple. Figure 2 is an illustration of the completed wellhead equipment.

This equipment was installed in wells which were produced by natural flow until increased water production forced installation of articial lift equipment. In all cases, the wells were equipped with a permanent type production packer. A latch type locator sub and seal assembly was run on the main tubing string and anchored in the production packer. The main string was landed in 8,000 to 10,000 pounds of tension to prevent any tubing movement during the pumping operation.

The integral landing head and crossover assembly was placed in the main tubing string near the bottom of the upper zone perforations. The lower pump seating shoe was installed about 90 feet below the crossover tool. Placement of the lower shoe is optional, but should be at a depth where sufficient pump submergence is maintained. The minimum amount of sucker rod spacers between the pumps provides for greater rigidity, resulting in more effective lower pump plunger travel.

After the lower seating shoe and the tubing between the shoe and the crossover assembly was run in the well, a trial pump seating was performed to determine the exact amount of sucker rod spacers required. This trial spacing eliminates the possibilities of being unable to seat the pumps when the rod string is installed.

An oversize seating nipple (1.75-inch + .080-inch) was installed above the crossover assembly. At a future date, should one zone water out or become depleted, a wire line tool could be installed to blank off the zone. The remaining oil zone could then be lifted by a pump seated in the over-size nipple.

A sufficient amount of 2⅞-inch O.D. integral joint tubing was run on the top of the main string to accommodate the 1-inch sucker rods.

The parallel string landing spear was made up on the 1.315-inch O.D. tubing and the tubing run into the well through the tubing bonnet. A 1-inch blowout preventer was used to insure well control. The spear was landed in the crossover integral landing head with a small amount of tubing weight applied. The crossover is furnished with an engaging lock for the spear which will insure an operator that the spear has been seated in the crossover. An upward pull of 2,000 pounds above the tubing weight disengages the lock to unseat the spear. This is readily checked with a weight indicator. Construction of the spear insures positive pressure balance between the seals, thus eliminating unseating forces on the parallel string.

No serious problems. All of these installations are relatively new, but no serious operational problems have been encountered. Paraffin scrapers were installed on several of the rod strings to prevent paraffin build up in the tubing from the upper zone. Should a paraffin problem exist in the lower zone, the small tubing can be cleaned by hot oil treatments down the casing annulus. Paraffin knives are available to cut paraffin in the small tubing.

Production control is a problem in dual zone tandem rod pump installations. Control of the upper zone production can be accomplished by circulating the fluids back down the casing annulus. Construction of the pumps will permit the lower zone pump to be unseated before the upper zone pump unseats. If the lower zone production is obtained at a faster rate, its pump can be unseated and production continued from the upper zone.

This article has dealt with one method of artificial lifting deep dually completed wells. As dual completions are becoming more popular, more simplified equipment is being made available to meet the requirements. Problems can be approached with a positive attitude because of the availability of informed personel among manufacturers and operators.

—The End

OIL CONSERVATION COMMISSION
SANTA FE, NEW MEXICO

Date 6-27-58

CASE 1453 Hearing Date 5-28-58

My recommendations for an order in the above numbered cases are as follows:

I recommend that this Dual be denied and an order on the style of R-1125 be written.

I have some misgiving in this recommendation because of the fact that both zones requested for dualling are marginal and we could well cause premature abandonment by this denial. However I feel ~~that~~ in view of the wording of R-1125 we might be inconsistant. Further I do not care to do any further missionary work.

[signature]

Staff Member

No. 16-58

DOCKET: EXAMINER HEARING MAY 28, 1958

Oil Conservation Commission 9 a.m. Mabry Hall, State Capitol, Santa Fe

The following cases will be heard before Elvis A. Utz, Examiner:

CASE 1225: Application of Moab Drilling Company and Utex Exploration Company for an order amending Order No. R-975. Applicant, in the above-styled cause, seeks an order amending Order No. R-975 to permit the conversion to a water injection well of the Utex Exploration Company Donohue-Federal No. 3 Well, located in the SE/4 SW/4 of Section 15, Township 16 South, Range 29 East, Eddy County, New Mexico.

CASE 1446: Application of The Texas Company for approval of a unit agreement. Applicant, in the above-styled cause, seeks an order approving its Cotton Draw Unit embracing 35,144 acres, more or less, of Federal, State of New Mexico, and patented lands, located in Township 24 South, Ranges 31 and 32 East; Township 25 South, Ranges 31 and 32 East, in Eddy and Lea Counties, New Mexico.

CASE 1447: Application of The Texas Company for a non-standard gas proration unit. Applicant, in the above-styled cause, seeks an order establishing a 320-acre non-standard gas proration unit in the Eumont Gas Pool comprising the E/2 of Section 11, Township 20 South, Range 37 East, Lea County, New Mexico, said unit to be dedicated to the applicant's C. H. Weir "B" Well No. 3, located 330 feet from the North line and 660 feet from the East line of said Section 11.

CASE 1448: Application of Ambassador Oil Corporation for approval of a unit agreement. Applicant, in the above-styled cause, seeks an order approving its North Caprock Queen Unit No. 2 embracing 1808 acres, more or less, of State of New Mexico lands located in Township 13 South, Ranges 31 and 32 East, in Chaves and Lea Counties, New Mexico.

CASE 1449: Application of Graridge Corporation for an exception to Rule 309 of the Commission Rules and Regulations. Applicant, in the above-styled cause, seeks an order permitting the consolidation of tank batteries to receive the production from more than sixteen wells in the North Caprock Queen Unit No. 1 in Chaves and Lea Counties, New Mexico, which was established by Order No. R-1145. The applicant further seeks permission to install automatic custody transfer equipment on the above-referenced Unit.

CASE 1450: Application of Neville G. Penrose, Inc. for approval of a unit agreement. Applicant, in the above-styled cause, seeks an order approving its November State Unit comprising 913 acres, more or less, of State of New Mexico and patented lands, located in Township 10 South, Range 37 and 38 East, and Township 11 South, Range 38 East, Lea County, New Mexico.

CASE 1451: Application of Amerada Petroleum Corporation for a non-standard gas proration unit. Applicant, in the above-styled cause, seeks an order establishing a 280-acre non-standard gas proration unit in the Justis Gas Pool consisting of the W/2 SW/4 Section 24, NW/4 and SW/4 NE/4 of Section 25, all in Township 25 South, Range 37 East, Lea County, New Mexico, said unit to be dedicated to the applicant's proposed well to be drilled in the NE/4 NW/4 of said Section 25.

CASE 1452: Application of Amerada Petroleum Corporation for the dual completion of a producing oil well to permit the disposal of salt water therein. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its H. C. Posey "A" No. 4 Well, located in the NW/4 NE/4 of Section 14, Township 12 South, Range 32 East, Lea County, New Mexico, in such a manner as to permit the production of oil through the tubing from the Pennsylvanian formation, adjacent to the East Caprock-Pennsylvanian Pool, and to permit the disposal of salt water through the casing tubing annulus into the Devonian formation between 11,205 feet and 11,370 feet.

CASE 1453: Application of Magnolia Petroleum Company for an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Stephens Estate No. 1 Well, located in the NW/4 SW/4 of Section 24, Township 21 South, Range 37 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Terry-Blinebry Pool and Wantz-Abo Pool.

CASE 1454: Application of Gulf Oil Corporation for an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Learcy McBuffington No. 4 Well, located 660 feet from the South line and 1980 feet from the West line of Section 13, Township 25 South, Range 37 East, Lea County, New Mexico, in such a manner as to permit the production of oil from an undesignated Blinebry oil pool and oil from the Justis-Ellenburger Pool through parallel strings of tubing.

CASE 1455: Application of Gulf Oil Corporation for an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Learcy McBuffington Well No. 5, located 1650 feet from the South line and 1980 feet from the East line of Section 13, Township 25 South, Range 37 East, Lea County, New Mexico, in such a manner as to permit the production of oil from an undesignated Blinebry oil pool and oil from the Justis-Ellenburger pool through parallel strings of tubing.

CASE 1456: Application of Gulf Oil Corporation for an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Learcy McBuffington Well No. 6, located 330 feet from the South line and 1980 feet from the East line of Section 13, Township 25 South, Range 37 East, Lea County, New Mexico, in such a manner as to permit the production of oil from an undesignated Blinebry oil pool and oil from the McKee formation, adjacent to the Justis-McKee Pool, through parallel strings of tubing.

CASE 1457: Application of Sinclair Oil & Gas Company for an oil-oil dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its State Lea Well No. 1, located 660 feet from the South and West lines of Section 24, Township 16 South, Range 33 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Kemnitz-Wolfcamp Pool and from the Pennsylvanian formation adjacent to the Kemnitz-Pennsylvanian Pool through parallel strings of tubing.

CASE 1458: Application of Albert Gackle for a non-standard gas proration unit. Applicant, in the above-styled cause, seeks an order establishing a 320-acre non-standard gas proration unit in the Jalmat Gas Pool consisting of the S/2 of Section 23, Township 23 South, Range 36 East, Lea County, New Mexico, said unit to be dedicated to the applicant's Sinclair State No. 1 Well, located 1650 feet from the South line and 990 feet from the East line of said Section 23.

CASE 1459: Application of Continental Oil Company for a dual completion and non-standard gas proration unit. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its Farney A-17 Well No 3, located in Section 17, Township 23 South, Range 36 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Lower Yates formation of the Jalmat Gas Pool and gas from the Upper Yates formation of the Jalmat Gas Pool through the tubing and casing-tubing annulus respectively. The applicant further seeks the establishment of a 160-acre non-standard gas proration unit in the Jalmat Gas Pool comprising the NW/4 of said Section 17, to be dedicated to the said Farney A-17 Well No. 3.

CASE 1460: Application of Phillips Petroleum Company for an oil-oil dual completion and for permission to commingle production from two separate pools. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its New Mex "A" Well No. 1 located 1983 feet from the South line and 2313 feet from the West line of Section 25, Township 16 South, Range 33 East, Lea County, New Mexico, in such a manner as to permit the production of oil from the Kemnitz-Wolfcamp Pool and oil from an undesignated Pennsylvanian pool through parallel strings of tubing. The applicant also proposes to produce the Wolfcamp and Pennsylvanian production from said well into common storage.

CASE 1461: Application of A. A. Greer, et al., for an exception to the acreage factors established by Order No. R-565-C for certain wells in San Juan County, New Mexico. Applicant, in the above-styled cause, seek an order granting an exception to the acreage factors provided in the Special Rules and Regulations for the Aztec-Pictured Cliffs Gas Pool and Fulcher Kutz-Pictured Cliffs Gas Pool, as set forth in Order No. R-565-C, for one well in the Aztec-Pictured Cliffs Gas Pool and eight wells in the Fulcher Kutz-Pictured Cliffs Gas Pool which were drilled on 40-acre spacing prior to the establishment of 160-acre spacing in the aforementioned pools.

CASE 1462: Application of El Paso Natural Gas Company for a non-standard gas proration unit. Applicant, in the above-styled cause, seeks an order establishing a 335-acre, more or less, non-standard gas proration unit in the Blanco Mesaverde Gas Pool consisting of the SW/4 of Section 7 and the W/2 of Section 18, all in Township 30 North, Range 8 West, San Juan County, New Mexico, said unit to be dedicated to the applicant's Howell No. 4-C Well, located 933 feet from the South line and 931 feet from the West line of said Section 18.

CASE 1463: Application of Pan American Petroleum Corporation for an oil-gas dual completion. Applicant, in the above-styled cause, seeks an order authorizing the dual completion of its O. H. Randel "A" No. 1 Well, located 1650 feet from the South line and 990 feet from the West line of Section 9, Township 26 North, Range 11 West, San Juan County, New Mexico, in such a manner as to permit the production of oil from an undesignated Gallup oil pool and gas from an undesignated Dakota gas pool through parallel strings of tubing.

ir/

Case # 1453

Oil-oil Dual

Exam hearing

LAW OFFICES OF
MODRALL, SEYMOUR, SPERLING, ROEHL & HARRIS
SIMMS BUILDING
P. O. BOX 466
ALBUQUERQUE, NEW MEXICO
TELEPHONE CHAPEL 3-4514

J. R. MODRALL
AUGUSTUS T. SEYMOUR
JAMES E. SPERLING
JOSEPH E. ROEHL
GEORGE T. HARRIS
DEAN P. KIMBALL
DANIEL A. SISK
JOHN H. STEWART
LELAND S. SEDBERRY

JOHN F. SIMMS (1885-1954)

April 22, 1958

New Mexico Oil Conservation Commission
125 Mabry Hall
Capitol Building
Santa Fe, New Mexico

Re: Application of
Magnolia Petroleum Company
for Permission to Dually Complete
Stephens Estate No. 1
NW$\frac{1}{4}$SW$\frac{1}{4}$, Sec. 24-21S-37E,
Lea County, New Mexico, in
Terry Blinebry Oil Pool and
Wantz Abo Oil Pool

Gentlemen:

Enclosed are three copies of Application in the above matter which we would appreciate your setting for hearing at your earliest convenience.

Shown below are the names and addresses of offset operators who are being furnished copies of this Application.

Very truly yours,

James E. Sperling
James E. Sperling

JES:sj
Encl.
c.c. Continental Oil Company
P. O. Box 427
Hobbs, New Mexico

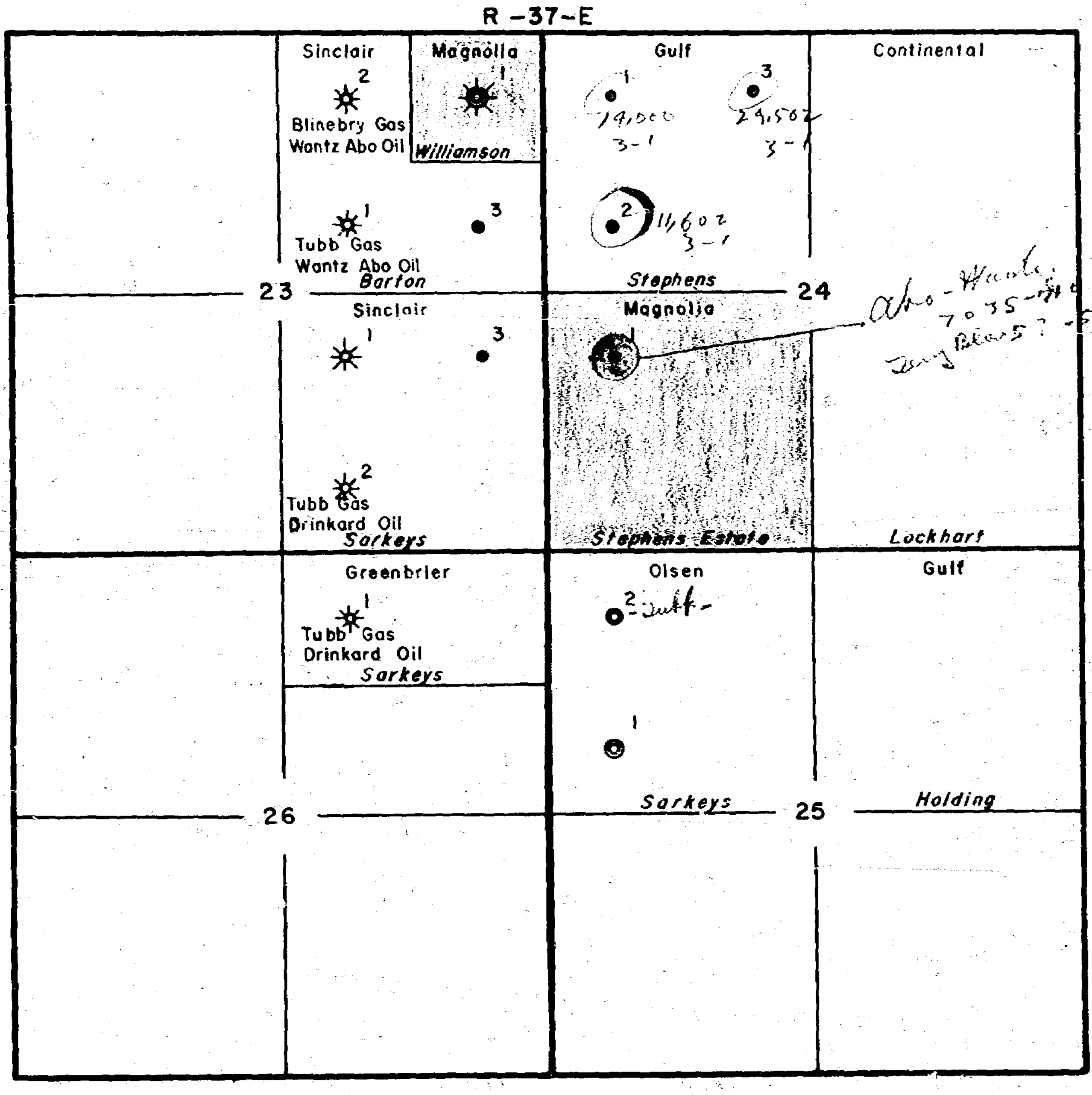
Gulf Oil Corporation
P. O. Box 1667
Hobbs, New Mexico

c.c. Greenbrier Oil Company
327 South Adams
Fort Worth, Texas

R. Olsen Oil Company
P. O. Box 2
Jal, New Mexico

Sinclair Oil & Gas Company
P. O. Box 1927
Hobbs, New Mexico

X-6645



LEGEND

- Wantz Abo Oil Well
- Terry Blinebry Oil Well
- Blinebry Gas Well
- Blinebry-Tubb Oil Well
- Blinebry-Tubb Gas Well

BEFORE EXAMINER UTZ
OIL CONSERVATION COMMISSION
Magnolia EXHIBIT NO. 1
CASE NO. 1453

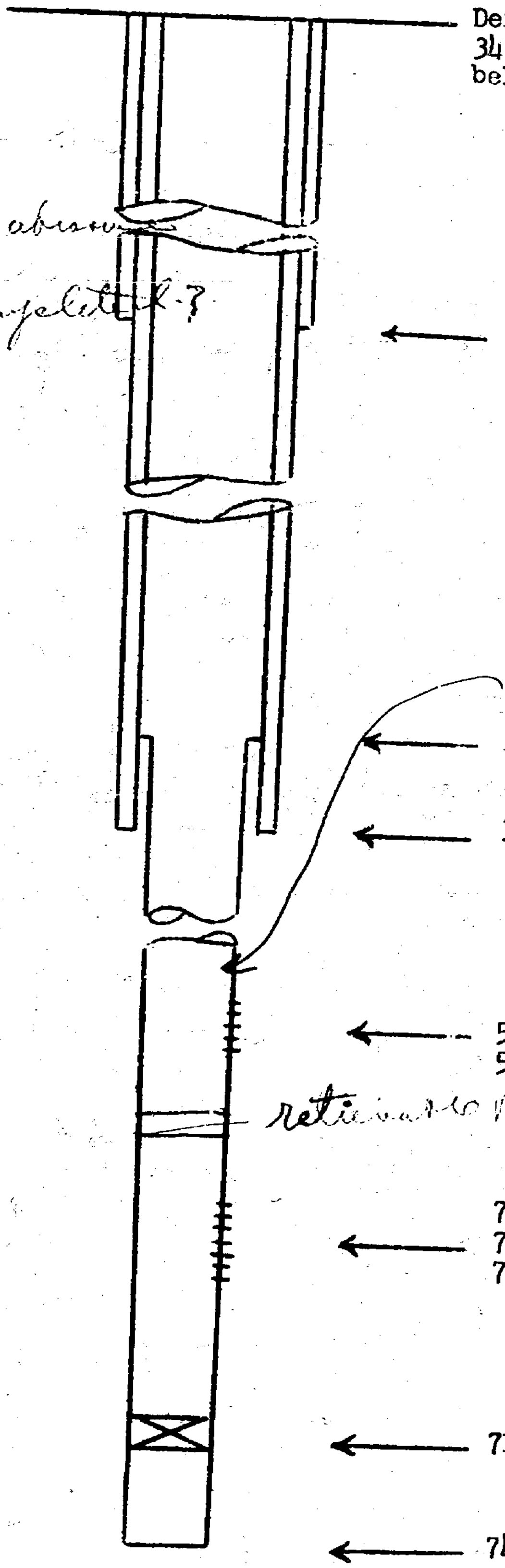
MAGNOLIA PETROLEUM COMPANY
PRODUCING DEPARTMENT
DALLAS - TEXAS
DISTRICT - LEA

STEPHENS ESTATE AREA

SHEET NO.	1
SCALE:	3.3" = 1 Mile
DATE -	3/7/58
DRAWN	geo
CHECKED	
APPROVED	C. J. E.
REVISED	

BEFORE EXAMINER UTZ
OIL CONSERVATION COMMISSION
Magnolia EXHIBIT NO. 2
CASE NO. 1453

Stephens Estate #1
Wantz Abo Field
Lea County, New Mexico



BEFORE EXAMINER UTZ
OIL CONSERVATION COMMISSION
Magnolia EXHIBIT NO. 5
CASE NO. 1453

MAGNOLIA PETROLEUM COMPANY
P. O. BOX 2406
HOBBS, NEW MEXICO

OIL RESERVES AND ECONOMICS
STEPHENS ESTATE NO. 1

I. Factors Used in Computing Blinebry Reserves:

A. Porosity of 6.5% (core and log data)
B. Water saturation 28% (electric logs)
C. Formation volume factor 1.36 barrels reservoir oil per barrel of stock tank oil (estimated using GOR, BHP, BHT, gravity, etc.)
D. Effective pay thickness of 27 feet (estimated from logs)
E. Oil recovery 15.6%
F. Average gas-oil ratio for life of well 10,000:1

II. Blinebry Oil in Place Equals 267 Stock Tank Barrels Per Acre Foot.

III. Blinebry Oil and Gas Reserves:

A. Gross barrels recovery per acre equals	1,125
B. Gross barrels recovery per 40 acres equals	45,000
C. Gross MMCF of gas equals	450

IV. Abo Oil Reserves Equals 19,000 Barrels (estimated from decline curve).

V. Price of Stock Tank Oil Equals $ 3.08 per barrel
Price of Gas Equals $ 55.00 per MMCF ?

VI. Economics of Blinebry Well (40 acres):

	Blinebry Single Well	Abo-Blinebry Dual Completion
A. Gross Value of Recoverable Reserves;		
Oil	$ 138,600	$ 197,120
Gas	24,750	24,750
Total	$ 163,350	$ 221,870
B. Charges Against Well;		
Royalty	$ 20,419	$ 27,734
Direct Taxes	8,750	11,919
Operating Expense	26,400	37,200
Cost of Developing	113,033	33,900
Total Charges	$ 168,612	$ 110,753

C.	Net Profit to Operator Before Income Taxes	$ -5,262	$ 111,117
D.	Income Taxes		
	State	$ -37	$ 778
	Federal	-2,717	29,620
	Total Taxes	$ -2,754	$ 30,398
E.	Net Cash Recovery	$ -2,508	$ 80,719

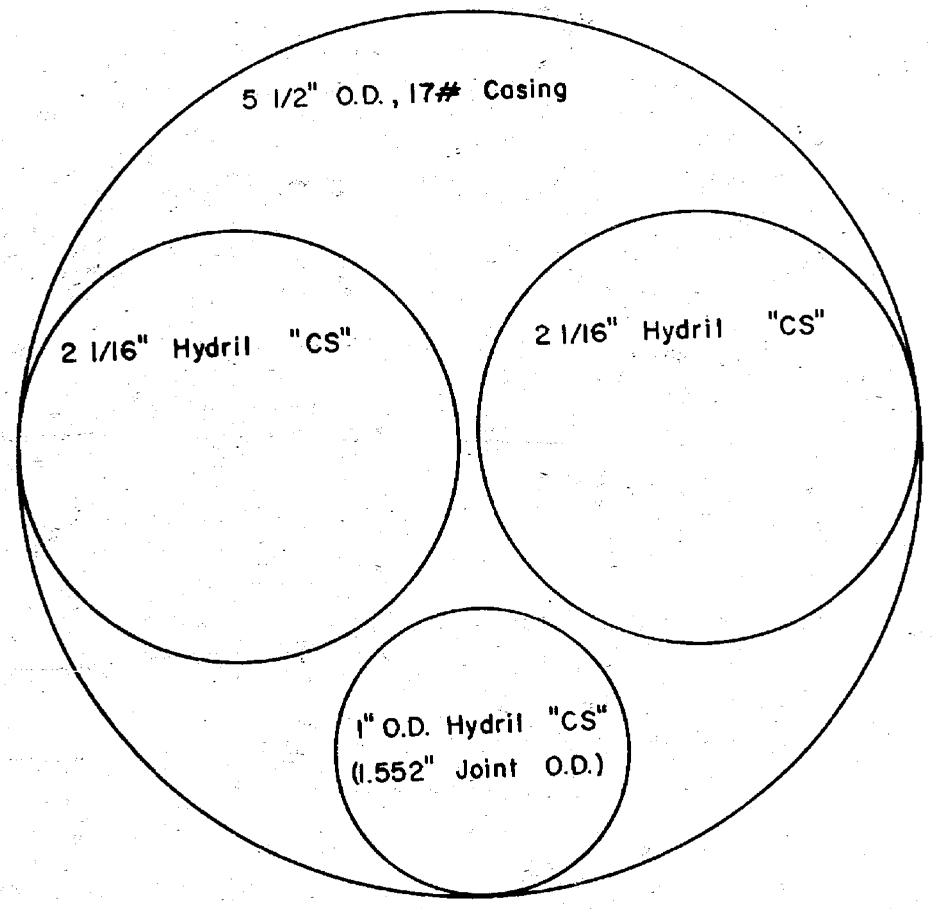
6

BEFORE EXAMINER UTZ
OIL CONSERVATION COMMISSION
Magnolia EXHIBIT NO. ~~1-5~~ 6
CASE NO. 1453

STATUS OFFSET WELLS
MARCH 1, 1958

	Feb. Prod.	Oil B/D	GOR	Water B/D
TUBB GAS (OIL)				
Jal Oil Company (Olsen)				
Sarkey No. 1 E 25-21-37	441	16	2525	
No. 2 D 25-21-37	382	14	891	
TERRY BLINEBRY				
Gulf Oil Corporation				
Stephens, N. No. 1 D 24-21-37	811	29	7493	2
No. 2 E 24-21-37	811	29	10412	2
No. 3 C 24-21-37	686	24	1712	3
BLINEBRY				
Jal Oil Company (Olsen)	No report for February, January used.			
Sarkey No. 1 E 25-21-37	446	14	6500	-
WANTZ				
Sinclair Oil & Gas Company				
R. Barton No. 1 G 23-21-37	695	25	3355	2
No. 2 B 23-21-37	669	24	872	2
No. 3 H 23-21-37	1775	63	1592	-
Sarkeys No. 3 I 23-21-37	113	4	6614	3
DRINKARD				
Sinclair Oil & Gas Company				
Sarkeys "A" No. 2 O 23-21-37	144	5	6700	-
Greenbrier Oil				
Sarkeys No. 1 B 26-21-37	177	6	16004	-

JLS:kb
5-21-58



BEFORE EXAMINER UTZ
OIL CONSERVATION COMMISSION
Magnolia EXHIBIT NO. 7
CASE NO. 1453